2011

PRODUCTION, EXCHANGE AND SOCIAL INTERACTION IN THE GREEN RIVER REGION OF WESTERN KENTUCKY: A MULTISCALAR APPROACH TO THE ANALYSIS OF TWO SHELL MIDDEN SITES

Christopher R. Moore
University of Kentucky, tacomonkey51@hotmail.com

ABSTRACT OF DISSERTATION

Christopher R. Moore

The Graduate School

University of Kentucky

2011

PRODUCTION, EXCHANGE AND SOCIAL INTERACTION IN THE GREEN RIVER REGION OF WESTERN KENTUCKY: A MULTISCALAR APPROACH TO THE ANALYSIS OF TWO SHELL MIDDEN SITES

ABSTRACT OF DISSERTATION

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
Christopher R. Moore

Lexington, Kentucky

Director: Dr. Richard W. Jefferies, Professor of Anthropology

Lexington, Kentucky

2011

ABSTRACT OF DISSERTATION

PRODUCTION, EXCHANGE AND SOCIAL INTERACTION IN THE GREEN RIVER REGION OF WESTERN KENTUCKY: A MULTISCALAR APPROACH TO THE ANALYSIS OF TWO SHELL MIDDEN SITES

The Green River region of western Kentucky has been a focus of Archaic period research since 1915. Currently, the region is playing an important role in discussions of Archaic hunter-gatherer cultural complexity. Unfortunately, many of the larger Green River sites contain several archaeological components ranging from the Early to Late Archaic periods. Understanding culture change requires that these multiple components somehow be sorted and addressed individually.

Detailed re-analyses of Works Progress Administration (WPA) era artifact collections from two archaeological sites in the Green River region – the Baker (15Mu12) and Chiggerville (15Oh1) shell middens – indicate that these sites are relatively isolated Middle and Late Archaic components, respectively. The relatively unmixed character of Baker and Chiggerville makes these sites excellent candidates for evaluating aspects of complexity during the Archaic.

After developing a theoretical basis for evaluating the relative complexity of the social organization of the Baker and Chiggerville site inhabitants on the basis of the material record they left behind, I employ detailed analyses of the bone, antler, and stone tools from these two sites to examine six microscalar aspects of complexity – technological organization, subsistence, specialization, leadership, communication networks, and exchange. These microscalar aspects of complexity all can be linked materially to the archaeological record of the Green River region and can be evaluated as proxies for changes in social organization among the hunter-gatherers who inhabited this region during the Middle and Late Archaic periods. Although the Baker assemblage indicated greater complexity in communication networks and certain proxies for leadership and technological organization, most indicators suggest that the Chiggerville site inhabitants were the more complexly organized group and were in the process of developing a tribal-like social formation. This research, therefore, tentatively supports the hypothesis of increasing complexity through time during the Archaic. However, marked differences in the technological strategies utilized by the Baker and Chiggerville site inhabitants indicates these groups may not have been historically related, thereby

violating one of the primary assumptions of the project. If this alternative hypothesis is confirmed through additional research, then no conclusions concerning change through time can be derived from this study.

KEYWORDS: Tribal Social Organization, Cultural Complexity, Hunter-gatherers, Bone Tools, Stone Tools

Christopher R. Moore
Student's Signature

02/4/2011
Date

PRODUCTION, EXCHANGE AND SOCIAL INTERACTION IN THE GREEN RIVER REGION OF WESTERN KENTUCKY: A MULTISCALAR APPROACH TO THE ANALYSIS OF TWO SHELL MIDDEN SITES

By

Christopher R. Moore

Richard W. Jefferies
Director of Dissertation

Richard W. Jefferies
Director of Graduate Studies

02/4/2011

RULES FOR THE USE OF DISSERTATIONS

Unpublished dissertations submitted for the Doctor's degree and deposited in the University of Kentucky Library are as a rule open for inspection, but are to be used only with due regard to the rights of the authors. Bibliographical references may be noted, but quotations or summaries of parts may be published only with the permission of the author, and with the usual scholarly acknowledgments.

Extensive copying or publication of the dissertation in whole or in part also requires the consent of the Dean of the Graduate School of the University of Kentucky.

A library that borrows this dissertation for use by its patrons is expected to secure the signature of each user.

Name Date

DISSERTATION

Christopher R. Moore

The Graduate School

University of Kentucky

2011

PRODUCTION, EXCHANGE AND SOCIAL INTERACTION IN THE GREEN RIVER REGION OF WESTERN KENTUCKY: A MULTISCALAR APPROACH TO THE ANALYSIS OF TWO SHELL MIDDEN SITES

DISSERTATION

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
Christopher R. Moore

Lexington, Kentucky

Director: Dr. Richard W. Jefferies, Professor of Anthropology

Lexington, Kentucky

2011

ACKNOWLEDGMENTS

Many times throughout my graduate career I have felt myself an Everyman character on an arduous journey from ‘this world’ to ‘that which is to come’ (i.e., post-student life). Fortunately, like John Bunyan’s protagonist in *The Pilgrim’s Progress*, I have been helped along my way by an assortment of characters. Foremost among these is my dissertation advisor, Dr. Richard Jefferies. Dick’s encouragement and gentle prodding is largely the reason I have been able to complete this document in a timely manner and for that I am forever grateful. Dick has excelled in his role as advisor, colleague, scholar, mentor, and friend. He has gone out of his way to provide me the opportunity to thrive as a scholar, and I cannot thank him enough.

I would also like to thank the other members of my committee for their patience and perseverance. Dr. Chris Pool set aside countless other tasks to give my dissertation a good, thorough read under a tight deadline. I am grateful for his insights and criticisms, particularly in pushing me to explore the breadth of available anthropological literature. My large references section is a result of his mentoring.

Dr. George Crothers went above and beyond his duties as a committee member in helping me complete my dissertation research. I have spent more hours arguing with George about the hunter-gatherers of the Green River region than I have with anyone else and, although we do not always agree, his advice, support, and knowledge have honed my thoughts and helped to keep me honest about what I can say about my data. George was with me in the field at Baker and Chiggerville and was integral in organizing and directing those projects. It was George who initially provided me access to the WPA Green River collections through a position at the Webb Museum, and it was he who was there by my side in the field instructing me in the basics of obtaining data from a shell midden. Money for the radiocarbon dates from Baker and Chiggerville were provided by George through the William S. Webb Museum of Anthropology at the University of Kentucky. Thanks to George, Nancy O'Malley, and the Webb Museum for access to collections, documents, photographs and for use of lab and storage space.

Thanks to Dr. Jonathan Phillips for agreeing to be my outside committee member. I am grateful for his advice in preparing chapter one and for his insights regarding use of the term 'complexity' outside of anthropology. I would also like to thank him for always having such a quick turnaround in reviewing various drafts of my proposal and dissertation. I would also like to thank my outside reader, Dr. Gary Hansen.

I would like to extend my heartfelt thanks to Mrs. Anna Dortch for her hospitality and support during my work at the Chiggerville site. Mrs. Dortch provided me with eager access to her property, including allowing us to camp in her front yard when the Green River was near flood stage. Thanks also to Roger Dortch for welcome conversation and for help with the thankless task of backfilling our trench.

Fieldwork at the Baker site was facilitated by Eric Williams and Jack Bell of the Peabody Wildlife Management Area in Muhlenberg County, Kentucky. Thanks to both for allowing access to the property and camping facilities. I would also like to thank my field volunteers at Baker and Chiggerville – Shawn Webb, Donald Handshoe, Zada Komara, Kyle Mullen, and Melissa Ramsey.

Initial research for this dissertation was funded by a University of Kentucky Department of Anthropology Susan-Abbott Jamieson Pre-Dissertation Research Grant. Thanks to Dr. Lynne Sullivan at the Frank H. McClung Museum at the University of

Tennessee, Knoxville and Eugene Futato at the University of Alabama's Office of Archaeological Research for facilitating that research.

Various other individuals have made contributions to this work. Thanks to Mary Alice Scott and Maureen Meyers for reading and commenting on drafts of certain chapters. Lauren Witt and Dan Valentine helped with photography. Dr. Christopher Schmidt of the University of Indianapolis provided lab space during completion of the final lab analyses.

Finally, I would like to thank my wife Anne for her continued support throughout this project. She has been with me from the very beginning, and for that she deserves some kind of honorary degree.

TABLE OF CONTENTS

Appendices

LIST OF TABLES

LIST OF FIGURES

Chapter One

Introduction

The Green River region of western Kentucky has played a role in the development of eastern North American archaeology since the first decades of the twentieth century. Although Squier and Davis (1848) recorded sites in the state, no scientific research was conducted in Kentucky until Harlan Smith's (1910) work at the Fox Farm site in Mason County. Soon thereafter, the Green River region was visited by two important contributors to the development of North American archaeology—Nels C. Nelson and Clarence B. Moore (Schwartz 1967).

Employing innovative archaeological field methods that incorporated consideration of site stratigraphy, Nelson (1917) excavated a series of rockshelters in the upper Green River drainage. His most important work, however, was a series of excavations in the vestibule area of Mammoth Cave. Here, Nelson (1917) concluded that the caves and rockshelters of the upper Green River area contained evidence of both agricultural and earlier, pre-agricultural ways of life. According to Schwartz (1967), Nelson was the first archaeologist to recognize the existence of non-agricultural, pre-Mound Builder groups in Kentucky.

Around the same time that Nelson was working at sites in the upper Green River valley, Clarence B. Moore (2002) was exploring the middle and lower Green in his steamboat, the *Gopher*. Although Moore (2002) investigated several of the now famous shell midden sites that characterize the Ohio, Butler, McLean, and Muhlenberg County area, his most important contribution was a discussion of the 296 burials excavated from the Indian Knoll site (15Oh2) and the strange 'bannerstones' and antler hooked implements oftentimes found in association. According to Moore (2002), these unique artifacts represented a prehistoric net-making toolkit, with the bannerstones and reamed antler sections (or handles) interpreted as net-mesh gauges and the antler hooks as netting needles.

Additional semi-professional investigations in the Green River region were conducted by two faculty members at the University of Kentucky—William S. Webb (a physicist) and William D. Funkhouser (a zoologist). Site surveys were conducted in several counties along the Green, with initial small test trenches opened at the Chiggerville site (15Oh1) in 1924 (Funkhouser and Webb 1928). Additional excavations at Chiggerville were not conducted until April 1938, after Webb had secured large Works Progress Administration (WPA) labor crews, which began work at the Read Shell Midden (15Bt10) under the supervision of Albert Spaulding in December 1937 (Jefferies 1988:16, Milner and Smith 1988, Webb 1950b). Additional Archaic sites excavated using WPA funds in Kentucky included Baker in Muhlenberg County (McBride 2000); Ward, Kirkland, Barrett, Butterfield, Reynerson, the Smith Rockshelter, and Site 15McL18 in McLean County (Webb and Haag 1940, 1947); Indian Knoll, Bowles, Jackson Bluff, and Jimtown Hill in Ohio County (Webb 1974), Roach Village in Trigg County (Rolingson and Schwartz 1966), Carlston Annis, the Read Shell Midden, the Read Rockshelter, Site 15Bt27, and Site 15Bt29 in Butler County (Webb 1950a); Parrish Village and Morris Village in Hopkins County (Rolingson and Schwartz 1966, Webb 1951); and the Shepard Rockshelter in Greenup County (Jefferies 1988). In total, at least 72 sites located in 17 counties were investigated using federal funding during the New Deal/WPA era (Milner and Smith 1988:8).

Significantly, Webb and Haag's (1939) analysis of the Chiggerville excavations was the first of the Green River site reports to be published. This report was a major contribution to the Southeastern literature in that it attributed the shell middens to a pre-pottery Archaic pattern within the Midwestern Taxonomic System (Jefferies 1988), a pattern defined a few years earlier by Ritchie (1932) at the Lamoka Lake site in New York. The Chiggerville site was later assigned to the Indian Knoll Focus of the Pickwick Aspect (along with the Lauderdale Focus—the Tennessee River Archaic shell middens) of the Archaic pattern (Webb and DeJarnette 1942).

During the 1950s and 1960s, Archaic period research in Kentucky shifted to the excavation of sites scheduled to be impacted by the construction of several dams and reservoirs (e.g., Duffield 1966). The next major research project in the Green River region was not conceived until 1971 when Patty Jo Watson and William H. Marquardt began planning the Shell Mound Archaeological Project (SMAP) to investigate the origins of native domesticates found in terminal Late Archaic and Early Woodland cave contexts upriver (Marquardt and Watson 1983, 2005b). Eventually the SMAP became a multidisciplinary environmental and geoarchaeological research project that continues through the work of Watson's former students to the present day (e.g., Crothers 1999; Hensley 1991a, 1994).

My research in the Green River region both augments and contextualizes these previous studies, particularly with regard to social and economic variables. Original research presented in this dissertation involves analyses of two previously excavated assemblages recovered by WPA crews from the Chiggerville (15Oh1) and Baker sites (15Mu12), located in Ohio and Muhlenberg counties, respectively. Additionally, a combination of geophysical survey, coring, and test excavations at these sites provides important information regarding stone tool production and the numerical age of these middens that was not obtained during the WPA investigations.

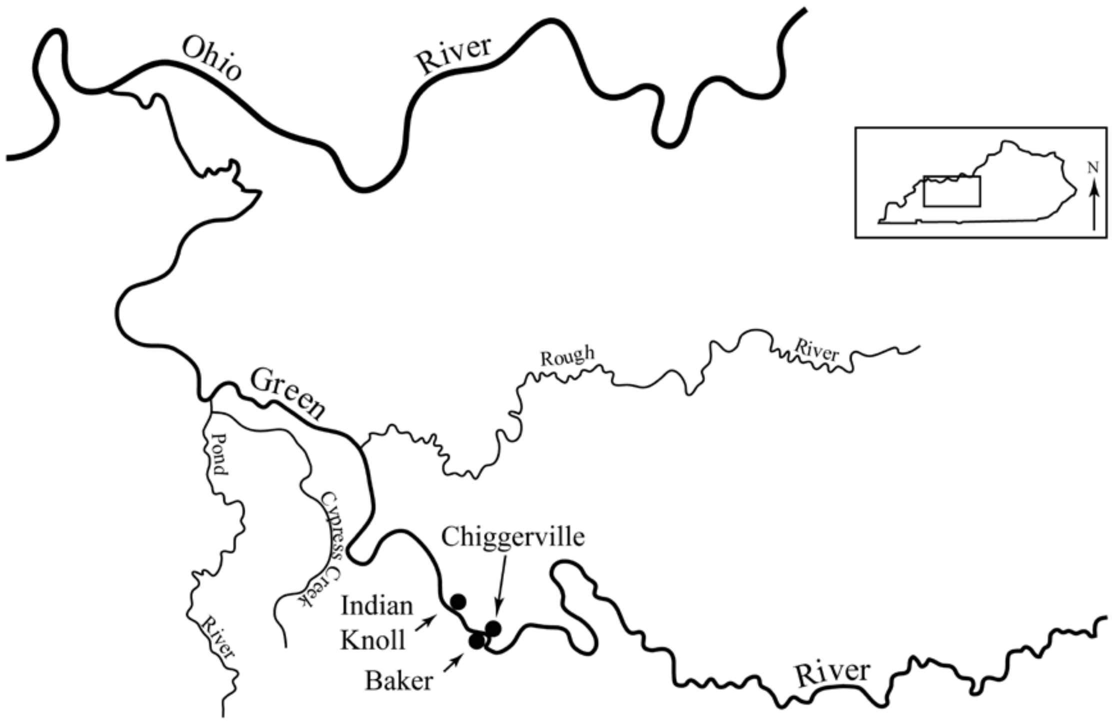


Figure 1-1. Map of the Green River Region Depicting the Locations of Major Ohio and Muhlenberg County Sites.

Paleoenvironmental History and Environmental Setting

The Chiggerville and Baker sites are located on opposite banks of the Green River in Ohio and Muhlenberg counties, respectively (Figure 1-1). These counties are located within the Western Coalfield physiographic region in an area included in Braun's (1950) Western Mesophytic Forest. The Western Coalfield region consists of Pennsylvanian aged sandstones, shales, and coal beds and is characterized by rolling uplands dotted by sandstone cliffs, some containing rockshelters (Pollack 2008). The Green River valley is poorly drained and filled with Pleistocene lacustrine sediments dotted by partially buried, protruding sandstone outcrops that were formed during the Pliocene (Crothers 1999).

The Green River drains approximately 14,885 km^2 in Kentucky and Tennessee and meanders over a length of 532 km (Crothers 1999:109). Crothers (1999, Morey et al. 2002) divides the Green into Lower, Middle, and Upper segments, with the Lower Green beginning at its confluence with the Ohio River in the north and extending to the town of Paradise, Kentucky. This portion of the river system is incised entirely into the late Pleistocene lacustrine plain. The Middle Green River region extends from Paradise to the confluence of Big Reedy Creek with the Green. This section of the river represents a "delta extension of the free flowing Green River into Pleistocene Green Lake" (Crothers 1999:116). Finally, the Upper Green extends from Big Reedy Creek to the river's headwaters across the Mississippian Plateaus physiographic region. Archaic shell middens have been identified only in the Lower and Middle Green River sections (Crothers 1999).

The Green River floodplain began forming around 25,000 years ago when the low lying areas of the Lower Green, Ohio, and Wabash River valleys were inundated by flood waters impounded by glaciofluvial outwash behind a bedrock constriction near Caseyville, Kentucky. Multiple impoundment episodes occurred over an approximately 10 to 15,000 year period (Jonathan Phillips, personal communication 2010). As a result, the eroded Mississippian and Pennsylvanian aged bedrock in these areas was covered by deep, fine-grained lacustrine sediments punctuated by remnant sandstone knobs and ledges. These now-drained lacustrine deposits are found throughout the Lower and Middle Green River valley and are characterized by poorly drained soils with little to no slope. Subsequent to the drainage of Pleistocene Green Lake, the Green River was entrenched into these sediments, resulting in the formation of a relatively stable, constrained channel with little potential for lateral migration or avulsion (Stein 2005, Stein et al. 1981).

Elsewhere in the Midcontinent, the late Pleistocene and very early Holocene landscape was characterized by dynamic hydrologic regimes consisting of braided streams carrying a high sediment load of both coarse and fine glacial outwash. By about 8500 B.P., the last of the glaciers had melted and drainageways had stabilized into a meandering system confined by fairly steep upland bluffs and Pleistocene terraces (Schuldenrein 1996). In the Ohio River valley, late Pleistocene landscape resculpting had created a lengthy, but relatively narrow river confined in its upper reaches by bedrock of various ages. In the area of modern-day Louisville, Kentucky, the river flowed over a 2 km series of shallows and ledges formed by the exposure of Mississippian bedrock in a region now known as the Falls of the Ohio (Gray 1984).

Vegetational changes during the late Pleistocene and early Holocene were not uniform, but generally can be reconstructed based on pollen data from sites across the Midcontinent. Around 18,000 B.P., the Interior Low Plateaus, including the Western Coalfield and Mississippian Plateaus physiographic regions, were characterized by jack-pine-spruce forests, with oak-hickory-southern pine forests confined to the southern Gulf and Atlantic coastal regions (Delcourt and Delcourt 1981). Beginning about 16,500 B.P., spruce, pine, and fir forests began migrating northward following the retreating Laurentide glacier (Delcourt and Delcourt 1979). Oak-hickory forests were established in western Kentucky by 10,000 B.P., while mixed hardwoods were present in eastern Kentucky (Delcourt and Delcourt 1981).

By about 7500 B.P., the relatively cool mesic, mixed forests of the early Holocene began to be replaced by a xeric, oak-hickory forest as the Midwestern climate entered into a warmer, dryer period known as the Hypsithermal Interval (Wilkins et al. 1991). In the lower reaches of the Green, Ohio, and other major river valleys, this warmer, dryer interval resulted in a change in hydrologic conditions and a stabilization of existing floodplain landforms, as floods became rarer and less severe (Bettis 1992, Mandel and Bettis 2001, Schuldenrein 1996). These regional climatic and landscape changes resulted in the formation of stable floodplain environments such as mussel shoals, backwater swamps and oxbows, sloughs, and other wetland areas that provided prehistoric inhabitants with an abundance of locally concentrated aquatic resources (Dye 1996, Schuldenrein 1996).

By about 6000 B.P., the major river valleys of the Midcontinent had developed their present-day meander belts, resulting in a relatively modern looking alluvial landscape (Schuldenrein 1996). Pollen data indicate the presence of mixed hardwood forests in western Kentucky around 5000 B.P. (Delcourt and Delcourt 1981). Around 4000 B.P., the regional climate changed once again, resulting in the wetter, mesic conditions present today. This increase in available moisture increased the frequency of flooding and erosion, resulting in a higher sediment load and the resumption of floodplain aggradation. This process continued after Euroamerican settlement, when sediment loads once again increased as a result of major upland and lowland erosion due to large-scale forest clearance for agricultural purposes (Bettis 1992, Mandel and Bettis 2001).

These climatic and hydrologic conditions have greatly influenced site formation processes in the alluvial valleys of the Midcontinent and Southeast. In the Big Bend area of the Green River valley, upstream from Baker and Chiggerville, the formation and subsequent drainage of Green Lake at the end of the Pleistocene resulted in the formation of an entrenched Green River with very little potential for lateral mobility. The fine sediment load contained within the Green and originating from the erosion of carbonate rocks upstream and lacustrine sediments downstream, combined with the lack of floodplain relief, results in a lack of deposition in the Big Bend as flood waters are carried across much of the lacustrine plain. Geoarchaeological evidence of river positions indicates that, in some cases, the river has laterally migrated only a few hundred feet in the last 5000 years. As such, typical floodplain features are rare in some portions of the river system (Stein 2005, Stein et al. 1981), although buried sites are present in the Middle and Lower Green (G. Crothers, personal communication, 2008).

This lack of floodplain deposition in the Big Bend over the last 12,000 years indicates that parts of the Green River valley have a relatively low chance of containing buried archaeological sites (Stein 2005). Instead, the Green is characterized by a relatively stable channel consisting of a fine bedload and punctuated at fault lines by near-surface bedrock ledges. Examination of pre-impoundment maps by Morey and Crothers (1998, Morey et al. 2002) indicates that these ledges acted as shallows where mussel shoals could form. The correlation of archaeological sites with these faults and shallows suggests that the mussel shoals were also stable features of the mid- to late Holocene landscape and acted as predictable resource patches for Middle to Late Archaic hunter-gatherers (Morey and Crothers 1998, Morey et al. 2002).

Presentation of the Question

The period of time of most relevance for purposes of this dissertation is the middle Holocene, or the period from approximately 7000 to 3000 B.P. In the Green River valley, these four thousand years were characterized by stable river conditions and environmental fluctuations resulting in dryer oak-hickory-chestnut forests giving way to mesic hardwood forests around 4000 B.P. (Wilkins et al. 1991). This period of time was also the region's most active in terms of the formation of archaeological sites (Jefferies, Thompson, and Milner 2005; Jefferies et al. 2007). Known archaeologically as the Middle to Late Archaic periods, the middle Holocene witnessed the accretion of dozens of large shell and dirt/rock middens like Baker and Chiggerville.

Discussed in more detail in chapter 3, the purpose of this research is to address the socio-economic contexts of production, consumption, and exchange among these Middle and Late Archaic hunter-gatherers of the Green River region. Specifically, this research asks whether the late Middle to Late Archaic Indian Knoll phase groups who lived at Chiggerville can be characterized as more or less 'complex' than the Middle Archaic groups who lived at Baker. To do so, I employ a multiscalar approach that addresses the question of complexity utilizing several organizational and material variables, situating these variables within the context of diachronic and geographic trends. That is to say, the relative complexity of the Late Archaic inhabitants of the Chiggerville site is evaluated in relation to the relative complexity of the Middle Archaic inhabitants of Baker and Early, Middle, and Late Archaic groups found elsewhere in the greater Midwest and Midsouth.

The specific methods I employ to address these questions are outlined below, but, generally, I investigate six major factors of the socio-economic and political organization of these groups—technological organization, subsistence, leadership, specialization, communication networks, and exchange. The multiscalar objectives of this research require that each of these factors be situated within and evaluated with regard to the others. Nevertheless, the collections-based focus dictates that some are more amenable to analysis than others. Aspects of complexity that cannot be directly evaluated at this time are indirectly addressed through a review of existing literature.

Outline of Dissertation

Chapter 2 provides the theoretical foundation for the development of a materialist definition of complexity that can be addressed using the available data. This chapter situates the development of anthropological concepts of 'complexity' within an evolutionary framework and outlines how complexity has been addressed within hunter-gatherer studies. I argue that much of the contention that has arisen within the literature over use of the term 'complexity' to describe hunter-gatherers has been the direct result of researchers using this term in very different ways and, therefore, arguing at cross-purposes. Through the theorization of a hunter-gatherer mode of production, I illustrate how the development of complexity among hunter-gatherers can be defined as a social organizational shift from more loosely organized band-level societies toward larger, structurally more complex tribes. Having outlined this macroscalar approach to the study of complexity, I then define the six microscalar aspects of complexity that are directly analyzed in this study. Although no one of these factors can be expected to directly co-vary with macroscalar trends, when taken together they can provide a strong analytical basis for deriving macroscalar conclusions.

Having developed the theoretical basis for this study in chapter 2, chapter 3 situates these ideas within the culture-historical framework of eastern North American prehistory. The first section of chapter 3 outlines the prehistory of the region, with particular emphasis provided to previous interpretations of developments among the various microscalar aspects of complexity. The second section then describes how each of these aspects is to be specifically addressed throughout the remainder of the dissertation.

Chapters 4 and 5 are descriptions of the Baker and Chiggerville sites, respectively. Field methods and results of both the WPA and the author's excavations at these sites are provided, along with descriptions of the site locations. Site stratigraphy and preservational biases that may affect the results of this study are discussed in this chapter, and radiocarbon dates of the middens are presented. These dates serve to confirm the ages of the two sites, with Baker's dates indicating that this Middle Archaic site (ca. 6700 – 5700 RCYBP) is one to two thousand years older than Chiggerville, which is Late Archaic in age (ca. 4600 RCYBP).

Chapter 6 provides a detailed macro- and microscopic analysis of the bone and antler tool assemblages recovered by WPA archaeologists during the 1930s excavations at Baker and Chiggerville. Particular attention is paid to the techniques employed in the manufacture of bone and antler implements at each site, and some important differences are noted. In general, antler tools at both sites appear to have been manufactured via lithic shaving (i.e., scraping with a flaked stone tool) but employing differing techniques.

Bone tools from the two sites, however, are manufactured using very different techniques, with lithic shaving being the dominant method employed at Baker and an abrasion technique (i.e., rubbing with a rough substance like sandstone) being used at Chiggerville. These differences may indicate a lack of culture-historical continuity between inhabitants of the two sites that would serve to limit the impact of conclusions drawn concerning the relative complexity of the two groups by severing the developmental link between the two sites. Nevertheless, the bone and antler assemblages are used to evaluate the relative complexity of the technological organization and communication networks of these two groups.

Chapter 7 provides the results of a study of the stone tools from the two sites. After describing the WPA assemblages, more detailed comparisons are made between the dominant diagnostic hafted biface types from the two sites – Large Side Notched Cluster points at Baker and Saratoga Cluster points at Chiggerville. These comparisons are largely concerned with evaluating the relative complexity of the technological organization and degree of specialization exhibited by the two groups. Technological organization is also addressed through study of the debitage recovered during the 2009 excavations at the two sites. Finally, the WPA ground and pecked stone assemblages are analyzed in order to evaluate the relative complexity of subsistence activities.

Chapter 8 provides a detailed study of the mortuary practices at Baker and Chiggerville, with the goal being to evaluate the relative complexity of leadership organization and exchange. All available data pertaining to each individual burial from each site is presented, with particular emphasis placed on field descriptions and grave good associations. Discussion of demographic and other bioarchaeological factors was not possible given the small size of the Baker burial population and the fact that no analysis of the Baker site human remains using modern methods has been performed.

The dissertation concludes in a summary of the results of each of the studies described in chapters 6, 7 and 8. These results allow an evaluation of the relative complexity of the Baker and Chiggerville site inhabitants with regard to their technological organization, subsistence practices, leadership roles, specialization, communication networks, and exchange practices. The results are then placed back in the larger theoretical and culture-historical frameworks provided in chapters 2 and 3 to derive macroscalar conclusions concerning trends in hunter-gatherer social relations in the Green River region during the middle Holocene. In short, the hunter-gatherers who lived at the Baker site are interpreted as organized into highly mobile bands practicing a foraging mode of production, while the Chiggerville site inhabitants are interpreted as more complexly organized. Evidence indicates that the latter have or are on their way toward forming tribal-like social formations.

Chapter Two

Evaluating Complexity: The Multifaceted Nature of Social Change among Hunter-Gatherers

Complexity research in anthropology has a long history that is rooted primarily in a Western model of progressive human developments beginning in the Middle Pleistocene and culminating in the advent of large industrial nation-states in the nineteenth and twentieth centuries. Although heavily criticized within the field, this model is oftentimes adopted as a kind of pre-theoretical assumption by some of its most prolific detractors (e.g., Pauketat 2007) and is overtly adopted herein as the general theoretical framework for modeling culture change and the advent of complexity among hunter-gatherers.[1] This basic materialist, evolutionary paradigm has two major branches (and many side branches) that are briefly described herein to provide a historical framework within which this study can be evaluated.

After outlining the history of 'complexity research' broadly conceived, I define a model of complexity that is strictly applicable to hunter-gatherers and limits the definition of hunter-gatherers to a particular form of socio-political and economic organization (a hunter-gatherer mode of production). This framework better facilitates the adoption of ethnographic and ethnohistorical analogs and provides a more theoretically sound and plausible basis for interpreting hunter-gatherers knowable only from the archaeological record. Finally, I discuss some of the microscalar aspects of complexity that must be incorporated into a larger model of 'complex hunter-gatherers'

[1] Much of the criticism of this model is rightfully directed at the unsubstantiated and unscientific tendency of nineteenth century evolutionists to make value judgments regarding developmental changes. As Dunnell (1980:35) points out, "Progress is an observation about the record of change. It is not a force or mechanism." This study adopts a cultural evolutionary framework but does not endorse the teleological implications that are implied in some of the works of its earliest formulators.

in order to evaluate the relative organizational complexity of archaeological cultures. Here complexity among hunter-gatherers is broken down into some of its component parts and discussion shifts from defining the structure and advent of complex hunter-gatherer groups to identifying the end of a hunter-gatherer mode of production and the advent of complex societies that cannot be appropriately classified as hunter-gatherers regardless of their mode of subsistence.

History of Social Evolutionary Theory

The two major branches of evolutionary theory in anthropology alluded to above are the various forms of American cultural evolutionism and the historical materialism of Karl Marx, Frederick Engels, and their adherents. Both of these models are 'evolutionary' in that they deal explicitly with change through time among human social groups and both model change as a progressive phenomenon leading from more simple socio-political and economic forms to those that are more complex. Furthermore, both of these branches can be traced directly to the work of Lewis Henry Morgan (1877), specifically his *Ancient Society or Researches in the Lines of Human Progress from Savagery, through Barbarism to Civilization*

In *Ancient Society*, Morgan (1877) presents an evolutionary theory for the origins of civilization through several stages of development. The theory is materialistic and economic in that each stage is marked by the advent of particular subsistence systems or technologies, such as the beginning of cultivation during the Middle Status of Barbarism and the advent of iron smelting during the Upper Status. Morgan also links these developments to changes in social organization and relations of descent and inheritance. In general, he argues that the earliest periods of savagery and barbarism were characterized by a social organization founded on kinship and organized into descent groups (i.e., clans, phratries, and tribes) that held property in common and that inherited the property of the deceased, while the Upper Status of Barbarism and Civilization witnessed a socio-economic reorientation wherein social government was replaced by political government and common property by personal property. This change, accompanied by the advent of the monogamian family, led to a system of inheritance wherein property could be passed from fathers to sons, leading ultimately to the inheritance of rank and status and the beginnings of an aristocracy. In concluding, Morgan argues that the next stage of civilization is likely to witness the abolishment of the aristocracy in place of a free, democratic society.

Often included among the fathers of cultural evolutionism, Morgan also provided much of the empirical basis for Marx and Engel's materialist conception of history (Bloch 1983, Terray 1972). As Childe (1963) points out, Morgan's evolutionary scheme represented an improvement over the 'threads and patches' approach of Herbert Spencer and E. B. Tylor in that these authors, unlike Morgan, failed to objectively establish the criteria used to rank societies and ended up ranking individual culture traits rather than cultural groups in a consistent fashion. Morgan, however, analyzed cultures as wholes; "he laid down in advance the framework of a sequence—the so-called 'ethnical periods'—and formulated criteria by which the position of any observable society in the sequence could be recognized" (Childe 1963:18). In this way, Morgan was not simply defining a series of cultural stages through which societies must pass, but was constructing a theory of history (Terray 1972). Although Morgan identified several cultural traits that acted as measures of human progress—subsistence, government, language, the family, religion, house life and architecture, and property (Morgan 1877:5)—the major structuring feature were each stage's 'arts of subsistence,' and change from one stage to another was attributed largely to contradictions stemming from the development of new technologies like the bow and arrow, pottery, and iron smelting. Thus, Morgan's theory of history was largely compatible with that of Marx and Engels and was readily incorporated into their work (Terray 1972).

Although heavily criticized by cultural relativists like Franz Boas, Morgan's theory of history came to have an important influence over 20th century Marxist-influenced theorists like V. Gordon Childe, Julian Steward, and Leslie White, at least one of whom considered Boas' approach to be unscientific in that he rejected generalization and "preferred to look at the trees rather than the forest—or even to inspect branches and twigs rather than whole trees" (White 1966:11). Citing increased efficiency in the harnessing of energy as the major mechanism for social evolution, White's (1959) *The Evolution of Culture* utilizes philosophical, archaeological, and historical literature to trace the development of human societies from the Lower Paleolithic through the Agricultural Revolution. Largely following Morgan, White divides the human experience from circa 1 million B.P. to the end of the Roman Empire into two major periods characterized by 1) the advent of a social structure based on kinship with the development of *Homo sapiens* as a symboling organism and 2) the advent of a social structure based upon territoriality and law with the beginnings of agriculture and the state-church as an administrative mechanism. Differing from Childe, White attributes the development of civilization not to the invention of writing but to the invention of agriculture, specifically the harnessing of the sun's energy through domestic plants and animals. The social, economic, political, and technological changes that accompanied this increased input of energy led to the breakdown of the age-old kinship system and the development of a political hierarchy characterized by marked status differentiation and the subjugation of the masses through politico-religious ideological structures (White 1959).

In his definitive statement on *Social Evolution*, Childe (1963) focuses on culture change in Europe and the Mediterranean from the period of savagery (Paleolithic and Mesolithic) through the period of barbarism (Neolithic) to the origins of civilization. Although the specific mechanisms resulting in changes between these cultural stages are considered many and varied, the signifying characteristics utilized to differentiate each are the advent of a food producing economy, signaling the beginning of the Neolithic, and the invention of writing, signaling the advent of civilization. According to Childe (1963), the primary mechanism for change is the diffusion of innovations through interaction. This process is distinct from the processes of mutation and differential reproductive success required for organic evolution and distinguishes social evolution from its biological analog. However, the basic framework for evolutionary change remains the same—societies adapt to their specific natural and social environments by selecting traits that permit beneficial competition with neighboring societies and continued prosperity in response to changing natural conditions. Within each cultural stage, these adaptations are historically particular and divergent, but convergence through diffusion ultimately leads to a predictable sequence—savagery to barbarism to civilization (Childe 1963).

In developing his *Theory of Culture Change*, Steward (1955) rightfully points out that the 'universal evolution' of White and Childe results in evolutionary sequences that "are so general that they are neither very arguable nor very useful. No one disputes that hunting and gathering, which is Childe's diagnostic of 'savagery,' preceded plant and animal domestication which is his criterion of 'barbarism,' and that the latter was a precondition of large populations, cities, internal social differentiation and specialization, and the development of writing and mathematics, which are characteristics of 'civilization'" (Steward 1955:17). Instead, Steward develops an approach termed 'cultural ecology' that compares cultures based upon their 'cultural cores'—subsistence related technologies and behaviors—and the sociocultural mechanisms that relate individuals and families to one another. These provide a means for developing plausible cross-cultural analogs and what he considers to be a valid sociocultural typology. According to Steward, distinctions among groups occupying similar environments are primarily attributable to their level of sociocultural development. Thus, multilinear evolution explains how similar sociocultural formations develop in different regions of the world along parallel evolutionary paths while allowing for divergences that result from historical processes such as kin structures and diffusion. Steward's (1955) multilinear evolution, then, does not attempt to predict the form evolutionary stages will take but explain why specific structures arise in particular environments among particular groups at particular times (Steward 1955).

The later cultural evolutionary sequences of Service (1971) and Fried (1967) represent continued debate and refinement of the sequences proposed by Morgan, White, Childe, and Steward. Service (1971, 1993) defines a series of increasingly complex cultural types, with increasing complexity measured through changes in social structure and increasing levels of social integration. He posits that the original social form was the patrilocal band. Eventually some bands increased in size and population and, under just the right circumstances, external pressures led to the formation of pan-tribal sodalities that united bands into loosely knit residence groups. Such was the origin of tribes. Over time, some of these tribes became relatively sedentary as population densities increased. In situations where environmental resources were dispersed but residence groups were immobile, a redistributive system developed wherein different segments of the tribe and, eventually, individuals within the tribe became specialist producers. Certain individuals were particularly efficient at mobilizing these dispersed resources and these individuals became the chiefs. As the redistributive function of the chief became more and more integral to the society, the position became institutionalized and hereditary, leading to a system of ranking that largely followed kinship lines. In all cases, increasing cultural complexity was the result of a need to integrate existing kin groups into a larger society; the specific form these integrations took were highly variable, but, at the same time, had a similar structure that can be studied within an evolutionary perspective.

Fried's (1967) approach to cultural evolution was rooted in political anthropology. Rather than focusing on social integration, kinship, or economics, Fried classified societies on the basis of social structure. Thus, all bands and many societies typically termed tribes were grouped together as egalitarian societies. It is only with the advent of ranking that Fried considered cultural evolution to have advanced to a significantly altered form to justify a new stage. Fried's ranked societies, however, were egalitarian in many respects, and members of these societies did not have differential access to the resources necessary for survival. When classes of society arose that overcame kinship requirements and established themselves as economic elites, then stratified societies formed. The state developed when this stratification grew beyond economic and political relations to dominate all aspects of society. Fried's (1967) reduction of all non-ranked societies into a single classificatory type illustrated the importance of ranking and the political economy in culture change. However, both Fried (1967) and Service (1971, 1993) failed to provide anything more than a cultural typology in that they did not provide a mechanism for culture change nor did they explain cultural evolution in either specific or general terms.

Beginning in the 1960s, the theoretical contributions of cultural evolutionists were once again heavily criticized and general models of cultural evolution, with few exceptions, ceased to appear in the literature. Over the last few decades, numerous theoretical approaches to culture change have developed, ranging from the neoevolutionary and systems approaches of the New Archaeology to the myriad post-processual approaches of the 1980s and 1990s. Regardless of the ink spilled over the nature of this processual to post-processual 'paradigm shift' in anthropology, the recent reintegration of these various perspectives into a 'processual-plus' framework (Hegmon 2003) illustrates the fact that archaeology has not witnessed a true Kuhnian (1996) paradigm shift. In fact, North American archaeology has and continues to employ the same materialist, evolutionary paradigm within which Morgan (1877) and his successors operated. Whether written from a political economy, neoevolutionary, culture ecology, agency, or other perspective, all of the models of hunter-gatherer complexity owe a debt to Morgan, Marx, White, Childe, Service, and Fried as all continue to build upon the insights of these theorists and typologists.

One potential exception to this generality is neo-Darwinian evolutionary (or selectionist) archaeology, which acknowledges the descriptive merits of the empirical generalizations made by earlier cultural evolutionists but that rejects these typologies as unscientific due to their lack of explanatory power (Dunnell 1980). Rather than simply describing variability through observation of the archaeological and ethnographic records, selectionist archaeologists attempt to explain change as the differential persistence of variability as a result of selection (e.g., Barton and Clark 1997, Dunnell 1980, Rindos 1989, Teltser 1995). Insofar as selectionist archaeology programmatically rejects models of transformational change (e.g., Dunnell 1980), it is inconsistent with the model of complexity defined below.[2] The goal of this dissertation is not to explain change but to evaluate differences in the social organization of two archaeological cultures within the framework of a particular model of complexity.

Defining Complexity

Current perspectives on the nature of cultural change can be illustrated by contrasting Carneiro's (1973) 'differential evolution' with Claessen's (1981) 'structural change' model. Borrowing from Herbert Spencer (1862), Carneiro (1973:90) defines evolution as "a change from a relatively indefinite, incoherent homogeneity to a relatively definite, coherent heterogeneity, through successive differentiations and

[2] That Dunnell (1980) was not able to extract himself entirely from transformational models seems evident in his attempt to model the advent of complex societies in selectionist terms as a shift in the scale at which selection is most effective from the individual to the group due to the inability of individuals to carry the "full 'code' for reproducing the human phenotype" (Dunnell 1980:51). While Dunnell explicitly states that this model is not transformational, I fail to see how this 'shift in scale' is not a difference in kind rather than degree.

integrations." According to Carneiro (1973), evolution is best conceived as occurring differentially, with societies and aspects of societies (e.g., economic, social, political, and legal systems) evolving at different rates. As Carneiro (1973) acknowledges and Claessen (1981) explicitly states, however, some cultural developments do not lead to increasing complexity and some cultural changes do not lead to structural changes. According to Claessen (1981:17), cultural evolution consists of "structural transformations of culture" wherein changes in one or more aspects of culture "have consequences for all (or most) of the other aspects of the system." The confusion of these two kinds of change (differential and structural) has resulted in the conflation of many micro- and macroscalar evolutionary processes like those to be discussed below. One of the implicit goals of this study is to better define which microscalar components of complexity provide the best indicators of structural changes and to evaluate the differential evolution of these archaeologically definable phenomena within the broader framework of structural change. Both kinds of change are represented in the two major branches of the materialist, evolutionary paradigm discussed above.

Most recently, Yoffee (1993) has argued for a 'new social evolutionary theory' that replaces the band-tribe-chiefdom-state developmental trajectory with a model of differential evolution where each of these ethnographically recorded organizational forms are considered end points on unique trajectories from a hypothetical pre-ethnographic stage of 'bandishness'. Rather than points on an evolutionary continuum, bands, tribes, and chiefdoms represent societies where states could not form due to a variety of constraints. Following Yoffee's (1993) non-developmental interpretation, complexity studies would focus on the differential integration of his three dimensions of power—

economic, social, and political—within each of these categories, rather than investigate changes from one category to another. Although recent studies of culture change in eastern North American prehistory have been highly influenced by Yoffee's ideas (e.g., Pauketat 2007), prevailing interpretations of eastern culture history adhere largely to the older evolutionary sequence (e.g., Smith 1986). The definitions of hunter-gatherers and hunter-gatherer complexity provided below could be incorporated within either interpretive framework.

But what is complexity? Complexity, of course, is a relational term (Service 1993). As Kim and Grier (2006:193) point out, "no human societies are in fact 'simple' except in a relative sense. The social lives of individuals in even the smallest scale hunter-gatherer societies can involve very complex relations and their economic activities can involve an intricate array of scheduling, task differentiation, and mobility." Fortunately, anthropologists are not the only academics interested in complexity as an emergent phenomenon. In attempting to build a unified Theory of Complexity, Johnson (2007:13-15) identifies the following characteristics of all complex systems: 1) they contain many interacting agents that form a network; 2) agents' behaviors are affected by memory of past experiences, or feedback; 3) each agent is an independent entity able to adapt its behavior based on its experiences; 4) complex systems are open systems that can be affected by their environments; 5) systems appear organic in that they appear to act as a whole; 6) systems exhibit emergent phenomena and are, thus, not in equilibrium—anything can happen (markets will crash, traffic will jam); 7) these phenomena typically have no central controller; and 8) systems are characterized by ordered and disordered behavior (traffic jams appear and then clear up).

All human groups exhibit these characteristics and, thus, all can be classified as complex systems. In defining one group as more or less complex than another, we might fall back on Spencer's (1862, cited in Carneiro 1973) definition of evolution cited above. If evolution consists of increasingly more differentiated and integrated systems, then relative complexity might be determined by measuring "the number of parts in a system and number of interrelationships among those parts" (Sassaman 2004:231). As Sassaman (2004) points out, such a definition is difficult to operationalize in absolute terms. As such, this chapter returns to the evolutionary models cited above for a definition of hunter-gatherer complexity based on changes in social organization and differential access to strategic resources.

As utilized herein, hunter-gatherer complexity begins when egalitarian societies integrate at a larger scale than individual bands of nuclear or extended families, forming what are oftentimes referred to as 'tribes' (Anderson 2003, Sahlins 1968, Service 1971). This does not mean that these tribally organized hunter-gatherers are 'complex' in an absolute sense or that they should be interpreted as somehow better than hunter-gatherer groups that are not so organized. This definition of complexity is useful in that it explicitly defines what it is that is 'emerging' when researchers discuss the 'emergence' of complexity. It also provides a basis for defining plausible ethnographic and ethnohistoric analogs. However, it should not be misconstrued as a universally applicable or idealized type for the ranking of hunter-gatherer groups. I reiterate that complexity is a relational term and that the relative complexity of one or more groups can be assessed only by first explicitly defining which components of the cultural system are being evaluated since components evolve differentially. An expanded and more operationalizable definition of 'complex hunter-gatherers' that takes account of these various caveats is provided below.

Models of Emergent Complexity

Analyzing several case studies provided in their seminal edited volume *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity,* Brown and Price (1985) conclude that, while hunter-gatherers have the potential to develop complex societies, such developments may take thousands of years and no prime movers can be identified that result in the emergence of complexity. Nevertheless, these authors are able to identify three conditions within which complexity may occur—1) increasing demographic pressures, 2) territorial circumscription resulting from decreased mobility, and 3) areas of abundant resources (Price and Brown 1985). More recently, Jeanne Arnold (1996a, b; 2000) and others have identified technological change as a fourth condition. Each of these four conditions and the models of emerging complexity among hunter-gatherers developed for them are discussed below.

The role of population growth in the advent of cultural complexity is considered ambiguous (Brown and Price 1985:438). Cohen (1985) argues that the emergence of complexity among hunter-gatherers around the world seems to occur simultaneously during the early to middle Holocene due to worldwide increases in human population densities. Price and Brown (1985) agree that population increases can lead to resource stress. "However, population numbers or densities should not be regarded in terms of an absolute constant or threshold value. We cannot specify the number of people, abundance of environment, or degree of circumscription that is necessary and sufficient for intensification to appear" (Price and Brown 1985:10).

Ester Boserup (1965) provided one of the earliest and most influential anthropological models of population growth leading to complexity. Divorcing herself from the classic Malthusian interpretation of agricultural intensification leading to population growth, Boserup argued that population growth was the impetus behind intensification. To illustrate this, she developed a five-fold classification of agricultural systems based on the extent and intensity of land-use. Placed within an evolutionary continuum from forest fallow swidden cultivation characterized by long periods between plot use to short fallow systems that involve annual cropping or multi-cropping, Boserup convincingly demonstrated that, over the short term, increased intensification reduced leisure time and increased labor inputs. As such, cultivators were not likely to intensify production unless some sort of external input required that they do so. Boserup's (1965) external input was population growth, which was assumed to be a constant among human groups.

Keeley (1988) is perhaps the greatest advocate of a population model for increasing complexity. Compiling a set of 94 hunter-gatherer groups from around the world, he found a strong correlation between socioeconomic complexity and population pressure; the latter defined as the ratio between population density and resource availability. By including resource availability as a factor of population, Keeley (1988) is able to overcome many of the critiques of the role of population in culture change. Population increase and density alone are not stressors that stimulate organizational changes, but population pressure is:

> It has been demonstrated that when the ratio between population density and available resources, as measured by latitude and 'edible' ecological productivity, reaches a certain level, storage dependence, sedentism, wealth/class distinctions, and the use of primitive monies appear. Moreover,

> the intensity of these traits increases as the density/resource ratio increases. Thus, population pressure fits very well the expectations for a necessary and sufficient condition for and the efficient cause of complexity among hunter-gatherers (Keeley 1988:404).

Keeley (1995) also found population pressure to be one of three factors characteristic of protoagricultural societies.

Although Keeley (1988) found no correlation between population size, increase, or density and sedentism, many advocates of population models attribute the advent of complexity to increasing populations in the context of environmental or social circumscription. Drawing on data pertaining to the Jomon of Japan and the Danish Mesolithic, Price (1981) argues that ever-increasing human populations and population densities in resource rich zones results in a feedback between reduced residential mobility, continued population growth, the emergence of hierarchies, and the intensification of food production to meet the new stresses introduced by this situation. The ultimate mechanism for these changes lies in the advent of kin-based corporate groups that were able to monopolize decision-making positions through the control of ritual authority. This model assumes that linear patches of high resource densities like coastal zones and riverine environments are characterized by higher populations as individuals and groups are attracted to these abundant resources. Scalar stresses resulting from increased populations and more intensive food production "necessitates the promotion of individuals or institutions to carry out these functions and to legitimize authority," resulting in more complex social and political organizations (Price 1981:82).

Cohen (1985) proposes a similar model, arguing that complexity results from the collapse of egalitarian social structures as increasing populations in the context of demographic circumscription lead to the increased use of r-selected species. As groups permanently aggregate in areas where these r-selected species are most abundant, a logistical procurement strategy becomes necessary to procure other strategic resources. This switch in settlement organization from high residential mobility to one characterized by sedentism and reliance on task groups for a variety of raw materials and foodstuffs results in the creation of inter-individual dependencies and a loss of autonomy as people can no longer avoid inequalities by 'voting with their feet'. The scalar stresses inherent in this more complex economic and social organization are resolved by the following: 1) the emergence of chiefs or Big Men/Women who guarantee access to resources; 2) the elaboration of decision hierarchies; 3) development of interregional alliances and extension of formal kin-based organizations (i.e., the development of tribes); 4) ceremonial regulation of reciprocal social relations; 5) management of storage facilities; 6) use of human labor for capital investment (such as the construction of fish weirs); 7) formal ritual organization of economic decisions and claims to access; 8) formalization of group membership; 9) banking that converts short-term surpluses into wealth; 10) expansion of trade networks; 11) demand for prestige goods; and 12) emergence of prestige as an economic commodity that can be stored and exchanged (Cohen 1985:105).

Kelly (1991) provides an ethnographic example of the role of population in the advent of complexity. Utilizing ethnographic data from the Pacific Northwest, Kelly argues that the origins of socio-political complexity lie in a complex interplay between hunter-gatherer mobility options, storage, and resource fluctuations. According to this perspective, increasing population packing leads to increased costs inherent in mobility. To offset these costs, hunter-gatherers must invest greater energy in plants and aquatic foods, with storage being a means of capitalizing on localized periods of resource abundance. In areas where resources are heterogeneously distributed, high resource patches are settled first, leading to region-wide sedentism as mobile groups lose access to the most productive patches. With reduced mobility comes the need to limit others' access to these patches and thus retain localized resources for one's own use. A means of doing this is through the replacement of individual social networks with alliances constructed among leaders from each group. Inequality is inherent in this political reorganization, as leaders must negotiate their positions both within and between groups. That is, to be effective, leaders must be generous to the members of their own group while appearing to exercise control over those individuals in the eyes of other group leaders. On the Northwest Coast this is accomplished through elaborate feasting events that involve the accumulation of prestige by the leader and a complex system of debt incursion and repayment (i.e., the potlatch). Emergent inequality among these groups is directly related to gender differences as women's labor is undervalued relative to men's and women are accumulated in the expansion of households in order to intensify production. Slavery exists for largely the same purpose (Kelly 1991).

By way of contrast, Shnirelman (1992) argues that complexity in the Pacific Northwest and elsewhere is the result of increased economic efficiency leading to a manipulable surplus that can be employed for a variety of social, political, and economic functions. In this case, increasing population sizes and densities are a consequence of complexity rather than a condition or cause (Shnirelman 1992).

As discussed above, several researchers consider population growth or pressure in the context of environmental or social circumscription to be an adequate explanation for the origins of complexity in some situations. However, according to Price and Brown

(1985), circumscription is a sufficient condition for complexity due to its effects on mobility. That is, reduction in mobility as a result of circumscription limits solutions groups have to situations of stress, whether that stress is from population pressure or some other factor. "In one sense, complexity arises as a solution to the problems of reduced mobility" (Price and Brown 1985:8).

One of the most widely cited circumscription models, championed by Brown (1985, 1986), pertains to the advent of complexity in the Midcontinent of the United States during the mid-Holocene. This period, termed the Hypsithermal Interval, witnessed a drying trend in upland environments that effectively pushed hunter-gatherers into the lowlands (Dye 1996). Here, resource rich zones containing rapidly reproducing species like mussels and backwater aquatic animals attracted individuals, resulting in the development of a logistical settlement organization and decreased mobility. This reduction in mobility was coupled with social circumscription as the riverine landscape began to fill up and resource rich patches came to be regularly occupied during seasons of high productivity. Inter-group spacing was maintained as a risk reduction strategy, lowering the potential for conflict and inter-group violence. As a result, increasing populations in these resource rich zones required an intensification of production and the advent of complex systems of organizing this production to meet increasing subsistence demands (Brown 1985, 1986). In some regions, these stresses were reduced through group fissioning as some splinter groups began to settle along secondary streams and in regions of lower productivity, resulting in large midden accumulations away from major river valleys (Munson 1986b).

As can be seen, population pressure and circumscription are linked, with the differing models of emerging complexity presented above providing more weight to one condition over the other. The link between population and resource abundance, Price and Brown's (1985) third condition, in the advent of complexity can be seen in tracking the development of Brian Hayden's accumulator model. Beginning with an evaluation of the developmental sequence of Pleistocene and early Holocene hunter-gatherers, Hayden (1981) posited that human groups around the world attempted to maintain a stable level of resource stress in the face of increasing population levels at this time. To do this, Pleistocene groups diversified their diets through time, eventually relying on low ranked, r-selected species that required specialized technologies to efficiently exploit. Once these technologies had been developed, however, these r-selected species represented a stable source of nearly inexhaustible food that could be exploited via a specialized extraction, processing, and storage technology, allowing genetically egotistical accumulators to compete for prestige where previously such behaviors were not tolerated. This competition, along with increased sedentism, resulted in ranked societies. Domestication developed as a part of the resource diversification process in regions where r-selected species were not abundant.

By the mid-1990s, Hayden (1996) had concluded that the strength of the egalitarian ethos among ethnographically recorded hunter-gatherers indicated that initial inequality must develop in areas of resource abundance. In these highly productive regions, individual accumulations of property and wealth are tolerated because of the benefits they offer the community as a whole through capital investments in facilities such as weirs. Once initial ownership and inequalities are established, however, either resource stress or abundance can lead to additional institutionalized inequalities (Hayden 1996).

One mechanism Hayden (1994) provides for such institutionalization of inequalities is competitive feasting. In areas of resource abundance characterized by a stable resource base focused on the exploitation of r-selected species, accumulators are able to control labor power through systems of competitive feasting like the potlatch. In these systems, prestigious accumulators are able to convert labor power into exotic goods and networks of social debt that provide them a great deal of prominence in society (Hayden 1994, 1995). Although feasts may act on one level as high-level buffering mechanisms against rare events of resource scarcity in these highly productive zones (Halstead and O'Shea 1989), they also act to reinforce existing relations of power (Dietler 2001). One unintended consequence of feasting and competition among individuals and groups for prestige is the emergence of rank societies, as illustrated by the case of the Mokaya of the Mazatan region of Chiapas, Mexico (Clark and Blake 1996).

Another means by which accumulators can control the production and distribution of wealth is through control of special technologies central to production, considered here to be the fourth condition within which complexity may occur. Arnold (1995), for instance, argues that the emergence of complexity among the Chumash of the Channel Islands of southern California and the Nootkans of British Columbia is tied to the invention and control of large canoes suited to ocean travel. These canoes, which replaced earlier, lighter canoes that were not capable of safely traversing long distances across channels and over the open ocean, allowed political, economic, and religious leaders to control the exchange of food, ornaments, and socially valued goods, as well as access to information and personal travel. The large amounts of labor and relative scarcity of materials used to construct these vessels limited access to advanced boating technologies to wealthy individuals and families so that commoner families became dependent on elites for transportation, food, and trade (Arnold 1995). As a result, elites were able to control and manipulate the labor of both kin and non-kin, an important component of chiefdom-level societies (Arnold 1996a, b; 2000).

In the case of the technological innovations model, the new technology acts as a condition for the advent of complexity, but the technology itself is not a causal variable. "What is more likely novel were the socioeconomics of its new relations of production orchestrated and promoted by those who most successfully applied the technology to existing situations" (Kim and Grier 2006:196). Indeed, none of the four conditions for complexity discussed above—population pressure, circumscription, resource abundance, and technological innovation—can be interpreted as causes for the emergence of complexity. The advent of complexity in any given group is dependent upon several interacting, historically contingent factors, some of which may not be readily identifiable in the archaeological record (e.g., the specific influences of single individuals). Culture change, although typically modeled as a series of stages, consists of a continuous series of events that, at the scale of the individual, amount to decisions concerning the allocation of time and resources in the pursuit of specific goals (Barth 1967). Likewise, interpreting complexity among hunter-gatherers requires examining change at a variety of scales. Before discussing these macro- and microscalar aspects of hunter-gatherer complexity, however, it is important to provide a definition of hunter-gatherers appropriate to the theoretical goals of this dissertation.

Complex Hunter-Gatherers

Numerous archaeological and ethnographic cultures have been described in the literature as ‘complex’ hunter-gatherers. In fact, following Yoffee (1993) each ‘stage’ of socio-political organization in Service’s (1971) evolutionary typology would be characterized by societies that are more or less complex than one another. What follows are several case studies of hunter-gatherer societies from around the world that have been classified as ‘complex’ in one way or another or that exhibit characteristics that have been interpreted as complex. The goal of this section is to illustrate the range of variation among so-called complex hunter-gatherers before deconstructing this variation and eliminating some of these hunting and gathering groups by developing a definition of a hunter-gatherer mode of production that can act as a more appropriate means for determining plausible analogs for prehistoric groups. The groups to be discussed in this section are 1) various San speaking bands of southern Africa, 2) various Australian Aborigines, 3) Upper Paleolithic cultures of Western Europe, 4) various groups of the American Pacific Northwest, 5) the Chumash of southern California, and 6) the Calusa of southern Florida.

San Speaking Groups of Southern Africa

Judging from the available literature, San speaking groups of southern Africa are among the best documented and most studied hunter-gatherers in the world. Typically described among the least complexly organized hunter-gatherers, these groups are highly variable and some exhibit characteristics that are oftentimes interpreted by archaeologists as evidence for complexity.

Taken as a whole, variability among San groups provides support for Yoffee's (2003) new social evolutionary theory. However, evidence for the advent of tribal-like political relations are present in at least one group. The //Gana of the northeastern Kalahari practice a limited form of food production that has allowed them a degree of security against environmental fluctuations and resulted in semi-sedentism and a relaxing of the egalitarian ethos. As a result, an incipient 'big man' system has developed among the //Gana, with some individuals and bands accumulating a relatively large amount of wealth, primarily in the form of cattle, goats, and wives. Politically, this has resulted in the recognition of certain wealthy individuals as informal, self-proclaimed 'headmen' who are considered to be capable of speaking for specific groups (Cashdan 1980). The advent of heritable property, decreased mobility, and decreased autonomy of individuals evident among the //Gana place this group among the most complex band-level societies and exhibit how such groups might integrate into societies classified in the anthropological literature as tribes.

Many San speaking groups are much less complex than this. The !Kung and G/wi are both characterized by high social fluidity, egalitarian social relations that emphasize autonomy, decision-making by consensus, and a lack of formal leadership positions (Lee 1968, 1982; Silberbauer 1982). The sexual division of labor among the !Kung is complementary, with women performing many of the child-care responsibilities and gathering approximately 2/3 of daily meals and men working longer hours hunting game and performing bride service (Lee 1972a, 1982). Tensions between husbands and wives result in divorce with little conflict or resistance, and the majority of divorces among the !Kung are initiated by women (Lee 1982). Marriages among the G/wi may be ended by one spouse simply leaving the other. However, if the divorce is not confirmed by the other spouse remarrying, trouble can ensue and the group may attempt to force a resolution. In one case, the divorcing wife chose to return to her abandoned husband along with her lover (and husband's friend) and the three lived together in a polyandrous relationship (Silberbauer 1982).

Like many egalitarian hunter-gatherers, San speaking groups are oftentimes characterized by group flux. The !Kung camp is described by Lee (1968:31) as "an open aggregate of cooperating persons which changes in size and composition from day to day." Although the composition of individual camps varies, territoriality based on language, kinship, and cultural practices is evident among San speaking groups. Territoriality correlates with resource predictability, with the Nharo and !Kung exhibiting less territoriality than the !Xo, who live in more marginal regions. Among the !Kung, the band is the territorial unit, and band territories overlap near waterholes. Social boundary defense is the predominate mechanism for asserting land claims (Barnard 1992, Cashdan 1983). Most San speaking groups are characterized by "a degree of flexibility in territorial ideology which permits the temporary occupation of territories by alien groups" (Barnard 1992:144). The !Xo, however, attempt to preserve group integrity by excluding other groups from their lands through perimeter defense, a characteristic that is oftentimes considered a form of complexity (Barnard 1992). The difficulty inherent in identifying these various territories of San speaking groups in the archaeological record has been illustrated by Sampson (1988), who had mixed results in defining style zones using ceramic distributions at sites in the Upper Seacow River valley of South Africa.

One characteristic of San speaking groups that is commonly cited as evidence for their lack of complexity is their high mobility. Individual foraging trips among the !Kung may result in travel of three to twenty miles in a single round trip excursion, with some people traveling up to 100 miles for visitations (Lee 1972a:330-331). The Kūa are also highly mobile, with camps relocating every six to eight weeks in the wet season and six to seven days in the dry season (Hitchcock and Bartram 1998:35). The !Kung tend to live in dispersed camps of between seven and fifty individuals during the summer wet season, but aggregate during the winter dry season near water sources. These periods of aggregation also result in an increase in the intensity of !Kung social life, as dancing, initiations, marriages, and other rituals occur at this time. Aggregations also tend to be unstable, however, as more people crowded together provides more opportunities for conflict and requires more per capita work effort to support the population concentrations (Lee 1972b).

As illustrated by the semi-sedentary //Gana, however, not all San speaking groups are highly mobile (Cashdan 1980). The so-called 'River Bushmen' of the Nata River region of the eastern Kalahari are a 'biologically negro' but linguistically Khoisan group who live in nuclear and extended family compounds in villages located along the river. These groups are divided into totemic clans and have positions of social and political status held by doctors and territory owners (Hitchcock 1982). These groups are highly reliant on agricultural foods, potentially excluding them from discussion, but, as Vierich (1982) points out, San speaking groups practice a range of subsistence behaviors depending upon individual and group preferences and economic opportunities. Some San speaking groups are nearly completely dependent upon hunting and gathering, while others are nearly completely dependent upon agricultural products. Some obtain agricultural products exclusively from Bantu speaking neighbors, and others tend their own gardens and livestock. No absolute distinction can be made among 'hunter-gatherers' and 'agriculturalists,' even among these most classic of hunter-gatherer groups (Vierich 1982).

One final aspect of complexity found among San speaking groups is the exchange of objects and goods over long distances. The !Kung practice little to no food storage (Lee 1968), but manage risk by building networks of social relations that can be drawn upon in times of need through the exchange of objects like ostrich shell bead headbands and hunting arrows (Wiessner 1982, 1983b, 1984). This exchange network, known as the *hxaro*, also acts as a mechanism for relieving social tensions and distributing food products in that some of the meat of slain animals is given to the maker of the arrow that killed the animal, whether that individual was a member of the hunting party or not (Marshall 1976). Children are introduced into the *hxaro* at an early age, with their first gift typically provided by a grandparent anytime between the age of six weeks and six months (Wiessner 1982:72). These objects, including beads, are sometimes placed in burials but do not imply any form of social status (Fiedel 1989, Wiessner 1982). San speaking groups have been participating in such exchanges with both other San and with neighboring agricultural groups for hundreds of years, but have until recently remained largely autonomous regardless of outside influences (Solway and Lee 1990).

Australian Aborigines

Ethnographic and ethnohistoric data pertaining to hunter-gatherer groups in Australia are supplemented by a long history of archaeological research. Pleistocene age sites in Australia indicate a low population and non-intensive food procurement patterns until around 5000 B.P when, in some regions, an increased number of sites with evidence for intensive occupations became evident. Other indications of increased complexity at this time include exploitation of a broader range of resources, the advent of long-distance exchange networks, and the development of figurative art (Lourandos 1985). At contact, these exchange networks linked groups across large expanses resulting in a kind of cultural homogeneity in spiritual matters. According to Paton (1994), exchange networks existed to facilitate the spread of spiritual knowledge pertaining to land rights established during the Dreamtime, the Australians' dominant origin myth. In the Northern Territories, blades manufactured from local quartzite were exchanged in bundles with boomerangs, digging sticks, and hair belts. Although the blades were manufactured from local materials, strict rules adhered to who could use the quarries from which the raw materials to manufacture the blades were obtained. During exchanges, portions of the Dreamtime myth were recited. The local availability of quartzite and the fact that archaeologically recovered blades were rarely found to have had any utilitarian function are interpreted as evidence that communication of the Dreamtime myth and the dissemination of land use rights were the primary purposes behind the exchange systems (Paton 1994).

As among the San speaking groups discussed above, land use rights and territoriality are highly variable among Australian Aborigines. Many Australian groups are characterized by high mobility and group flux such that group membership is highly flexible (Layton 1986). Although well defined territories exist, groups frequently forage in territories that are not their own (Hiatt 1968). The major land holding group is the clan, made up of about 15 to 50 individuals who are united by right of birth to a particular portion of the Dreamtime landscape. Clans are not true descent groups since membership is based on where one is born rather than from whom one is descended (Hamilton 1982). However, clans are interrelated through marriage and organized into larger linguistically united tribes. Clans and tribes are not resident groups, and rights to land do not include exclusive foraging rights but "consist primarily of exclusive access to, and the responsibility to look after, places of spiritual significance; the so-called 'sacred sites'" (Layton 1986:22).

As a result of this confusion between land use, land rights, and the spiritual significance of land, researchers have differentiated between the economic and ideological spheres of Australian land use. At the economic level, 'hordes' (consisting of patrilineal kin, their wives and children, and unrelated 'adherents') occupy and exploit a 'range'. At the religious level clans own a smaller territory known as an 'estate.' "The estate is defined by virtue of 'spiritual' ties between individuals and certain places in the landscape, whereas the 'range' is defined by the hunting and foraging activities of people in the landscape" (Hamilton 1982:86). Economic rights of access for purposes of foraging are maintained through social boundary defense, with non-owning groups conducting one of several greeting ceremonies to obtain permission to use a group's territory. Once the greeting ceremony is performed, the visiting group has use rights equal to those of the owners (Peterson 1975).

Unlike San speaking groups, unequal gender relations characterize some Australian groups. Although egalitarian social relations are considered the rule, in actual practice males have more support in domestic disputes, and the poor treatment of women by their husbands is, thus, legitimated (Begler 1978). Androcentrism is present even among highly dispersed populations in the interior. This is evident in the focus on male age-set initiation rites during aggregation events. These events, which provide a mechanism for the maintenance of interband solidarity among dispersed groups, are focused on male rites of passage involving sons and mother's brothers. The continuation of interband relations are guaranteed through a cross-cousin marriage rule also perpetuated at these events (Yengoyan 1972).

In addition to long-distance exchange, incipient status differentiation, and a complex land rights system, some Australian hunter-gatherers practiced a form of food production and exhibited social ranking. The Gunditjmara of Southwest Victoria, Australia, for instance, were a complex society with a ranked political hierarchy and an extensive trade network. Recent archaeological data from the area of the Mt. Eccles lava flow indicates this region is characterized by hundreds of archaeological features interpreted to consist of an extensive and complexly organized system of dams, weirs, and eel traps punctuated by habitations. These dams and weirs served to extend and direct the wetlands flowing across the volcanic landscape, thus providing year-round access to a nutrient-rich, high calorie foodstuff—the shortfin eel. During eel migrations, these animals were captured and processed in bulk using culturally modified hollow trees as drying facilities. Dried and stored eels were then exchanged by the local chiefs, who used their economic and political power to organize warfare, manipulate a prestige goods economy and the marriages of their constituents, and to mediate both intra- and inter-tribal disputes. As such, the Gunditjmara are only hunter-gatherers in a basic sense in that their political economy was ranked and structured much more like that of early agricultural societies elsewhere in the world (Builth 2006).

European Upper Paleolithic

One of the more interesting cases of complexity among hunter-gatherers comes from the European Upper Paleolithic. These groups, considered the first modern *Homo sapiens* in Europe, are generally characterized as logistically organized mobile hunter-gatherers that exploited a wide range of food sources including ibex, reindeer, horse, bison, wild cattle, red deer, pike, salmon, ptarmigan, rabbit, hare, and many other animals and plants. Groups lived in dispersed bands of between 10 and 30 individuals, but aggregated periodically for communal hunts and ritual events (Dobres 1999). The heterogenous environment of late Pleistocene Europe has led Burke (2004) to posit that most Upper Paleolithic hunter-gatherers were likely characterized by a high degree of group flux. In addition to these traits, found among many non-complex hunter-gatherers, the Upper Paleolithic exhibits many aspects of social complexity, including highly developed stationary and mobiliary art, monumental architecture, and long-distance exchange (Soffer 1985).

The Magdalenian is interpreted as the most complex period of the Upper Paleolithic by Mellars (1985). Evidence for complexity during this time period includes the existence of large aggregation sites, a more technologically complex material culture indicative of the existence of specialists, larger numbers of ceremonial burials containing burial goods suggesting the existence of some form of ranking (contra Fiedel 1989), and a peak in the production of mobiliary and cave art (Mellars 1985).

Art forms have played a prominent role in interpretations of the European Upper Paleolithic. According to Conkey (1985), the greatest elaboration in art is found at large Magdalenian aggregation sites that were located in good hunting locales. Magdalenian art forms are interpreted by Conkey to be forms of ritual communication and the density of art forms at aggregation sites is interpreted to indicate the need to alleviate scalar stresses inherent in such large gatherings. It is suggested that the manipulation of Upper Paleolithic art by ritual leaders may have provided a basis for the advent of incipient hierarchies among these groups (Conkey 1985). Bender (1989) takes this argument a step further by interpreting cave art in difficult to access locations as evidence for exclusivity in the communication of ritual knowledge. Widely distributed but esoteric knowledge is also evident in abstract mobiliary art. Both forms of exclusivity are interpreted as evidence for social differentiation through the manipulation of ideological beliefs and practices (Bender 1989).

Barton et al. (1994) provide a model of social interaction and territoriality based upon Gamble's (1986) three Upper Paleolithic temporal divisions—the downturn period (30 to 21,000 B.P.), the refuge period (21 to 13,000 B.P.), and the upturn period (13 to 7000 B.P.). According to Barton et al. (1994) the open social networks and dispersed populations of the downturn period are marked by the formation of individual networks of alliances and the importance of personalized mobiliary art (assertive style). Increasing population densities during the refuge period, however, led to increased territoriality and negotiated boundary maintenance as a risk reduction mechanism. The group-level nature of these changes led to the advent of parietal art (emblemic style) in the form of landscape modifications (i.e., cave and rock art) at aggregation sites. Changing environmental conditions during the upturn period then led to the dispersal of these populations and the reestablishment of mobiliary art as the dominate information encoding mechanism.

The most complex hunter-gatherers present during the Paleolithic in Europe may be those of the Russian Plain studied by Soffer (1985). After about 18,000 B.P., logistically organized hunter-gatherers on the Russian Plain increased their food production by hunting a larger number of large herbivores and expanding their diet to include a wider variety of smaller species. This economic change was coupled by an increased emphasis on food storage and evidence for the specialized procurement of fur bearing species for long-distance exchange. It is also at this time that complex base camps appear at sites like Eliseevichi, Mezhirich, and Mezin. These sites contain mammoth bone dwellings, hearths, large numbers of storage pits, and a wide variety of exotic and local trade goods including decorated objects, portable art, jewelry, and fur bearing animal remains. The mammoth bone structures are interpreted as a kind of monumental architecture given the complex arrangements of bones to create repetitive sequences and mirror images. The distribution of exotic materials like non-local lithics and pendants manufactured from amber and fossil marine shell indicates both directional and down-the-line exchange and increased social interaction. Finally, the advent of status differentiation is interpreted in the burial of certain individuals with grave goods and in the control of resources by select households, indicated by the concentration of storage pits around a single dwelling at Mezin (Soffer 1985).

Complex Hunter-gatherers of the Pacific Northwest

Cross-cultural analyses of hunter-gatherer subsistence practices and environmental data indicate that maritime hunter-gatherers like those of the Pacific Northwest of North America are unique in that they are more likely to be characterized by high population densities, more permanent settlements containing more people, more restricted territoriality, socioeconomic competition, and a greater degree of political complexity (Pálsson 1988, Yesner 1980). Historical data from the Northwest indicates that environmental factors cannot entirely explain social complexity among these groups in that, prior to about 5000 B.P., they consisted of small-scale, generalized, egalitarian hunter-gatherers (Ames 1981, Coupland 1996). By contact in what is now Washington and British Columbia, "were peoples with permanent houses in villages of more than a thousand; social stratification, including a hereditary caste of slaves and ranked nobility; specialization in several kinds of hunting and fishing, crafts, and curing; social units larger than villages; elaborate ceremonies; and one of the world's great art styles" (Suttles 1968:56).

The archaeological record of the Pacific Northwest indicates an increase in technological diversity and a trend toward the specialized exploitation and storage of shellfish and salmon about 5000 B.P. (Ames 1981, 1985). An additional increase in technological diversity is indicated around 3500 B.P. (Ames 1985). At this same time, increased regional population corresponds with the advent of the first identified permanent village at the Paul Mason site. This site is interpreted as evidence of a horizontal change in social organization as dispersed bands integrated for the first time into a single lineage residential unit. No evidence of status differentiation is present at this time (Coupland 1996).

By 2500 B.P., during the Marpole phase (2500 to 1500 B.P.), a network of long-distance exchange involving the movement of nephrite adze blades and dentalia shells is present on the coast (Grier 2006). A vertical social reorganization is indicated at the McNichol Creek site, as an increase in prestige goods and the construction of a single, significantly larger structure in the village signals the advent of hereditary ranking (Coupland 1996). Burials at the False Narrows site indicate the existence of at least four categories of individuals at this time, including two distinct social groups. The existence of a class of slaves is indicated by burials from Prince Rupert Harbor, where human trophy skulls and other modified human remains have been recovered (Ames 1985:171). An additional horizontal differentiation is indicated at 1500 B.P., as larger multilineage villages divided among multiple, ranked Houses appear in the archaeological record (Coupland 1996).

Although maritime hunter-gatherers of the Pacific Northwest were more complex than most other hunter-gatherers described in the ethnographic literature, these groups were also characterized by much variability. Kelly (1991), for instance, identified a south to north trend in complexity that he associates with increasing resource fluctuations as one moves north along the coast. On the southern coast, the Tolowa and Yurok occupied permanent villages, but many individuals traveled inland in the fall to collect acorns and catch salmon. Resource patches were not owned and corporate groups did not own common property. Prestige goods were used as bridewealth and no permanent leadership positions existed (Kelly 1991).

On the central coast, groups were a bit more complex. Salishan and Wakashan groups practiced individual and family ownership of some property, but hunting grounds and berry fields were corporately owned. Kin groups were ranked, and lower-ranked groups provided payments to those of higher rank. Prestige was obtained via the potlatch, with the most prestigious households being those that were able to effectively maximize production, sometimes with the use of slaves (Kelly 1991).

The most complex societies were the Tsimshian, Tlingit, and Haida of the northern coastal region. These groups lived in large, permanent villages organized into moieties. Matrilineal clans owned large territories, and chiefs were supported by lower-ranked commoners and slaves (Kelly 1991). The House was the social unit among these groups. The residential compound belonging to the House consisted of multiple dwellings, with the largest being the dwelling of the House chief. A single House could own as many as three to five such structures, with each residential group consisting of 20 to 25 individuals. The House itself was a corporate group made up of 60 to 125 individuals united through common descent, property, and allegiance to the House chief (Coupland 1996).

The Chumash

At contact, the Chumash of southern California "were ruled by hereditary chiefs who orchestrated regional exchanges with neighboring groups, served as war lords, hosted ceremonial gatherings, and controlled a political economy fueled by intensive exploitation of marine and terrestrial resources and a 'monetary' system of shell beads produced by specialists" (Sassaman 2004). Examination of microblades and microblade cores from two sites on Santa Cruz Island by Arnold (1987) indicated a change through time in core production technologies concomitant with the adoption of a shell bead money system and the advent of cultural complexity among the Chumash. Earlier microblade production (ca. A.D. 800-1150) at Site SCrI-93 consisted of an expedient technology of unprepared core reduction resulting in a high failure rate and much wasted raw material. Later production (ca. A.D. 1300) at Site SCrI-306 was more standardized and involved the use of prepared cores, resulting in a more consistent product. These sturdier, less variable microblades could be used to produce better microdrills needed for the production of shell bead money from the hard calluses of Olivella shells. The movement of production from the quarry at Site SCrI-93 to the coastal location at Site SCrI-306 and the increased specialization evident in the production process suggests elite control over the production of shell bead money as the Chumash became increasingly centralized into a chiefdom level society (Arnold 1987).

This complexity was further tied to the development and control of ocean-going plank canoes (or *tomols*) among the Chumash between A.D. 500 and 800. The control of large canoes suited to ocean travel allowed political, economic, and religious leaders to control the exchange of food, ornaments, and socially valued goods, as well as access to information and personal travel. The large amounts of labor and relative scarcity of materials used to construct these vessels limited access to advanced boating technologies to wealthy individuals and families so that commoner families became dependent on elites for transportation, food, and trade (Arnold 1995). This dependency was extended to shell bead specialists on the islands who were independent in the sense that their production activities were not directly monitored by elites but attached in the sense that the distribution of their products was controlled by the *tomol* owners (Arnold and Munns

1984). Through control of the major means of transportation, Chumash elites were able to control non-kin labor and the distribution of both prestige goods and foodstuffs (Arnold 2000). Such distinctions between elites and non-elites are supported by burial data dating from A.D. 500 in the Buchanan Reservoir area of central California, where two distinct groups of burials—one of extended burials associated with many grave goods and one of flexed burials with fewer grave goods—were identified (King 1978).

The Calusa

The Calusa chiefdom of southern Florida was a ranked society characterized by a tributary mode of production and a fisher-hunter-gatherer mode of subsistence. The chiefdom was a paramountcy of around 25 towns united under a single ruler who maintained authority through his supernatural control over the natural environment. Contradictions existed within this group, however, as intra-familial tensions resulted in factionalism and peripheral town chiefs shifted allegiances to neighboring groups. Ultimately, Spanish interaction in Calusa affairs resulted in the group's demise and eventual extermination (Marquardt 1988).

According to Milanich and Fairbanks (1980:241), the Calusa were "the most important aboriginal group in South Florida in terms of population size, political importance, and influence on neighboring tribes." The paramount chief of the Calusa operated out of the capital town of Calos, located at Mound Key. Evidence of Calusa architectural complexity at this site takes the form of large earth and shell platform mounds, terraces, ridges, water courts, and a series of canals that cut across the island (Morgan 1999). The recovery of large numbers of painted and carved wooden masks, plaques, and figurines from Key Marco illustrates the skills of Calusa artisans and indicates a significant investment of labor in socio-politically and ritually valued objects (Gilliland 1970, Milanich and Fairbanks 1980).

Politically, Calusa society was stratified into three classes – the nobles, commoners, and captured servants. In addition to the paramount chief and his family, individual towns were led by chiefs whose daughters or sisters were married to the paramount chief. A kind of advisor or assistant to the chief was referred to by the Spanish as the 'captain general'. The paramount chief was both the political and the religious head of the Calusa, although other priests of the noble class existed. The chief's power is illustrated by the fact that his house could accommodate as many as 2000 individuals (Marquardt 1988).

The Hunter-Gatherer Mode of Subsistence

As can be seen, hunting, gathering, and fishing groups from around the world are characterized by a great range of variability in social, economic, and political organization. Various groups from the relatively non-complex San speaking bands of southern Africa to the highly complex Calusa chiefdoms of southern Florida practiced a hunter-gatherer mode of subsistence, and the entire range of these groups have been used as ethnographic analogs for Archaic hunter-gatherers in eastern North America. Such comparisons are no longer viable. As Sassaman (2004:230, see also Ellen 1994) points out:

> A vast literature now supports the notion that a subsistence economy based on wild food resources is not structurally linked to any particular form of social organization, technology, labor arrangement, intergroup relations, or ideology. In fact, the term 'hunter-gatherer' implies nothing but that—a mode of subsistence—with permutations asserted to account for emphases on plant foods (gatherer-hunter) or fish (fisher-gatherer-hunter) instead of game. We can likewise cite many cases in which husbanding wild resources is tantamount to food production, or suggest

> that the abundance of high-yield wild foods is the equivalent to agricultural produce in its economic elasticity.

It follows that the use of the mode of subsistence as a basis for constructing ethnographic analogs for archaeological interpretations fails to adequately explain variability in other aspects of complexity among these groups. Established as the primary unit of analysis at the Man the Hunter conference (Brown and Price 1985, Lee and DeVore 1968), the category 'hunter-gatherer' is too broad when left to refer simply to the kinds of food a particular group consumes (contra Panter-Brick et al. 2001). The advent of agriculture is no longer a necessary prerequisite for the emergence of sociopolitical complexity (Arnold 1996b, Rowley-Conwy 2001), and, likewise, the use of agricultural products is no longer a sufficient criterion for eliminating a particular group from comparison with hunter-gatherers (see Solway and Lee 1990 and Yellen 1989).

The inclusion of all of the above described groups into a single analytical category on the basis of a shared mode of subsistence has resulted in much confusion as to what constitutes complexity among hunter-gatherers. For instance, it is easy to compare the Calusa to the !Kung and conclude that the former are more complex than the latter. If the difference in complexity between these two groups is one of degree, then there is a quantitative distinction between them and the two are comparable (Figure 2-1a). However, the difference in complexity between these two groups might also be relational on an ordinal scale and take the form of Figure 2-1b. In this case, the difference between these two groups is not one of degree, but of grade (or kind), with each ordinal category defined qualitatively. Such a scale of complexity resembles the bands-tribes-chiefdom models of Service and Fried (Figure 2-1c).

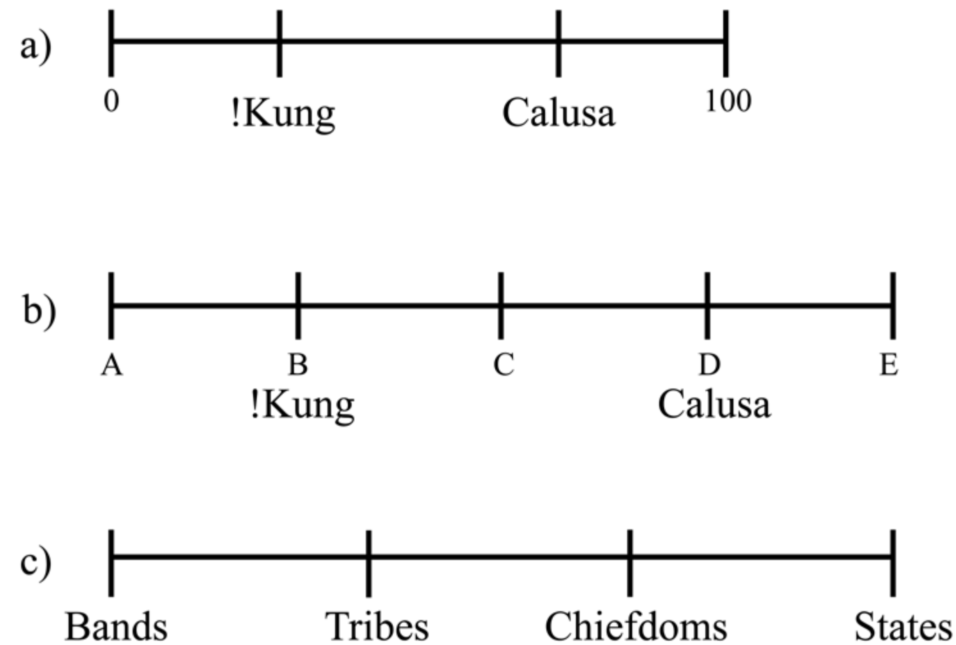


Figure 2-1. Hypothetical Scales of Hunter-Gatherer Complexity.

This unilinear stage model has been rightfully critiqued. For instance, McGuire (1983) points out that such a model reduces culture change to a single directional process where change in one aspect of society affects all other aspects, resulting in a series of evolutionary steps from bands to tribes to chiefdoms. According to O'Shea and Barker (1996) such a model reduces variability by assigning different groups to an ideal taxonomic category defined by dichotomizing social properties into a presence/absence scale. The groups that are assigned to these ideal classes are then assigned specific properties based upon the definition of the ideal type. Both sets of authors argue that the stage model reduces a continuum of cultural types into a discontinuous scale represented by modal values (McGuire 1983:94, O'Shea and Barker 1996:14).

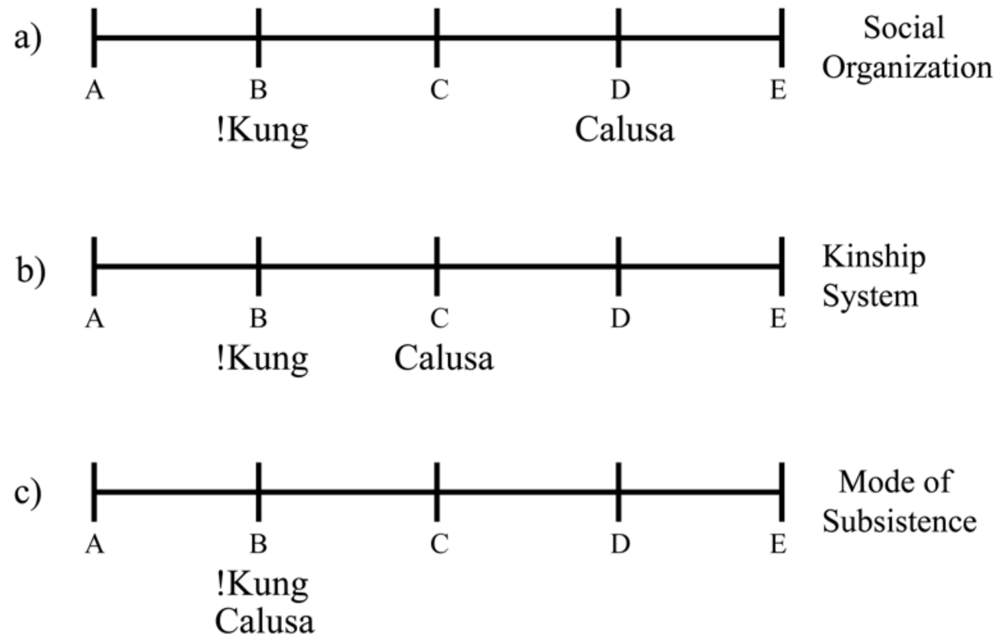


Figure 2-2. Hypothetical Relative Ranking of !Kung and Calusa based upon Three Aspects of Complexity.

McGuire (1983) and O'Shea and Barker's (1996) critiques are correct in the sense that the bands-tribes-chiefdoms model tends to (or is used to) reduce variability into a set of ideal types that, as Yoffee (1993) points out, are not always linked as an evolutionary sequence. In reality, few societies can be appropriately fit to the evolutionary model because each ordinal category (Figure 2-1c) is defined by a set of simplified criteria that may be contradictory. For example, figure 2-2 illustrates how the !Kung and Calusa could be differentially ranked in terms of the complexity of their social organizations, kinship systems, and modes of subsistence.

McGuire (1983) and O'Shea and Barker (1996) are incorrect, however, when they argue that the bands-tribes-chiefdoms model reduces a continuous scale of cultural complexity to a discontinuous set of idealized types. As the several examples of hunter-gatherers described above illustrate, aspects of culture as central to our definitions of social types as subsistence practices and political systems do not co-vary in a predictable manner. Different aspects of society and, thereby, different aspects of complexity evolve at different rates. As a result, societies that may be comparable to one another at one scale or based upon one criterion are qualitatively distinct from one another at others. Such qualitative distinctions cannot be illustrated by a continuous scale of social evolution and, in this sense, variability is not uniformly continuous but is punctuated by transformational changes that redefine social, political, or economic systems in such a way that they are no longer comparable to those of other groups.

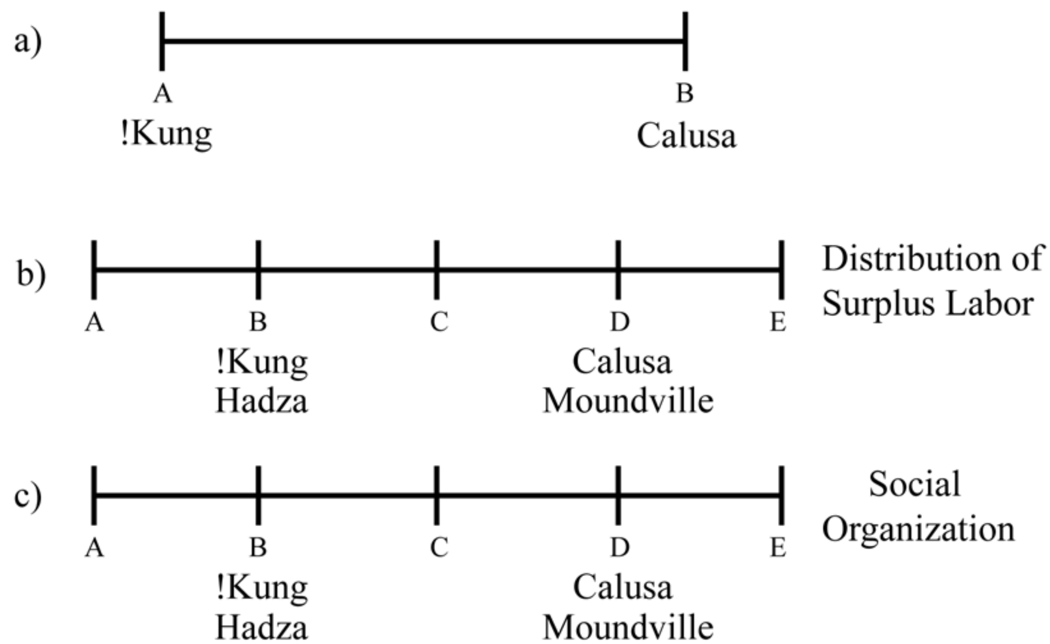


Figure 2-3. Hypothetical Rankings and Cross-Cultural Comparisons.

Alternatively, one can avoid the confusion of analyzing societies on any kind of scale at all by simply evaluating each group on a subjective basis as either ‘simple’ or ‘complex’ and comparing different groups accordingly (Figure 2-3a). This approach is not very satisfactory, however, in that it does not first define a single criterion by which simplicity or complexity is applicable to all societies included in each nominal category, nor does it provide a nuanced approach to cross-cultural comparison.

Having invalidated a continuous scale model and not been satisfied with a nominal presence/absence model, we are left with an ordinal ranking model for determining plausible analogs for cross-cultural comparison. Rather than reducing variability by assigning distinct groups to ideal types along an ordinal scale, however, it seems most productive to rank societies on the basis of a single aspect of complexity and then to make comparisons among groups on the basis of that particular criterion. This is what has been done to date in hunter-gatherer studies, with mode of subsistence being the favored criterion for cross-cultural comparison. However, as discussed above, comparison of the full range of variation among groups that hunt and gather indicates that the absence of domesticates is not a valid basis for ranking societies since the mode of subsistence fails to explain variation among other potential ranking criteria. Figures 2-3b and 2-3c, for instance, provide hypothetical rankings based upon the distribution of surplus labor and social organization. In this case, meaningful comparisons could be made among the !Kung and Hadza and among the Calusa and the complex agricultural Moundville chiefdom of the Late Prehistoric period in Alabama in terms of other aspects of culture, but such comparisons among the !Kung and the Calusa would be inappropriate since these two groups are qualitatively distinct from one another based upon the criterion selected for the basis of comparison. The appropriate basis for cross-cultural comparison must be decided by each analyst but should, as a rule, explain much of the variability among groups in the properties to be analyzed. This study draws on hunter-gatherer theory to define a ‘hunter-gatherer mode of production’ and uses this mode of production definition as the basis for determining analogs for Archaic cultures in eastern North America.

The Hunter-Gatherer Mode of Production

Although oftentimes equated with evolutionary ecology or behavioral ecology (e.g., Bettinger 1991, Kelly 1995), both of which have generated massive amounts of data pertaining to the study of hunter-gatherers, 'hunter-gatherer theory' more broadly conceived might best be thought of as a subset of a general theoretical approach in North American archaeology that Michelle Hegmon (2003) terms 'processual-plus'. As Hegmon (2003) points out, the North American theoretical landscape is diverse and tolerant of multiple perspectives, combining the study of several post-processual themes (e.g., gender and agency) with the methodological rigor of processualism. With regard to the study of human social organization, Service's (1971) typological framework has largely been replaced by a multidimensional approach to topics that cross-cut standard types, such as forms of power, mobility strategies, craft specialization, etc. (Hegmon 2003:227). Hunter-gatherer theory, then, might be equated with a 'theory of gender' or 'landscapes theory' within this general processual-plus framework.

Isolation of a hunter-gatherer theory as a distinct topical perspective also demonstrates a methodological concern for integrating archaeological, ethnological, and ethnoarchaeological data developed within diverse theoretical perspectives into a holistic approach to a particular kind of social and economic organization. Differentiating hunter-gatherers from agriculturalists or pastoralists demonstrates a concern for developing a logical comparative framework for the study of prehistoric foraging groups. As Lee and DeVore (1968:3) point out, over 99% of human history is characterized by a hunting and gathering way of life. Thus most of the archaeological record (and much of anthropology) is concerned with hunter-gatherers. The development of a distinct 'hunter-gatherer theory' reflects the need to develop a body of plausible analogs applicable to the interpretation of this record (see Smith 1977).

This focused concern for studying hunter-gatherers has deep roots within anthropology. As Bettinger (1991:2) points out, anthropology was largely founded upon the study of hunter-gatherers:

> The theories of anthropology have been shaped in fundamental ways by hunter-gatherers. It was primarily in response to direct encounters with primitive peoples, many of them hunter-gatherers, that anthropology itself arose. Subsequent attempts to understand hunter-gatherer lifeways have directly contributed to the development of many powerful anthropological theories: structural-functionalism, environmental possibilism, structuralism, cultural ecology, and neofunctionalism, to name but a few. It is arguable, indeed, that what distinguishes anthropology from other social sciences is that it has theories of primitives and that anthropology did not and could not emerge as a separate discipline until there were such theories… It remains as true today as in the past that no anthropological theory can lay any credible claim to generality until put to the test against primitive peoples, hunter-gatherers in particular. Hunter-gatherers are not merely a part of anthropology, they are one of its cornerstones (Bettinger 1991:2).

Finally, justification for a 'hunter-gatherer theory' lies in the above discussed recognition that most hunter-gatherers are linked not only by the practice of a common mode of subsistence (Ellen 1994) but also by a distinct mode of production wherein the purposive action of obtaining food is conducted within a set of ever-present social relations. Originally developed within a Marxist framework, the economic generality of a 'hunter-gatherer mode of production' makes the concept amenable to incorporation into a processual-plus hunter-gatherer theory.

As defined by Hindess and Hirst (1975:9), a mode of production "is an articulated combination of relations and forces of production structured by the dominance of the relations of production." The relations of production refer to the means by which labor is organized and surplus labor appropriated and distributed. The forces of production refer to the way in which work, the subject of work, and the instruments of work are combined into products during production. Thus, a mode of production refers to an integrated social, economic, political, and ideological whole but is defined primarily by the degree to which labor and property can be alienated (Hindess and Hirst 1975).

Hindess and Hirst (1975:41) further define a primitive communist (or hunter-gatherer) mode of production as a mode of production characterized by the collective appropriation of surplus labor; the absence of classes and states; and an articulation of the economic and ideological spheres of society. The absence of classes does not refer to the absence of some form of supra-individual organization and coordination or the absence of non-productive yet socially necessary individuals like headmen, healers, and shamans. Although such leaders may exist within a group characterized by a hunter-gatherer mode of production, these individuals are not afforded special privileges and still contribute to the labor force either through direct participation in production or by facilitating the reproduction of society by healing the sick. Among hunter-gatherers so defined, kinship provides the ideological basis for the relations of production, and surplus labor is redistributed among producers on the basis of these relations. Ownership of the means of production varies, with certain tools belonging to individuals and other tools and land tending to be held by the corporate group. In either case, as long as an individual is a member of the group, that individual cannot be alienated from the means of production or the products of labor. Production is cooperative at the household and group levels and the productive forces tend to be poorly developed. The predominant modes of subsistence in a hunter-gatherer mode of production include hunting, gathering, fishing, and primitive gardening (Hindess and Hirst 1975).

According to Ingold (1988), the distinction between a hunter-gatherer mode of production and simple browsing or foraging by animals lies in the manufacture of tools and objectification of work.

> A mode of subsistence *per se* is not a 'mode of production'. The latter includes not only the means for making a living but also the relationships involved: who owns these means, how is production organized, who controls the product and how is it distributed, and who consumes what part of it? (Leacock and Lee 1982:7).

A hunter-gatherer mode of production, then, involves "self-conscious planning, the harnessing of possible behaviour patterns to the realization of an intentional project" (Ingold 1988:270-271). A hunter-gatherer mode of production is one based upon widespread access to the means and forces of production, individual autonomy within the structure of a sexual division of labor, and a generalized system of sharing and reciprocity predicated on a socially and logistically induced lack of personal accumulation of goods (Ingold 1988, Leacock and Lee 1982).

As defined herein, the hunter-gatherer mode of production includes aspects of Sahlins' (1972) 'domestic mode of production,' which can be said to characterize a variety of hunter-gatherer, horticulturalist, and agriculturalist groups. Sahlins (1972) argued that a key characteristic was a socio-cultural system that enables the under-utilization of labor focused on production for livelihood rather than production for surplus. Among slash-and-burn horticulturalists in New Guinea, for instance, "the social-cultural organization is not designed after the technical limits of production, to maximize output, but rather impedes development of the productive means" (Sahlins 1972:48). Unless producing food for use during seasons of low productive capacity (e.g., late summer and fall storage for use in winter and early spring in eastern North America), hunter-gatherers practicing a domestic mode of production end their food quest as soon as their hunger is satiated (Sahlins 1972:65, 68). Among groups characterized by seasonal fluctuations in resource availability, production will cease as soon as a group has stored enough food to last them through the predicted period of difficulty. The technology of production from extraction of raw materials to manufacture is small scale and "can usually be handled by household groups; much of it can be wielded autonomously by individuals" (Sahlins 1972:79). Not all non-capitalist societies practicing a domestic mode of production are hunter-gatherers practicing a hunter-gatherer mode of production, however. What distinguishes hunter-gatherers from other small scale economies is that hunter-gatherers, while united within a social collective through cultural tradition, retain control of their labor power.

This holistic definition of a hunter-gatherer mode of production combines elements of the 'foraging mode of production' or 'primitive communism' as used by Lee (1990) and the 'lineage mode of production' as described by Rey (1975). Although appropriately combined under a single hunter-gatherer mode of production following Hindess and Hirst's (1975) above provided definitions, Terray (1972) provides a convincing argument for retaining these two sub-categories of the hunter-gatherer mode of production as distinct analytical units. According to Terray (1972:178), "if we define the concept of a mode of production narrowly and precisely, each socioeconomic formation must appear as a complex combination of several modes of production." By retaining both the concepts of a foraging mode of production and a lineage mode of production within the more holistic comparative framework of the hunter-gatherer mode of production, we provide a basis for forming comparisons among qualitatively similar hunter-gatherer groups without arbitrarily reducing variability among these groups. Additionally, the retention of these two sub-categorical modes of production allows one to develop a model for the emergence of complexity among hunter-gatherers operating within the structures of a hunter-gatherer mode of production. Definitions of the foraging and lineage modes of production are provided below and the relationship between these two sub-categories and the hunter-gatherer mode of production are provided in Figure 2-4.

In their introduction to *Politics and History in Band Societies*, Leacock and Lee (1982) introduce and outline some of the key characteristics and core features of a foraging mode of production. According to these authors, foragers are characterized by egalitarian sharing, anti-authoritarianism, cooperation and autonomy, group flux, permissive child-rearing practices, and the use of leveling mechanisms like ridicule and ritual to reduce conflict and integrate social groups. Core features of a foraging mode of production include the collective ownership of the means of production, reciprocity and the open sharing of land and resources, a lack of personal accumulation due to high mobility, generalized reciprocity in terms of food sharing behaviors, a sexual division of labor predicated on reciprocity and equality in terms of tool making and using skills, and individual ownership of tools leading to the development of networks of exchange (Leacock and Lee 1982:7-9, Lee 1988:255).

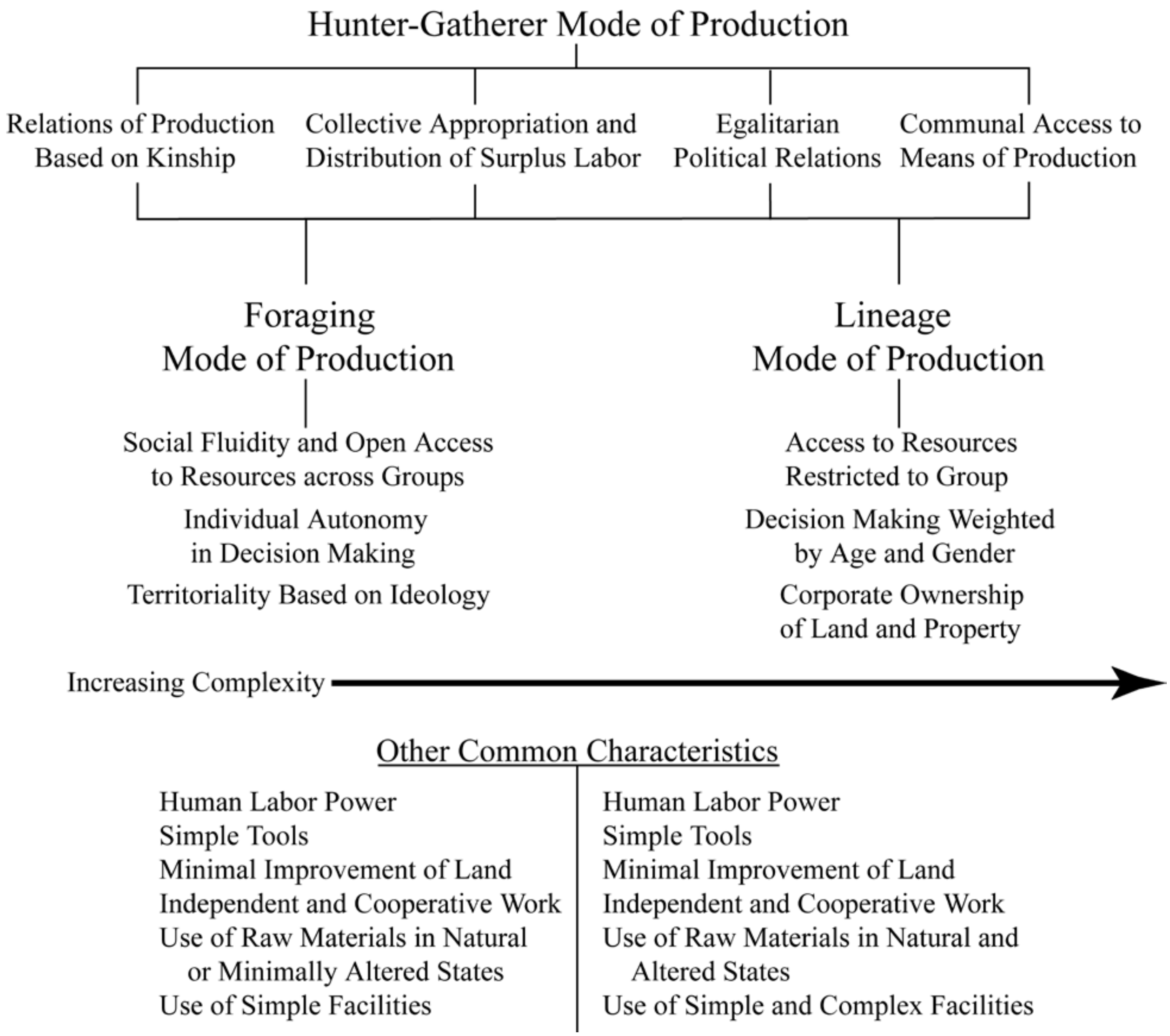


Figure 2-4. The Hunter-Gatherer Mode of Production.

According to Ingold (1999), one of the key components of the foraging mode of production is the fact that social relations are based upon face-to-face interactions and a close-knit kinship system. As a result, leadership and exchange relations are based on trust rather than any form of obligation or domination. Although Lee (1982) states that food sharing among these groups is consistent with a model of generalized reciprocity and exchanges of durable goods on balanced reciprocity, Ingold (1999) argues that such interactions are more akin to Service's (1966) notion of 'familism' and that the term ‘society’ is not applicable to the loosely organized and unbounded nature of social group composition (Ingold 1999).

Hunter-gatherers practicing a foraging mode of production may practice a form of territoriality, but land is not so much owned as it is held in trust by the core resident group. Even so, access to this land and its resources is not restricted as the “right of reciprocal access to food resources is a fundamental principle of land use” (Lee 1982:52). It is this fundamental principle that provides the political basis for high social fluidity among these groups. As a result, production is predominately for use rather than for exchange (Lee 1990), and the economic system tends to be one based upon immediate returns on labor (Crothers and Bernbeck 2004). One corollary of this is that these groups tend to lack complex means of regulating the environment (e.g., use of plant management strategies like controlled burns) (Ellen 1994).

The tendency for hunter-gatherers practicing a foraging mode of production to exhibit an economic system based upon immediate returns is largely due to the strong leveling mechanisms that enforce a lack of accumulation of wealth by individuals. According to Lee (1988, 1990) it is this maintenance of egalitarian social relations that is one of the core components of the foraging mode of production. Although leaders exist among these groups, they tend to have little or no authority and decisions are made by consensus among the group (Lee 1990). According to Ingold (1999:406), the basic principle of autonomy shared among hunter-gatherers is “that a person’s autonomy should never be reduced or compromised by his or her relationships with others. Or, more positively, it is through their relationships that persons are constituted as autonomous agents.”

Not all hunter-gatherers amenable to study within the framework of a 'hunter-gatherer theory' are characterized by a 'foraging mode of production', however. Incorporation of more 'complex' hunter-gatherers characterized by a delayed-return economic system and more restrictive territoriality into a generalized 'hunter-gatherer mode of production' requires inclusion of some aspects of Rey's (1975) lineage mode of production. Groups practicing a lineage mode of production are more complex than those practicing a foraging mode of production, and many have reached the level of socio-political integration commonly referred to in the literature as 'tribal'. Hunter-gatherers practicing a lineage mode of production are integrated into lineages, tribes, and/or other corporate groups, and land is considered communal property.

According to Rey (1975), the most important distinction between the lineage mode of production and less complex groups is the degree to which the mode of production is controlled by older male members of the society. Such control is maintained through control of social reproduction by limiting male juniors' access to ritual knowledge and women. Additionally, elders maintain some control over surplus labor through their privileged access to exchangeable goods as the heads of households and lineages. Although Rey (1975) would include tribes exhibiting ranked clans and vertical leadership hierarchies within his definition of the lineage mode of production, the term is best reserved for complex hunter-gatherers defined by horizontally differentiated egalitarian social groups characterized by status differences that are restricted to age and gender (as opposed to kinship or class). Thus, while Rey (1975) maintains that male elders within a lineage mode of production represent a class that exploits a lower class of male juniors, the exploitation of juniors by elders is not considered a form of ranking herein in that all male members of these societies will one day be elevated to high status positions through the natural aging process.

It should be clear from this discussion, then, that ‘hunter-gatherer theory’, defined as those components of a processual-plus approach that deal with a hunter-gatherer mode of production, is something of a misnomer since it refers more to the articulation of particular social and economic systems rather than to hunting and gathering *sensu stricto*. As such, some farmer/gardeners can easily be incorporated into the framework of hunter-gatherer theory and some groups that primarily hunt and gather are best analyzed from some other perspective (e.g., Hall 1988). Unfortunately, while the general anthropological focus on hunter-gatherers mentioned above has led to hunter-gatherer theory being applied to nascent horticulturalists, researchers oftentimes have failed to consider the important distinctions between hunter-gatherers who practice a hunter-gatherer mode of production and other more complexly organized societies who simply practice a hunting and gathering mode of subsistence. The result has led to a conflation of a hunter-gatherer mode of production with a hunting and gathering mode of subsistence, particularly with regard to discussions of hunter-gatherer ‘complexity’ (e.g., Arnold 1996b).

The logic of incorporating certain farmers and nascent horticulturalists within a hunter-gatherer theoretical framework can best be illustrated utilizing Smith’s (2001) concept of low-level food production. As Smith (2001) points out, there is a large range of ‘middle ground’ groups falling between pure hunter-gatherer-foragers and full scale agriculturalists. A large number of ‘complex’ or ‘affluent’ hunter-gatherers and ‘incipient’ agriculturalists rely on domesticates for less than 50 percent of their annual caloric budgets and wild resources for the other 50-plus percent of their diets. In cases such as the late Middle to Late Archaic of the North American Midcontinent and late Mesolithic in Europe, where egalitarian social structures preclude the immediate development of exclusive property rights or institutionalized inequalities, these low-level food producers can be said to practice a hunter-gatherer mode of production and are, thus, amenable to study within the framework of hunter-gatherer theory (Smith 2001). Such a perspective also can account for the continuation of a 'hunter-gatherer way of life' among groups living in close contact with non-hunter-gatherers (e.g., Bird-David 1991).

Just as some 'low-level food producers' can be said to practice a hunter-gatherer mode of production, however, some hunting and gathering societies, such as the so-called 'complex' hunter-gatherers of the Pacific Northwest and southern California, do not. The incorporation of such groups into discussions of hunter-gatherer complexity has led to many misunderstandings with regard to the nature of change in hunter-gatherer political and economic systems and a conflation of a manner of obtaining food with a form of socio-economic and political organization. Based upon the definition of the hunter-gatherer mode of production provided above, societies characterized by social stratification, ascribed status, and exclusive property and land ownership rights can in no way be said to have practiced a hunter-gatherer mode of production, as their economies were structured in a manner more reminiscent of many agricultural groups (Leacock and Lee 1982:7).

Of the hunting and gathering groups described above, then, only the San speaking groups of southern Africa, the Australian Aborigines, and European Upper Paleolithic cultures can be considered to have practiced a hunter-gatherer mode of production and can be used as plausible analogs for the Archaic of eastern North America. Within a hunter-gatherer mode of production, an increase in complexity can take many forms. Here, increasing complexity is measured in terms of increasing horizontal differentiation and local group integration in the absence of ranking. Thus, increasing complexity consists of a shift from a foraging mode of production to a lineage mode of production while maintaining a set of egalitarian social relations. Such a shift in Service's (1971) terms would represent the evolution of band level societies into tribes.

The hunter-gatherers of the Pacific Northwest, the Chumash, and the Calusa, on the other hand, were all ranked societies characterized by control over access to the means of production by a class of elites. Surplus labor was appropriated by these elites, who also maintained exclusive ownership of productive forces like fish weirs and ocean going canoes (Arnold 1996a, b; Sassaman 2004). The advent of this kind of mode of production represents an increase in complexity but also the advent of a new mode of production that is currently poorly defined but possibly subsumed within Hindess and Hirst's (1975) definition of the 'ancient mode of production'. While such an approach to complexity has analytical validity, this approach is beyond the scope of this project.

Social Integration and the Advent of Tribal Societies

As described above, the use of sociocultural integration as a key indicator and measure of levels of complexity has a long history in anthropological research. Morgan's (1877:6) developmental sequence specifically refers to the "successive stages of integration" as a component of culture change, with gens combining into phratries, phratries into tribes, and tribes into confederacies of tribes in his *populus* form of government. Steward (1955:13) importantly points out how each of these levels of integration (his 'cultural types') are qualitatively distinct from one another:

> Whereas relativism seems to hold that a rather fixed and qualitatively unique pattern persists in each cultural tradition, despite cumulative changes which create quantitative complexity, it is implicit in the evolutionary view that developmental levels are marked by the appearance of qualitatively distinctive patterns or types of organization. Just as simple unicellular forms of life are succeeded by multicellular and internally specialized forms which have distinctive kinds of total organization, so social forms consisting of single families and lineages are succeeded by multifamilial communities, bands, or tribes, and these, in turn, by state patterns, each involving not only greater internal heterogeneity and specialization but wholly new kinds of over-all integration.

Just as I have used the concept of the hunter-gatherer mode of production to isolate plausible analogs to the Green River Archaic, Steward (1955) uses his cultural type criterion to compare similar adaptations to natural environmental conditions. Unlike the cultural type criterion, however, the hunter-gatherer mode of production criterion places Steward's 'bands' and 'tribes' types in the same qualitatively distinct category, while retaining the 'simple' and 'complex' distinction between the two. In this sense, this approach is similar to Fried (1967), who places bands and many tribes into the single classificatory category 'simple egalitarian societies'.

This grouping of bands and tribes recognizes the fact that both forms of sociocultural integration are heterarchical in the sense that both 'culture types' are socio-political entities consisting of unranked individuals, families, or other kinds of social groups (see Crumley 1995 and Rogers 1995). Tribes are differentiated from bands, however, in that they tend to exhibit fewer leveling mechanisms and more status positions that provide greater opportunities for differentiation. In what follows, I outline definitions for bands and tribes. These definitions are provided for heuristic purposes and should not be considered absolute. They are simply outlines of salient features that can be used as a basis for comparison with the archaeological record of the Green River Archaic.

Working in the first half of the 20^{th} century, Julian Steward was the first anthropologist to formalize the concept of the band. His tripartite division of bands into patrilineal, matrilineal, and composite forms has since been heavily revised (Kelly 1995). Some of the common features of band level hunter-gatherers have also been used to describe the 'original affluent society' by Sahlins (1972). Lee and DeVore (1968:11) summarized these societies as small groups of people who "move around a lot." Bands vary in size from 25 to as many as 150 people and, according to Steward (1955:135) consist of "persons who habitually exploit a certain territory over which its members can conveniently range." Sustainable communities of up to 500 persons form unstable, non-corporate macrobands at the extra-local level (see Ruby et al. 2005). These groups are united through kinship or weak sodalities (Service 1971).

According to Service (1971), the defining feature of bands is the fact that all political economic, social, and religious aspects of people's lives are conducted at the local level of the domestic/kinship unit. No centralized authority structures exist among these groups, and leadership positions tend to be short-term and limited to hunts or other communal projects (Fried 1967:83, Steward 1955:126). Egalitarianism is asserted through a variety of leveling mechanisms, and the number of potential status positions among these groups is equal to the number of persons afforded membership in the group. No restrictions are placed on access to strategic resources, and prestige gained in one component of members' lives like hunting cannot be transferred to other components (Fried 1967).

Bands tend to be patrilocal and exogamous, practicing cross-cousin marriage. The nuclear family is the primary productive unit, and the only division of labor is a complementary sexual division of labor at the household level (Service 1971, Sahlins 1972, Waguespack 2005). Exchange tends to be based upon generalized and balanced reciprocity depending on the scale and context of social interaction (Sahlins 1972) and takes "the form of *ad hoc* or time-independent ritual which brings together scattered segments of the same ethnic group" (Flannery 1972:134). Such aggregations and exchanges are oftentimes conducted as a means of facilitating information flow that reduces costs inherent in high mobility. That is, the more groups are able to share about the distribution of resources across the landscape, the less risk is associated with moving to a new area (Hegmon and Fisher 1991).

Bands do practice a form of territoriality, but territorial boundaries tend not to be sharply defined and overlap with those of other bands (Wilmsen 1973). The low population densities characteristic of bands reduce the potential for perimeter defense (Petersen 1975), but the degree to which social boundary defense will be practiced varies depending upon the availability and predictability of resources (Dyson-Hudson and Smith 1978). Three of Smith's (1988:246) ideal types of land tenure can be found among groups at a band level of socio-cultural integration—common property, communal property, and local-group ownership of land.

Ownership of territories guarantees rights of access to a variety of resources, and weak sodalities found among bands extend these rights to include distant territories that can be accessed in times of localized resource scarcity (Wilmsen 1973). “Territoriality seems to be often largely a social matter; it is a way of describing membership in a group rather than being rigorously a matter of economic exploitation” (Service 1971:60). Oftentimes territorial prerogatives will not include strategic resources but will be restricted to access to religious or ancestral sites and important places linked to ritual sodalities. Access to strategic resources tends to be fairly open with fewer restrictions in periods of abundance (Casimir 1992). Typically, rites of entry or greeting ceremonies are sufficient means by which foreigners can obtain access to areas that are not in use by the resident group (Petersen 1975). Refusal to grant access to neighbors and passers-by may result in conflict (Casimir 1992).

Warfare among bands tends to be restricted to short-term raids involving little preparation or advanced planning. Warriors receive no specialized training and weapons consist of standard tools used in hunting. Bands are not known to have built fortifications or accumulated military stores (Fried 1967:102).

According to Milner (1999), interpersonal conflicts and homicides within small groups like bands are unlikely due to the social disruption such events would cause. “Overall, the majority of people shot with projectiles or clubbed to death most likely fell victim to enemies from other communities” (Milner 1999:111). Lee (1972) identified seasonal macroband aggregations among the !Kung as one source of increased conflict. “Arguments and fights take place in Bushman camps of all sizes and at all seasons, but the larger camps seem particularly plagued with disputes” (Lee 1972:346). Such aggregations are, presumably, also more likely to foster incidents of interpersonal conflict.

The term ‘tribe’ has been used in the anthropological literature to refer to groups united by shared territories, languages, names, genealogies, and/or ceremonial or political organizations. This lack of a universal criterion for distinguishing tribes has led some, most notably Fried (1966), to argue that tribes are not coherent political entities but are a reaction to incorporation in modern states (Dole 1968). Tribes may be fairly unstable forms of sociopolitical organization and are prone to cycling (Anderson 2003). According to Sahlins (1968:16):

> The tribe (as a whole) is often the weakest link in the segmentary chain. Its peripheral communities develop close relations and cultural similarities with neighboring peoples, setting in motion a marginal erosion of tribal integrity, and rather than a definite inter-tribal border one comes upon an ambiguous zone of transition. Rarely united politically, often not definable with precision, the ‘tribe’ may be beset by a crisis of identity: it is nameless, except as the people are considered ‘Stinkers’ or something to that effect by their neighbors.

Tribal level societies practicing a hunter-gatherer mode of production are ‘complex’ hunter-gatherers. It should come as no surprise, then, that tribes tend to be characterized by higher population densities, increased numbers of independent social groups, more specialization among groups, and new means of integration relative to bands. Tribal sodalities tend to be stronger and more stable than those found among bands. These sodalities are pan-tribal in extent and include corporate kinship groups like clans, age-grade associations, secret societies, and military or ritual sodalities, among others.

According to Stone (2006:14), corporate groups consist of “a group of persons who collectively share rights (usually rights to some property or resource), privileges, and liabilities.” Although some clans are dispersed and united through a common mythology or totem, others are corporate groups in the sense that they are territorial land-owning units (Sahlins 1968). Tribes tend to consist of multiple such self-sufficient, autonomous, and politically equivalent local groups (Sahlins 1968, Service 1971).

Tribal social relations are egalitarian, although charismatic leaders or Big Men/Women may obtain temporary political influence and prestige through the manipulation of exchange relations and systems of debt. These positions are unstable and do not provide access to real power, as a Big Man's influence lasts only as long as he or she is able to maintain his or her position through gifting (Sahlins 1968). Although such individuals may have much influence at the local level, this influence does not typically extend beyond the residence group or kinship unit (Service 1971) so that each leader "remains a big-man in a little pond" (Sahlins 1968:22). Tribes lack specialized political, economic, or religious bodies like priesthoods or ruling classes (Service 1971).

Like bands, production among tribes is conducted at the household level, with exchange based on generalized or balanced reciprocity at the local level and negative reciprocity at the inter-tribal level (Sahlins 1968, 1972). Such exchanges may be *ad hoc* and unscheduled or may involve "a time-dependent, scheduled series of ceremonies, whose sponsorship is rotated by artificial subgroups or sodalities within the group" (Flannery 1972). Such events include trade fairs observed among the Inuit of northwestern Alaska and among Australian Aborigines in New South Wales (Jackson 1991, Sheehan 1985).

As mentioned above, territoriality and land ownership may be more institutionalized among tribes than among bands. Thus, tribal territoriality includes all three of Smith's (1988) forms of land tenure mentioned above, with the addition of kin group ownership. Such corporate group ownership and territoriality may be expressed materially through the construction of formal cemeteries or mounds to the dead (Charles and Buikstra 1983, 2002; Buikstra and Charles 1999; Saxe 1970). Such practices are related to the fact that tribal religions tend to be concerned primarily with ancestor worship, which reinforces the kin-based social structure and acts as a "supernatural representation of a social fact" (Sahlins 1968:107). Corporate ownership and identity may also be expressed in communal construction projects unrelated to mortuary practices such as mound building (Gibson 2004, Russo 1996), earthwork construction (Jackson 1991, Yerkes 2003), or the building and manipulation of fish traps or other forms of subsistence-related facilities (Jackson 1991).

Tribal societies may also unite for purposes of conducting warfare. Like bands, refusal to grant access to land or resources may result in conflict with neighboring groups (Casimir 1992). However, such conflicts tend to be of a limited nature, and military alliances are not permanent (Sahlins 1968). Raiding is more common among tribes than among bands, but military actions are typically not for purposes of conquest (Service 1971). An exception to this can be found among segmentary tribes like the Tiv and Nuer, however, who tend to be expansionistic and predatory (Sahlins 1961).

Microscalar Aspects of Complexity

The organizational changes identified above in the emergence of complexity among hunter-gatherers are all macroscalar phenomena that operate at the level of the society or region. This is the scale at which complexity emerges in political and economic systems, but it is not the scale at which complexity can be measured using data obtained from the archaeological record. Changes at the macroscale must be inferred from data obtained at much finer scales of analysis. In what follows, I discuss the microscalar components of emerging complexity to be analyzed in this study and attempt to link these microscalar changes to the macroscalar processes discussed above. The theoretical framework outlined thus far is intended to provide an interpretive framework within which comparisons can be made between the Archaic hunter-gatherers of the Green River region and ethnographically and archaeologically recorded hunter-gatherers from other regions and time periods. The theoretical framework provided in the next section is intended to provide an interpretive framework within which the relative complexity of the Middle Archaic Baker and Late Archaic Chiggerville sites can be evaluated. The specific data from the Chiggerville and Baker sites that are utilized to address each of these microscalar components of complexity are provided in chapter 3.

Complexity and Technological Organization

As discussed in the introduction, this research project addresses the relative complexity of the hunter-gatherers who occupied the Chiggerville and Baker sites through an analysis of six social, political, and economic variables—technological organization, subsistence, leadership, specialization, communication networks, and exchange. Perhaps the best review of the relationship between technological organization and complexity is Nelson's (1991) discussion of technological strategies. According to Nelson (1991), hunter-gatherers practice three general kinds of technological strategies: curation, expediency, and opportunistic behavior. Curation strategies are defined as those in which tools and toolkits are prepared and maintained "in anticipation of inadequate conditions (materials, time, or facilities) for preparation at the time and place of use" (Nelson 1991:62-63). Curation can be considered more 'complex' than an expedient strategy due to the degree to which raw material and tool needs must be anticipated and incorporated into the decision-making process. An expedient strategy, on the other hand, involves the manufacture, use, and discard of tools at a single location and is oftentimes employed in areas of high resource predictability, where ample time is available for tool production. “While curation anticipates the need for materials and tools at use locations, expediency anticipates the presence of sufficient materials and time” (Nelson 1991:64). Thus, raw material needs do not take priority in provisioning decisions. Finally, opportunistic behavior is the least complex strategy in that it involves no planning at all, only responses to immediate needs. Opportunistic behavior is use of available resources in situations of unanticipated need, for instance, in the opportunistic use of a stone to hammer in a stake when hammer is not available. It is important to note that these technological strategies are not mutually exclusive (Nelson 1991).

The complexity of a group’s technological organization is oftentimes evaluated through the intervening variable of group mobility and settlement organization. However, these variables should be independently addressed given the lack of a direct correlation between them. As Kelly (1988:719) points out, “it is possible that a set of conditions concerning tool production and use during logistical forays in a system of low residential mobility can be similar to the conditions affecting tool use in base camps of a system of high residential mobility.” Additionally, in some cases raw material availability will outweigh mobility as a constraint influencing technological organization (Andrefsky 1994). Nevertheless, some correlates between technology and mobility can be derived from the extensive literature on the subject.

Shott (1986) utilized data from several ethnographic sources to test the influence of mobility on hunter-gatherer technological organization cross-culturally. He found that technological diversity tends to increase with decreased mobility while versatility and flexibility tend to decrease with decreased mobility. This suggests that the number of distinct tool forms will increase as groups become more sedentary but that complexity in other aspects of technological organization will actually decline as groups become less mobile. This pattern is confirmed by Amick and Carr's (1996) literature review of various studies of lithic technological organization in eastern North America. According to Amick and Carr (1996), the highly curated bifacial industry of the Paleoindian and Early Archaic periods was found to give way to an expedient technology during the Middle Archaic. This trend was not absolute, however, as the mobility constraints imposed by increased population during the Middle Archaic were solved through the adoption of a strategy of direct procurement of lithic resources from source locations by logistical task groups during the Late Archaic. These materials, once obtained, could be reduced into multifunctional bifacial implements or raw materials could be stockpiled at base camps and used more expediently (Amick and Carr 1996). In either case, the overall complexity of the organizational system was greater than that of the embedded procurement strategy of earlier groups, which involved the collection of toolstone in the normal course of subsistence activities (Binford 1979).

Parry and Kelly (1987) also found a general decrease in the complexity of technological organization with increasing sedentism in their study of diachronic trends in North American core reduction. According to these authors, the use of standardized bifacial and/or blade cores tends to give way to use of nonstandardized expedient cores through time. Ruling out technological and economic changes, such as the adoption of the bow and arrow and horticulture, as potential causes, they hypothesize that this change is directly related to a reduction in residential mobility. In comparing bifacial to expedient cores, Parry and Kelly (1987) point out that while bifaces are more portable, they require higher-quality raw materials, take more time to manufacture, and may not be as efficient due to their generalized form. Expedient tools, on the other hand, are easy to manufacture and can be shaped to any desired form, but nonstandardized cores are bulky and not very portable. Although mobile hunter-gatherers may practice an expedient core technology in situations where raw material is widespread and readily available, they are more likely to require a highly portable and dependable bifacial technology (Kelly 1988, Parry and Kelly 1987). Sedentary societies, on the other hand, can practice the more efficient expedient technology whether raw materials are readily available or not simply by importing raw material to the residential site (Odell 1998, Parry and Kelly 1987). In these situations, groups may attempt to conserve material by intensifying reduction through adoption of a bipolar or other similar technique (Parry and Kelly 1987).

Emerging complexity among hunter-gatherers is directly related to changes in settlement organization and concomitant changes in technological organization resulting from decreased mobility:

> Generally speaking, as hunter-gatherer residence becomes stationary for longer periods, the breadth and diversity of the food base increases, with the consequence that the proportion of smaller and more prolific food sources increases in the diet. With intensification of resource utilization comes plant husbandry, food storage, and the development of the institutional means for regulating social life. This relation reaches its logical development in completely sedentary groups that remain residentially stationary throughout the year (Brown 1985:202).

No matter the cause of this decreased mobility, a single group remaining in the same place for an extended period of time may instigate a trend toward regional sedentization because the decreased mobility of one group reduces resources available to other groups, thereby creating a patchier environment that encourages their decreased mobility (Kelly 1998). Since it is expected that groups that choose to reduce their mobility will do so in resource rich areas with fewer provisioning constraints (Brown 1985), this reduction in mobility oftentimes corresponds with increasing population densities as individuals and groups settle together in those resource rich patches (Cohen 1985, Keeley 1988). Price (1981) has identified this kind of feedback between reduced residential mobility, continued population growth, the emergence of hierarchies, and the intensification of food production to meet the new stresses introduced by this situation among the Jomon of Japan and Mesolithic groups in Denmark, while Brown (1985) has identified this pattern among Middle to Late Archaic groups in the lower Illinois River valley.

As Ames (1991) has pointed out using data from the Intermontane Plateau of northwestern North America, this proposed correlation between reduced mobility, increased population levels, and complexity is not absolute. It is, therefore, important to explore the relationship between the movements of hunter-gatherer *groups* and the organization of mobility *patterns* a bit further to provide a context for interpreting changes in technological organization that result from these adjustments in settlement organization.

Crothers and Bernbeck (2004) identify two 'dimensions of mobility' found among groups practicing a foraging mode of production—group flux and locational mobility. Defined by Turnbull (1968:132) as "the constant changeover of personnel between local groups and the frequent shifts of campsites through the seasons," Crothers and Bernbeck (2004:407) further refine the term 'flux' and use it to refer to "a kind of social mobility that is characterized by the frequent and largely unpredictable change of the composition of actual inhabitants in any one camp." This differentiates group flux from locational mobility, which refers to "the recurring and largely regular, often seasonally governed movement of whole camps" (Crothers and Bernbeck 2004: 407). The social fluidity characteristic of small-scale hunter-gatherers has been discussed above.

Hunter-gatherer mobility patterns are oftentimes described with reference to Binford's (1980) forager-collector continuum. According to this model, foragers practice residential moves among resource patches, lack storage, and gather food on a daily basis while collectors practice a logistically organized procurement strategy, sending task groups to obtain specific resources that they then return to residential bases where they may be consumed or stored. The preference for one strategy over the other tends to be correlated with the distribution of resources, with hunter-gatherers living in high biomass areas tending to relocate residential bases more often than those living in areas of low biomass (Kelly 1995). Rowley-Conwy and Zvelebil (1989) further refine the forager-collector model by identifying four major variations on hunter-gatherer settlement: 1) serial specialists—Binford's (1980) classic foragers, 2) semi-nomadic hunter-gatherers—part-time foragers who sometimes store objects at select locations, 3) logistic hunter-gatherers—Binford's (1980) classic collectors who organize themselves logistically throughout the annual cycle, and 4) sedentary or semi-sedentary hunter-gatherers—logistically organized groups that are stationary throughout the year, practicing a very limited form of locational mobility (i.e., migration).

It is important not to conflate these two concepts of hunter-gatherer mobility—the social and the organizational—when discussing aspects of hunter-gatherer complexity.

As Crothers (2004) points out, a ‘foraging mode of production’ characterized by a high degree of group flux can result in an individual location being permanently or semi-permanently occupied in the absence of true sedentism. The advent of a sedentary existence, on the other hand, results from a reorganization from residential to logistical mobility. As Brown and Vierra (1983:168-169) point out:

> In any one settlement system the two mobility patterns can be combined, but what is important here is that the more sedentary a system becomes, the less residential mobility there is. Simply stated, the trend toward sedentism consists of the gradual reduction of residential mobility and a complementary increase in the duration of occupation at one or more fixed settlements.

It is important to note that even some of the most organizationally complex groups in eastern North American prehistory (e.g., the Northern Ojibwa, Cherokee, Chickasaw, Natchez, and Chippewa) altered their organizational strategies and dispersed into small bands during the winter to avoid resource stress (Walthall 1998a:6), a pattern that could confound settlement pattern analyses and studies of long-term trends in the complexity of technological organization.

Complexity and Subsistence

Perhaps the most influential early work on Archaic subsistence practices was Caldwell’s (1958) *Trend and Tradition in the Prehistory of the Eastern United States*. In this influential book, Caldwell divides the eastern developmental trajectory into three major trends: 1) primary forest efficiency, 2) regionalization, and 3) increasing contact with Mesoamerican civilizations. The first trend, he contends, is evident in the hunting and gathering, or Archaic, stage wherein groups became ever more efficient in exploiting the natural resources of the eastern culture area. By the Late Archaic period, these groups had developed a subsistence technology that was highly adapted to hunting large mammals such as deer, supplemented in some areas by use of abundant localized resources such as acorns, hickory nuts, fish, and shellfish. By the end of the Late Archaic and beginning of the Early Woodland period, this economic focus was supplemented by gardening, but the high productivity of the eastern forest region and, perhaps, the relatively low yields of eastern domesticates prevented the development of a Formative agricultural village stage.

Although the progressive implications of Caldwell's framework have been supplanted by additional data on Archaic subsistence economies, developmental trends toward increased complexity in the food quest are still recognized. According to Price and Brown (1985:11) complex hunter-gatherers tend to be characterized by subsistence strategies that are both "more diversified and more specialized—more diversified in the numbers of new species that are exploited and more specialized in terms of technology, habitats exploited, and organization of procurement activities." According to Halstead and O'Shea (1989), such a broadening of the resource base is a kind of risk reduction mechanism that guards against starvation, a problem that might be particularly vexing under conditions of decreased mobility and increasing population densities.

This trend toward a more diversified subsistence economy provides the basis for Cleland's (1976) Focal-Diffuse Model. Contrary to Price and Brown (1985), however, Cleland (1976) argues that the general trend in evolutionary history is from a diffuse to a focal adaptation, with reversals resulting from major climatic or cultural disruptions, such as the end of the Ice Age and military conquest. Unfortunately, this framework requires the approximately 9000 years from the advent of the Archaic to the end of the Woodland periods to be facilely disregarded as a 'reversal' on a predetermined course toward the development of corn agriculture, referred to as the Late Focal Pattern (Cleland 1976).

It is only during this Late Prehistoric period (after ca. A.D. 1000) that agriculture is fully adopted as a kind of specialized subsistence strategy in eastern North America. Thus, subsistence specialists (e.g., full-time agriculturalists) and subsistence ideologies oftentimes found among these societies (see, e.g., Earle 1997) are not expected during the Archaic and are not discussed further. Nevertheless, some evidence of increasing complexity might occur in the form of initial domestication, or what Smith (2001) refers to as 'low-level food production'.

Although numerous models have been developed to explain the advent of horticulture among complex hunter-gatherers (e.g., Bender 1978, Keeley 1995, Price and Gebauer 1995, Rowley-Conwy 2001), the prevailing model for the development of the Eastern Agricultural Complex is Bruce Smith's (1987, 1995) Floodplain Weed Theory. According to this model, the coevolutionary process leading to initial domestication began with the long-term, seasonal utilization of riparian resource patches in rich aquatic habitats during the 7th millennium B.P. These disturbed locations, termed domestilocalities, provided a human-altered ecological niche for colonizing weedy plants like sumpweed, chenopodium, and sunflower. As these seeds were unintentionally introduced to the site in the form of stored and processed foodstuffs and through defecation, initial domestication would have required only the tolerance of these economically valuable plants. Through time, selective harvesting of plants resulted in the morphological changes indicative of domestication evident in the archaeobotanical record by 4000 to 3000 B.P. True plant husbandry developed as soon as humans ceased merely tolerating these weedy species and began selectively encouraging the most economically productive plants. This process required minimal effort and did not immediately lead to any major changes in subsistence or scheduling, but did lay the groundwork for the expansion of the economic potential of these plants between ca. 2500 and 2000 B.P. In eastern North America, this process is thought to have occurred at the larger mid-Holocene riverine sites of the Midcontinent and, thus, in resource rich environments where increased food production was a 'stress-free' enterprise (Smith 1987, 1995).

As Brown (1983) points out, the paleobotanical record of early domesticates in the Midcontinent is spotty and utilization of this resource by Late Archaic hunter-gatherers was likely highly variable. Good evidence for the consumption of considerable quantities of domesticated plants does occur in some regions of Kentucky (Gremillion 1996, 2004; Yarnell 1993), suggesting that the Green River region may be a viable candidate as a source location for the origins of early gardening. Intensive investigation focused on recovering evidence for this, however, has proven unsuccessful (Marquardt and Watson 2005c).

An important model for characterizing hunter-gatherer subsistence that focuses more on organizational strategies than the kinds and quantities of food resources consumed is Woodburn's (1980, 1982) concept of immediate versus delayed-return systems. Immediate return systems characterize "societies in which individuals and groups go out for part of most days to obtain their food and other requirements which are then consumed for the most part on that particular day or casually over the days that follow" (Woodburn 1980:98). These groups exhibit no fixed camps, properties, or ritual sites that restrict movement, thus allowing people to live in relatively small family units that tend to be highly mobile. This mobility acts as a leveling mechanism that restricts interpersonal conflicts and limits the development of status inequities. These societies oftentimes have sanctions against the accumulation of personal property. Leadership is on the basis of merit but is not institutionalized (Woodburn 1980, 1982).

Delayed-return systems, on the other hand, tend to be much more complexly organized. These consist of societies that "hold rights over valued assets of some sort, which either represent a yield, a return for labour applied over time or, if not, are held and managed in a way which resembles and has similar social implications to delayed yields on labour" (Woodburn 1982:432). Delayed-return systems characterize farmers and complex hunter-gatherers that are organized in ways similar to farming societies (e.g., fishermen who invest in weirs, semi-sedentary groups who store food, etc.). According to Woodburn (1982:433):

> Delayed-return systems in all their variety (for almost all human societies are of this type) have basic implications for social relationships and social groupings: they depend for their effective operation on a set of ordered, differentiated, jurally-defined relationships through which crucial goods and services are transmitted. They imply binding commitments and dependencies between people. For an individual to secure the yield from his labour or to manage his assets, he depends on others.

This often takes the form of kinship structures like lineages and clans (Woodburn 1982).

Barnard and Woodburn (1988) further elaborate on the economic implications of this division, arguing that one important distinction between the two is the way in which property rights are organized. Among immediate-return societies, individual property rights are established through one's control over one's own labor, with inequalities in property prevented through practices of sharing and social sanctions on the accumulation of goods. The transition to a delayed-return system, however, is related to the elaboration of ideological ties between individuals (e.g., clans and lineages) that establish unequal relations between older men and younger men and women. In these societies, younger women and men are oftentimes alienated from the fruits of their labor through the ideological position of older men who act as lineage or clan leaders and who maintain unequal access to esoteric knowledge. As in the case of the Australian Aborigines, younger men and women are socially obligated to older men through access to knowledge that is considered crucial to the functioning of the social system (e.g., knowledge that is required to marry or successfully procure game) (Barnard and Woodburn 1988).

As with all of the other aspects of complexity discussed so far, there is no one-to-one correlation between organization of subsistence pursuits and complexity. Layton (1986), for instance, argues that Australian Aborigines should be classified as nonegalitarian hunter-gatherers with an immediate-return economy and non-exclusive property rights with regard to subsistence resources. Fortunately, Dale et al. (2004) have partially resolved this problem in their 'ownership model' of moderate delayed-return hunter-gatherers. Utilizing data obtained among the Okiek of Kenya, these researchers contend that the Okiek are delayed-return hunter-gatherers due to their investment in a delayed honey crop. However, they are distinguished from more complex hunter-gatherers in that they do not elaborate their material culture, exchange prestige or exotic goods, have specialized discard areas, or construct elaborate architectural features. Furthermore, moderate delayed-return hunter-gatherers are distinguished from immediate-return hunter-gatherers on the basis of property ownership indicated by the repeated use of sites by territorial clans, sites exhibiting a high density of archaeological material, the use of ceramic storage vessels, the use of other storage containers of various kinds, and the use of specialized tools (Dale et al. 2004). Relying on this refined model as an example, then, we might posit that the organization of the food quest be characterized as a continuum of increasingly more complexly organized groups, with the important distinction between immediate- and delayed-return systems (at any level of complexity) lying in the expression of property rights (Barnard and Woodburn 1988).

One potential material correlate of a delayed-return system is storage. According to Testart (1982), storage practices correlate with other aspects of complexity such as increasing sedentism, increasing population densities, and the emergence of social inequalities. Storage is likely in situations where food is seasonally abundant and where technology is developed to a point where food gathering and storage are efficient. Under these conditions, groups will store foodstuffs in times of plenty, thus changing times of scarcity into periods of relative leisure as stored foodstuffs can be relied upon. Additionally, storage is linked to the emergence of status inequalities in that groups are likely to store more food than they need to guard against unpredictable fluctuations. In the case that these extra resources are not needed, feasts or other rituals can be held. Individuals likely to preside over communal food stores and, therefore, to benefit from communal events are ritual and lineage leaders who are also less likely to produce an equal share due to their important non-subsistence roles. This, then, provides the basis for the exploitation of producers by non-producers among hunter-gatherers (Testart 1982). It is important to note, however, that in environments marked by high seasonal variability in food availability, some storage is required for basic survival and may not be amenable to the processes of emergent inequalities described by Testart (O'Shea 1989).

Within these environments, storage may be a means of protecting foodstuffs or concealing them from predators. DeBoer (1988) argues that the distinction between above-ground and subterranean storage is an important one. Rather than acting as a mechanism through which inequalities can be emphasized, subterranean storage may misrepresent surplus through concealment (DeBoer 1988).

An additional correlate of increasing subsistence complexity is a diversification in subsistence equipment. As new foodstuffs are adopted and more foodstuffs are processed for storage, material culture inventories will increase to include new facilities and specialized gear for effectively capturing and processing game and vegetal products (Price and Brown 1985). This pattern has been demonstrated by Wright (1994) using data from the Levant, where she argues that the limited use of groundstone prior to the Natufian corresponds with occupation of the area by highly mobile hunter-gatherers. Increasing territoriality during the Kebaran, however, led to a gradual shift that culminated in the proliferation of groundstone technology at woodland sites occupied on a semisedentary basis during the Natufian. Further intensification is indicated in the Late Natufian by an increase in the use of grinding slabs. These tools indicate more labor input in plant-food processing as cereals are first pounded and then ground. This process maximizes the caloric gain from a given unit volume of grain, suggesting that increasing population and decreasing opportunities for mobility (possibly related to the Younger Dryas climatic episode) resulted in the need to feed more people with the same or fewer resources.

Specialization

According to Price and Brown (1985), the subsistence diversification cited above may result in the development of within-group occupational specialization among complex hunter-gatherers. This specialization increases efficiency in individual tasks, but may also provide a basis for emergent status differentiation. Occupational specialization among hunter-gatherers can be placed at one end of a continuum ranging from the simple gendered division of labor found in Sahlin's (1972) domestic mode of production to the complex division of labor characteristic of modern industrial societies (Brumfiel and Earle 1987).

Clark and Parry (1990) use Human Relations Area Files data to examine the relationship between craft specialization and political complexity. They found that almost all societies have some forms of part-time, independent craft specialists; however, patronized and attached specialists were found predominately among agrarian, ranked and chiefdom level societies. The presence of this more complex division of labor among chiefdoms corresponds with the use of hypertrophic prestige goods by elites among these groups. Some kinds of utensils and ornaments were produced by craft specialists in all societies. Finally, full-time craft specialists were predominately found among highly complex state-level societies characterized by urbanism and intensive agricultural production. These specialists participated in the labor-efficient production of standardized goods for general consumption and were primarily a means of producing elite wealth in highly stratified societies (Clark and Parry 1990).

In evaluating part-time, independent specialization among hunter-gatherers of the Late Archaic Susquehanna Tradition in Maine, Cross (1990:35) defined craft specialization "as a situation in which a relatively large portion of the total production of a given item or class of items is generated by a small segment of the population." Defined in this way, craft specialization is expected to develop among relatively egalitarian hunter-gatherers in situations where artifact production is spatially segmented and where individuals within the group differ in skill (Cross 1990). Among logistically organized hunter-gatherers, for instance, task groups whose job it is to procure lithic raw materials may be formed of only the best flintknappers. These individuals will produce early stage bifaces and preforms at quarry locations for redistribution to the group. Although this division of labor does not assume inequality, it may lead to an increased tolerance of status differences since individuals will develop economic interdependencies that will bind groups into economic units and increase the social costs of group fissioning (Cross 1990:41). Consequently, this can be expected to lead to a further reduction in mobility.

According to Cross (1990), craft specialization is expected in situations characterized by greater numbers of steps in production, a spatial or temporal separation of production stages, increased storage of the products of different production stages, uniformity in the products and by-products of tool manufacture, increased distances to raw materials, increased time spent in production, and an increased number of items produced. Additionally, Cross (1990, 1993) interprets the variability in hafting element forms noted among Susquehanna Cluster points as evidence that craft specialists were producing standard biface preforms that were then redistributed to and hafted by numerous individuals within the group. Craft specialization is a special kind of technological organization wherein complexity can be quantified as the number of individuals involved in the transfer of a given item from the producer to the consumer and the degree to which these relationships translate into status inequities and economic dependencies.

Although most of Costin's (1991) discussion of craft specialization is applicable primarily to complex ranked and stratified societies that do not practice a hunter-gatherer mode of production, her discussion of standardization as a correlate of specialization may also apply to specialized production by part-time, independent craftspersons. According to Costin (1991:33), standardization can be considered evidence for specialization since 1) "specialized systems have fewer producers; therefore, less individual variability (caused by unconscious motor habits and skills, consciously made decisions regarding form and decoration, and/or the use of a wider range of raw materials) will be manifest in the assemblage" and 2) specialization is expected to result in cost cutting behaviors that are manifest as standardization. Standardization is not always an indicator of specialization, however, since standardized forms may also result from consumer demand or the fact that a product is most efficiently produced in a particular form regardless of how many people are producing it (Costin 1991, see also Pool 1992).

Leadership among Hunter-Gatherers

The normative description of hunter-gatherer political systems is of general egalitarianism and few to no disparities in access to material resources (Lee and DeVore 1968). Over the past four decades, however, this view has been dramatically altered, with non-egalitarian social structures now widely recognized among both prehistoric and ethnographically recorded groups. As Cashdan (1980) demonstrates using data from the Kalahari region of Africa, egalitarianism is not a 'natural' condition of hunter-gatherer societies, as a number of leveling mechanisms are required to enforce this condition among highly mobile groups. Among more residentially stable groups experiencing increasing population pressures and circumscription, status differentiation is expected to develop to provide an efficient decision-making body that can mediate the stresses inherent under such conditions (Price and Brown 1985).

From an ethnographic perspective:

> Egalitarian societies are not those in which everyone is equal, or in which everyone has equal amounts of material goods, but those in which everyone has equal access to food, to the technology needed to acquire resources, and to the paths leading to prestige… The critical element of egalitarianism, then, is individual autonomy (Kelly 1995:296).

Nonegalitarian societies, on the other hand, tend to be characterized by many of the other indicators of increased complexity outlined above. In addition, these groups, which include many hunting and gathering groups that do not practice a hunter-gatherer mode of production, tend to exhibit some form of ascribed status, ritual feasting complexes, prestige goods or currency, and increased evidence for inter-group hostilities resulting from the defense of fixed resources (Kelly 1995).

Whether these status inequalities are institutionalized (such as among the chiefdoms of the Calusa) or based more on merit and achieved status, a primary means of asserting differentiation among hunter-gatherers is through leadership in kin or other kinds of corporate groups. Kinship is a key organizational variable among egalitarian and nonegalitarian societies alike, but with increasing complexity the kinship structure becomes more rigid and politicized, allowing centralized figures (e.g., chiefs or village headmen) to restructure the scale of the political economy and deploy extra-household labor to personal ends (Sahlins 1972). Within such a system, termed the 'collective mode' by Feinman (1995), groups are expected to emphasize collective ritual, public construction, and other attributes that indicate that leadership is communally sanctioned and derived from the support of the corporate group.

A second means of establishing leadership among complex hunter-gatherers is Feinman's (1995) 'network mode'. In this approach, individuals develop influence by maintaining ties with leaders from other groups, oftentimes through the exchange of prestigious goods. This kind of leadership, which is not tethered to the social obligations inherent in kin groups, provides a basis for the development of the most complex political institutions characterized by social stratification (Earle 1997). Such systems are very rarely found among hunter-gatherers.

Somewhere between egalitarian and nonegalitarian hunter-gatherer societies are a large number of variations on complexity that have been termed 'transegalitarian' social formations (Hayden 1995, Owens and Hayden 1997). Leadership positions among transegalitarian societies may be similar to those discussed above for nonegalitarian groups, with the exception that leadership positions are more typically situational and short-term. Roles played by such leaders might include the organization of feasts (Dietler 2001, Hayden 1994), ritual specialists such as medicine men or shamans (Aldenderfer 1993, Spielmann 1998), or traveler-diplomats charged with negotiating alliances or short-term economic interactions with neighboring or distant groups (Johnson and Brookes 1989, Marquardt 1985).

According to Anderson (2003), one correlate of complex political organizations in eastern North American prehistory is the communal construction of monuments such as earthen mounds. In his now famous Hypothesis #8, Saxe (1970:119) related the construction of mounds and other mortuary facilities with the existence of corporate descent groups:

> To the degree that corporate group rights to use and/or control crucial but restricted resources are attained and/or legitimized by means of lineal descent from the dead (i.e., lineal ties to ancestors), such groups will maintain formal disposal areas for the exclusive disposal of their dead, and conversely.

Whether the construction of mounds would have required integrated leadership and organization of labor is a matter of considerable debate among archaeologists (Gibson and Carr 2004). In situations where mound building can be related to the existence of corporate groups, however, such groups provide an excellent mechanism for status differentiation among emergent leaders (Feinman 1995, Sahlins 1972). Such corporate groups have been identified among late Middle to Late Archaic hunter-gatherers in southern Illinois (Buikstra and Charles 1999; Charles and Buikstra 1983, 2002).

Leadership positions and status differentiation might also be found in mortuary patterning and the association of specific individuals with exotic or high-status prestige goods. Utilizing data from the Human Relations Area Files, Binford (1971) found that distinctions of age, sex, social status, and social affiliations affect the manner of disposal of the dead within societies of all levels of socio-political complexity. As complexity increases, as measured through changing subsistence strategies, these mortuary behaviors tend to become more diverse and elaborate. Re-evaluating these data, Carr (1995) concluded that several aspects of identity, as well as social and philosophical values, can be expressed in mortuary treatment, a conclusion that he later extends to identify several kinds of leadership roles among the horticultural Middle Woodland Havana societies of Illinois (Carr 2005). It is important to note, however, that the association of individuals with exotic burial goods does not *a priori* indicate status differentiation, as many egalitarian societies ranging from the Upper Paleolithic in Europe to the historic Kalahari San have been known to bury their dead with valuable objects with no social implications intended (Fiedel 1989).

A final potential indication of situational leadership roles might be found in evidence for the control of esoteric knowledge. According to Marquardt (1985:81), the "conflation of the political with the ideological-religious thus forms a leadership structure founded on the possession of esoteric knowledge, access to exotic goods, and practical information that leads to local group prosperity." This esoteric knowledge is obtained through travel and interaction with other groups and might take the form of ritual knowledge, knowledge of distant resources, or access to networks of exchange (Marquardt 1985). In material terms, this knowledge may take the form of medicine bags or other ritual paraphernalia (Spielmann 1998), prestige goods (Peregrine 1992), over-sized bifaces or other "sacred markers for secular exchange" (Johnson and Brookes 1989:143), symbols of corporate group identity, and other classes of objects that might be characterized as 'inalienable possessions' (Mills 2004, Weiner 1992).

Hunter-Gatherer Communication Networks

The networks of alliances and exchange that provide mechanisms for the emergence of leadership positions among complex hunter-gatherers are intricately tied to expanding communication networks. As mobility decreases and population pressures increase, the role of information in averting resource stress increases. Such stress places a premium on both long- and short-term information (Hegmon and Fisher 1991). As these communication networks expand to include many different groups, increased importance is placed on non-verbal signaling through material culture styles (Wobst

1977). According to Braun and Plog (1982), increasing risk is expected to correspond with increasing regional homogenization in decorative styles as communicated messages become more widespread and standardized within regional social units. Additionally, as connectedness becomes more long-term, exchange in exotic or high cost objects is expected to decline as alliances become more stable (and less negotiated).

Alternatively, artifact styles can be employed to express group identities to differentiate individuals of differing social groups from one another:

> We would expect to find social-group-specificity of stylistic signals particularly in those instances where all members of a social group potentially encounter a given stylistic message (and thus its expression would be standardized among all the members of the group), *and* where this message enters into contexts of boundary maintenance (so that it will be maintained *in contrast* to similar signals of surrounding social groups) (Wobst 1977:329, original emphasis).

According to Schortman (1989), some of the most commonly and strongly held identities are 'salient identities' such as ethnic group and class affiliations. These kinds of identities are formed through individual action and interaction as a kind of negotiation among people and groups (Nassaney and Sassaman 1995) and may be either strictly or loosely asserted depending upon the contingencies of local inter-group relationships and economic stressors (Hodder 1979).

Material styles recognized by archaeologists may also be the unintentional result of individual interactions in contexts of production. Among the northern Kalahari San, for instance, there is a high amount of beadworking and individual beadworkers have ample opportunities to compare styles. This results in a general similarity in design that is not found in southern areas (Wiessner 1984). Regional similarities in arrow styles, on the other hand, occur among individuals who do not frequently interact and reflect the need to maintain a sense of regional solidarity as a risk reduction mechanism (Wiessner

1983b, 1984). In both cases, the messages emitted by material culture styles can be expected to be intended for individuals of intermediate social distance due to the costs involved in sending, receiving, and decoding messages (i.e., individuals at a closer social distance could receive less costly messages through verbal communication and distant individuals cannot be expected to encounter or decode the messages) (Wobst 1977), thus providing a theoretical basis for delineating prehistoric communication networks.

As hunter-gatherer groups become more complexly organized and communication networks expand, then, we can expect two parallel processes. At the level of the local, integrated group we should expect a homogenization of artifact styles (Braun and Plog 1982), while at the regional scale we can expect a diversification of styles related to the formation of differentiated salient identities (e.g., sodalities) (Schortman 1989). At its most extreme, this process of regionalization and inter-group differentiation may take the form of evidence of interpersonal violence and conflict (Milner 1999). Both processes have been identified in the late Middle to Late Archaic periods in the Midcontinent (Burdin 2004; Jefferies 1997, 2004; Mensforth 2001).

Hunter-Gatherer Exchange

Related to expanding communication networks and oftentimes inherent within them are increasingly complex networks of exchange. Although numerous economic models of trade and exchange have been proposed, among hunter-gatherers the movement of goods and services can be differentiated into two categories: 1) economic transfers—"the shift of something with economic content (X) from one social unit (A) to another social unit (B)" and 2) exchanges—a transfer of X from A to B that corresponds with a resulting transfer of Y from B to A (Hunt 2000:14). Economic transfers typically involve short-term events such as meat sharing, whereas exchanges are more complex and take the form of long-term relationships between exchange partners (Hunt 2000), oftentimes as a social buffer against environmental variability and risk (Brose 1979, Halstead and O'Shea 1989, Wiessner 1982). According to Braun and Plog (1982), increasing social connectedness between regions should be accompanied by an increase in the amount of goods exchanged between those regions and a decrease in the costs of those goods (i.e., a switch from the exchange of small amounts of primarily exotic finished goods to the bulk exchange of local raw materials, foodstuffs, etc.).

Renfrew (1975:41-43) identifies ten distinct modes of trade differentiated on the basis of the spatial implications of each: 1) direct access—individuals can access the source of raw material without the involvement of other individuals, and even if territorial boundaries exist they are permeable; 2) home-base reciprocity—an individual visits another at his or her residence and exchanges one item for another; 3) boundary reciprocity—two individuals meet at a common boundary for exchange; 4) down-the-line trade—home-base or boundary reciprocity involving the same item is conducted among multiple individuals so that that item is transported across several boundaries; 5) central place redistribution—individuals give their goods to a central figure who then redistributes everyone's items in exchange for continued receipt of the original items; 6) central-place market—redistribution occurs at a central location between the individual producers without involving a central figure; 7) middleman trading—an individual travels to several locations trading independently with each individual at their places of residence or home bases; 8) emissary trading—trading is conducted for an individual by an intermediary with other individuals at their places of residence or home bases; 9) colonial enclave—trading is conducted for an individual by several intermediaries who set up a central place (i.e., colony) near the residence or home base of the individuals with whom they trade; and 10) port of trade—trading is conducted for several individuals by several other individuals at a central place located outside the territory of those individuals (Renfrew 1975). Of these, the first four have been associated with groups practicing a hunter-gatherer mode of production.

Sahlins (1972) defines three forms of reciprocal exchange found among hunter-gatherers: 1) generalized reciprocity, wherein exchanges are informal and not directly mediated; 2) balanced reciprocity, wherein exchanges are of equal measure and immediate; and 3) negative reciprocity, wherein exchanges are characterized by haggling and attempts by parties to take advantage of one another. According to Sahlins, the degree to which these different kinds of reciprocity will characterize a particular exchange is dependent upon social distance and the relative rank and wealth of participants. In general, generalized reciprocity is expected in situations where individuals are close kin and/or of unequal rank and wealth. Balanced reciprocity is expected among groups of intermediate social distance, and negative reciprocity in situations where individuals are from different communities and/or kinship groups.

Using ethnographic data obtained among the Nayaka (or Naiken) of South India, Bird-David (1990) argues that immediate-return hunter-gatherers do not practice reciprocity but instead exhibit a characteristic he terms the 'giving environment'. According to Bird-David (1990), groups practicing reciprocity invoke a metaphor of 'nature as ancestor,' while immediate-return hunter-gatherers like the Nayaka invoke a metaphor of 'nature as parent.' Such a difference in worldview results in a distinct economic system where gifting does not involve the calculation of returns, although requests for gifts are always expected to be honored. The Nayaka do recognize a form of personal property wherein some objects are 'to the self' of individuals. In this case, the rights obtaining in these objects are rights to give, and the value of the objects lies in the relationships created between the individuals who give and receive (Bird-David 1990).

Although immediate-return hunter-gatherers, Wiessner (1982) classifies the !Kung *hxaro* exchange network as a form of delayed balanced reciprocity. The *hxaro* consists of a network of exchange relationships spread among camps as distant as 200 km away. Made up mostly of overlapping nodes of consanguineal relatives, the network serves to reduce risk by providing participants with a number of friendly relationships in many different camps throughout the region so that individuals may move from one camp to another in times of economic hardship and/or resource scarcity. In terms of material culture, all non-food goods possessed by the !Kung eventually enter the *hxaro* and are oftentimes repaired and/or otherwise modified along the gifting chain. Items are sometimes buried with the dead, but are more often passed on as children take part in the *hxaro* networks developed by their parents. Very young children enter the *hxaro* network early, oftentimes being given their first gift by a grandparent sometime between the age of six weeks and six months. *Hxaro* networks serve to distribute goods widely throughout the greater !Kung territory (Wiessner 1982).

Food exchange is also an important component of hunter-gatherer social interactions. Although difficult to identify in the archaeological record, Jochim (2006) points out that food exchange can be an important means of promoting hunter-gatherer subsistence efficiency and security and a way for individuals to gain prestige. He identifies four kinds of exchange, three of which may involve the movement of food or other perishables: 1) immediate exchange of foodstuffs or other goods to promote subsistence efficiency among groups living in different environmental zones, 2) delayed exchange of foodstuffs as a risk reduction strategy among groups living in environmental zones prone to periodic fluctuations in resource abundances, 3) delayed exchange of non-subsistence items as a risk reduction strategy in the same environmental contexts, and 4) delayed exchange of foodstuffs and non-subsistence goods in the context of feasts or other events by individuals or groups hoping to obtain prestige (Jochim 2006).

Some hunter-gatherers develop a form of trade relationship termed the 'trading partnership'. These relationships oftentimes involve the exchange of both food and non-food items. The most widely cited example of hunter-gatherer trading partnerships is that found among northern Alaskan groups. According to Burch (1970), these partnerships are a case of balanced reciprocity wherein coastal peoples meet with inlanders and trade required goods and/or services at organized trade fairs. Trading partnerships are a rare kind of non-kin relationship that establishes contacts outside of the geographically limited areas within which kin reside. One service of the trade partnership is to provide safe passage and shelter to partners traveling through one's territory. Citing the northern Alaskan case, Burch (1970) concludes that balanced reciprocity must involve balance in political, economic, and other aspects of the trade relationship to be viable. As a result, balanced reciprocity is likely a rare and unstable form of social interaction (Burch 1970).

Most of the trading conducted among trading partners in northern Alaska during the Late Prehistoric and Protohistoric periods was undertaken at centralized annual markets, or trade fairs, held at the mouth of the Colville River and on Kotzebue Sound.

Peoples from northern Alaska and as far away as the MacKenzie delta region of Canada, southwestern Alaska, and Siberia would travel to these fairs each year to trade, obtain information, dance, play sports, and meet potential trading partners and mates (Burch 1970, Jackson 1991). Whaling captains, known as *umialiks*, would attend these events and were known to maintain several trading partnerships (Sheehan 1985). Other similar gatherings occurred among Australian Aborigines and have been inferred at the Poverty Point site in northern Louisiana (Jackson 1991).

Marquardt (1985) suggests that certain late Middle to Late Archaic individuals in eastern North America created trading partnerships, thus fostering the long-distance exchange of goods like marine shell bead necklaces. These peripatetic 'traveler-diplomats' and the partnerships they formed also served to create social alliances among groups of hunter-gatherers and resulted in a form of status differentiation as traveler-diplomats came to possess important esoteric knowledge concerning other peoples and other lands. This knowledge, particularly information concerning the availability of foodstuffs and other resources, benefited the entire community and elevated the traveler-diplomat's position in society. As a result:

> For organizational reasons, one person, perhaps an older male who had traveled far and often, might become a permanent leader. The conflation of the political with the ideological-religious thus forms a leadership structure founded on the possession of esoteric knowledge, access to exotic goods, and practical information that leads to local group prosperity… The alliances made by traveler-diplomats would contribute to the society's production, by guaranteeing access to alternative resource zones in times of periodic stress, and to the society's reproduction, by providing the forum for negotiating marriage alliances. In a sense, information itself would become a commodity to be brokered by the traveler-diplomat as authority figure (Marquardt 1985:81).

Microscalar Aspects of Complexity and the Advent of Tribes

Variability among band and tribal level societies makes relating these microscalar aspects of complexity to changing social organization difficult. As described above, tribal level societies tend to be characterized by increased population densities, increased differentiation in terms of the numbers of social groups and status positions present, an increased reliance on specialists of varying sorts, the advent of corporate kin groups and/or other sodalities, the possible advent of Big Men/Women or other prestigious but short lived leadership positions, an increased organization of exchange relations that may include the advent of trade fairs, increased territoriality, the construction of corporate facilities like cemeteries or fish weirs, more organized ritual practices like ancestor worship, and an increased incidence of raiding and other inter-group conflicts. Since these traits cannot be directly linked to a specific microscalar correlate, evaluation of whether the Middle and Late Archaic hunter-gatherers at the Baker and Chiggerville sites were complex hunter-gatherers at a tribal level of social organization is based upon the totality of evidence derived from each microscalar aspect of complexity interpreted within a diachronic and macroregional framework of eastern North American prehistoric cultural developments. The specific variables evaluated in this dissertation and the bridging arguments linking these variables to the above-described microscalar aspects of complexity are provided in chapter 3.

The Political Ramifications of Complexity

With increasing complexity comes increasing possibilities for status differentiation. Although complexity at the local level may allow groups a competitive advantage over others, the advent of complex tribal level societies, pan-regional sodalities, and stable networks of long-distance exchange provides mechanisms by which individuals can co-opt these structures and assert influence and, eventually, control over others. In small-scale societies, this process is subverted by leveling mechanisms and the capacity for group fissioning (Cashdan 1980). However, increasing population density, decreasing per capita resource availability, increasing social circumscription and other scalar stresses eventually lead some hunter-gatherers to adopt full-time leaders to mitigate the conflicts caused by these stresses (Cohen 1985, Lee 1990). Status differentiation among complex hunter-gatherers, then, may not always be the result of individuals' attempts to establish a form of hegemonic power over a particular group of people. Institutionalized inequalities may have developed through a consensual reliance by the group on certain recognized leaders as a kind of organizational strategy necessary to maintain order within a relatively large, naturally or socially circumscribed, semi-sedentary social group (Marquardt 1985).

One model for how this kind of consensually established elite leadership can form is Charles Stanish's conditional-cooperator model. According to Stanish (2004:8), "cooperation actually constitutes one evolutionarily stable strategy for individuals acting in their own self-interest under the appropriate conditions." That is to say, coercion is not required to bring groups of people together to produce in that cooperative labor organizations are much more efficient at maximizing production. This system facilitates a kind of specialization wherein those who are particularly talented at certain kinds of activities (e.g., hunting) will spend a proportionately longer amount of time performing that activity for the benefit of the group. In this model 'elites' arise as specialized managers in that "the central role of the elites is to keep the benefits of cooperative labor organizations consistently higher than the costs of defection from that labor… Failure to keep benefits high will result in a collapse in the specialized labor organization to a simpler one of individual household production and exchange" (Stanish 2004:16).

According to Stanish (2004:13), "people are 'irrationally' prosocial;" individuals will only agree to participate in increasingly large-scale, managed production endeavors if they perceive the distribution of the results of their production to be fair. The semblance of balance is maintained through what Stanish refers to as "rituals of production and exchange that sanctify and 'schedule' the cancellation of deferred debts by the elite to the commoners" (Stanish 2004:9). These rituals of production and exchange are found in the archaeological record in the form of mounds, areas of feasting, and evidence for extra-local and interregional exchange of both 'prestige goods' and utilitarian items.

Several researchers associate the advent of social inequality with rituals like feasting. Marcel Mauss (1990) was among the first to illustrate how social debts and hierarchies are created through the giving of gifts at events like potlatches. According to Brian Hayden (1994, 1995, 1996), systems of competitive feasting like the potlatch are manipulated by accumulators to create networks of social debt that allow them to convert labor power into exotic goods that confer prestige. These ambitious individuals are found in all societies, but may be able to elevate themselves to positions of prestige only in situations of resource abundance (Hayden 1995) where feasts act as high-level buffering mechanisms against unpredictable and rare events of resource scarcity (Halstead and O'Shea 1989).

As Feinman (1995) points out, there are multiple pathways to inequality. Co-optation of feasting and exchange relations is just one of these. Another is through the control of ritual knowledge. For instance, Spielmann (1998) illustrates how skillful carvers may gain positions of prestige by carving ritual masks or other paraphernalia. Such specialized production of ritual craft goods creates dependencies among craftspersons and non-craftspersons that can be exploited to the benefit of the former (Costin 1998). These inequalities may become institutionalized if ritual practitioners are able to monopolize ritual knowledge by acting as both ritual craft specialists and purveyors of ritual knowledge (Spielmann 1998).

Aldenderfer (1993) also argues that manipulation of rituals is an important component of emerging status inequalities:

> Ritual, since it can control in part the definition of social categories, is an ideal means of literally redefining social relationships. If wielders of ritual power are in fact successful in convincing individuals to continue their belief in the power of ritual, they may in fact also be able to convince them to allow the extension of ritual into other social fields (Aldenderfer 1993:15).

Citing ethnographic examples among the Basarwa of Namibia and Botswana, Algonkian groups in the Great Lakes region of North America, and the Gabrielino of southern California, Aldenderfer (1993) identifies a common trend wherein village headmen and lineage leaders manipulate ritual systems to merge the political and the ritual into a single, highly influential, social office. Such a development may lead to the development of institutionalized simultaneous hierarchies and the advent of ranked social systems (Paynter 1989).

The advent of institutionalized inequalities and social ranking signals the end of a hunter-gatherer mode of production. Even the most prestigious Big Men/Women among complex tribal-level hunter-gatherers maintain status positions that are temporary and social influence that is confined predominately to a single kin group. The control of both kin and non-kin labor by ritual and/or political leaders is one component of a chiefdom level of social organization and indicates a major reorganization in social relations that is beyond the scope of this dissertation (Arnold 2000). Among these societies, authority may be maintained through control of maturation rites (Owens and Hayden 1997), marriages, the distribution of prestige goods (Bender 1985b), military might, ideology, etc. (Earle 1997). In any case, the social relations that develop in chiefdom level societies are very different from those found among bands and tribes in that inequality becomes naturalized as elite Houses are seen as qualitatively distinct from commoners. That is, hierarchies among chiefdom level societies are naturalized and elites are seen as extra-human through their ideological links with supernatural beings and ancestors (Helms 1998).

Chapter Three

Current Perspectives on Complexity in Eastern North American Archaeology

The purpose of this chapter is to outline the culture history of eastern North America from the Paleoindian through the end of the Archaic period, focusing on interpretations of the archaeological record dealing with the microscalar aspects of complexity discussed in chapter two. This will provide readers with the historical context within which later evaluations of the relative complexity of the Chiggerville and Baker sites can be made. Whether readers consider any of the archaeological cultures discussed herein to be 'complex' in an absolute sense has little relevance to the more important goal of identifying and interpreting the nature of cultural changes through time in the Archaic material record.

Paleoindian Beginnings (ca. 15,000 to 10,000 B.P.)[1]

Sites like Meadowcroft Rockshelter in Pennsylvania are continually increasing our knowledge of pre-Clovis groups living in North America prior to 14,500 B.P. (Adovasio et al. 1990). Unfortunately, these sites are widespread in geographic distribution and have as yet yielded little other than small lithic assemblages, limiting the kinds of social organizational, economic, or other interpretations that can be derived from them. Our knowledge of the earliest groups inhabiting eastern North America, then, is limited and is not such that broader interpretations of technological organization, subsistence practices, exchange, etc., can be made. Although assumed to be non-complex given the presumed low population densities present at the time, very little about these groups can be said with any semblance of certainty.

---

[1] All dates are uncalibrated unless otherwise stated in the text.

The first widespread and well studied archaeological culture in North America is the Late Pleistocene Clovis culture. Due to the considerable emphasis that has been placed on Paleoindian studies, a large database has accumulated pertaining to this time period. Compiling data from across the eastern United States, Anderson (1995, 1996) provides an interpretive model for how the eastern North American landscape was settled at the end of the Pleistocene. He interprets patterns in the distribution of projectile point types to reflect the movement of colonizing populations across the regional landscape. According to Anderson's staging area model, initial colonization around 14,000 B.P. led to the rapid occupation of major river valleys. Through time, populations grew and culturally-perceived crowding resulted in the continued movement of people away from these staging areas. As these groups spread into the interior, they required a mechanism to facilitate contact over large distances to provide contexts for information sharing and mate exchange. Periodically, these bands would aggregate[2] as macrobands in resource-rich staging areas and in the vicinity of regional landmarks like high-quality chert sources. By the Middle Paleoindian period, subregionally distinct macrobands began to settle into territories whose boundaries were open to group flux as a means of risk reduction (Anderson 1995, 1996).

Although these short-term, periodic aggregations brought together larger groups of people, the dominant model of Paleoindian social organization posits small groups of 20 to 50 individuals organized into highly mobile bands (Anderson and Sassaman 1996, Tankersley 1996). Based largely on negative evidence (i.e., a lack of material correlates

[2] Shott (2004) uses available Paleoindian site size data to argue that current methods of identifying these kinds of sites in the archaeological record are problematic. Although he does not demonstrate that Paleoindians did not aggregate, he does convincingly show that the interpretation of site function based on size (e.g., large Paleoindian sites are aggregation sites) is based on false assumptions.

reflecting status) and ethnographic analogs of small-scale hunter-gatherers practicing a foraging mode of production, Tankersley (1996) argues these groups were egalitarian with no formal leaders or classes. It is also likely these groups were characterized by a high degree of group flux and regular locational mobility reflecting Binford's (1980) residential mobility strategy.

Seeman (1994) interprets the clustering of artifacts at the Nobles Pond site in Ohio into four discrete loci as evidence that this site was the location of a Paleoindian aggregation event. These lithic clusters were related to each other technologically and through refit analyses, demonstrating their contemporaneity. Nearly all artifacts from these clusters were manufactured from Upper Mercer and Flint Ridge cherts found in outcrop 70 and 110 km to the southwest, respectively. The lack of variety in cherts at the site is interpreted as evidence that these cherts were stockpiled prior to the aggregation event. That the Upper Mercer and Flint Ridge chert sources were selected when lower-quality cherts were present in the immediate vicinity of the site (Seeman 1994) demonstrates the distances to which Paleoindian flintknappers would travel to obtain quality raw materials, as well as the large size of Paleoindian territories or home ranges.

Utilizing data from several Paleoindian sites in the Northeast and Midwest, Tankersley (1998) argues that Early Paleoindian Clovis and other fluted point manufacturing groups practiced a seasonal settlement pattern of summer raw material procurement and tool manufacture and winter big game hunting. Tankersley (1998) contrasts sites like Bostrom, located approximately 25 km east of the confluence of the Mississippi, Missouri, and Illinois rivers, with sites like Arc, located in New York. The presence of debitage, preforms, and finished bifaces manufactured from non-local raw materials at the former is inferred to be evidence for embedded procurement by nomadic groups with large home ranges, while the lack of non-local debitage at the latter is inferred to indicate exchange of finished tools. Finally, these patterns of site distribution and raw material use are interpreted as evidence for a flexible economy adapted to exploiting a variety of game animals and raw material types (Tankersley 1998).

Working in the western Lake Erie Basin, Stothers (1996, Stothers et al. 2001) supports Anderson's (1995, 1996) stagewise eastern settlement model, arguing that the shift to the use of local cherts in the Late Paleoindian period reflects a period of 'settling in' that is then interrupted by an additional in-migration of groups using exotic raw materials from southern-derived sources during the Early Archaic. To Stothers, limited numbers of fluted points manufactured from raw materials derived from sources hundreds of kilometers away provides evidence for Paleoindian trade. These include points manufactured of Hixton quartzite, Pennsylvania jasper, Flint Ridge chalcedony, and Knife River flint found between 200 and 2000 km from their source areas (Stothers et al. 2001). Brookes (1999), on the other hand, interprets the presence of Paleoindian points manufactured from exotic raw materials—Fort Payne chert, Coastal Plain Agate, unidentified blue-black chert, quartzite, and novaculite—in Mississippi as having been brought into the state by highly mobile bands rather than as evidence of exchange. Additional research is required to determine the extent to which the occurrence of limited numbers of Paleoindian points of exotic raw material types throughout North America represent exchange, embedded procurement, and/or local procurement of secondarily deposited cherts found in river gravels and glacial till.

White (2006) provides a similar study of time-transgressive changes in Paleoindian tool forms and raw material uses as Stothers (1996, Stothers et al. 2001). Coding a variety of technological data for Paleoindian points from northeastern Indiana, White (2006) posits a technological link between Early Paleoindian Clovis/Gainey points, Middle Paleoindian Barnes/Cumberland points, and Late Paleoindian Holcombe points. Hi-Lo and Agate Basin points from the region, however, are distinct from the other point forms and are thought to have belonged to groups whose origins lay to the south and west, respectively

In addition to using projectile points manufactured from high quality raw materials from distant sources (obtained either via trade or direct procurement), Paleoindian lithic technology consists of highly formalized bifacial and unifacial blade tools that were heavily curated (Amick and Carr 1996). Such a light and portable, formalized toolkit is consistent with the high mobility of these groups (Parry and Kelly 1987).

The high mobility of Paleoindian groups is consistent with the two prevailing models of Paleoindian subsistence practices. Traditionally conceived of as specialized big game hunters practicing a focal subsistence pattern based on the exploitation of large game (Cleland 1976), Meltzer and Smith (1986) argue, based on ecological and foraging theory, that a generalized subsistence strategy is more likely, particularly in the high-diversity, species-rich environments of eastern North America. Waguespack and Surovell (2003), on the other hand, return to the earlier specialized hunting model, citing faunal assemblages from 33 sites from across North America. It seems likely that both of these models are correct, with a specialized subsistence economy focused on the hunting of large game being present in some parts of North America, while a more generalized pattern was practiced in others (Meltzer and Smith 1986).

Evidence of Paleoindian mortuary practices are limited to just a few widely spaced sites. Mason and Irwin (1960) discuss a Late Paleoindian Eden/Scottsbluff burial in Brown County, Wisconsin. Excavation at the site yielded fire damaged projectile points and other artifacts, fire-cracked rock, and cremated human remains. "It appears, then, that a corpse accompanied by grave offerings (perhaps personal possessions) was placed on a shallow bed of rocks or in a shallow rock-lined pit (for which evidence did not survive) and was then cremated in an intense fire" (Mason and Irwin 1960:44). Age and sex information could not be determined beyond that the individual was an adolescent (Mason and Irwin 1960).

A Paleoindian female aged 25 to 30 years and directly dated to 9700 +/-250 B.P. was excavated at Site 5Lr99 in an arroyo bank of Gordon Creek in Colorado (Breternitz et al. 1971:172). The individual had been buried with several bifaces, flake tools, cut bone, a smoothed stone, and perforated elk incisors. The burial was covered in red ochre, illustrating the ceremonial importance of ground hematite even at this early date (Breternitz et al. 1971).

Finally, the Buhl burial from Site 10Tf1019 in Twin Falls County, Idaho was directly associated with an AMS date of 10,675 +/-95 B.P (Green et al. 1998:440). The individual was a young adult female in good health but with extreme dental attrition. She had been placed in a burial pit but was exposed during quarrying activities so the exact position and burial form could not be ascertained. A stemmed biface, bone needle, and two bone ornament fragments were interred with her (Green et al. 1998).

As can be seen, data from across North America are consistent with the characterization of Paleoindian groups as small-scale, immediate-return hunter-gatherers practicing a foraging mode of production. However, by the Late Paleoindian Dalton period in the central Mississippi River Valley, certain groups were developing characteristics that has led Anderson (2004) to suggest they may have been developing a tribal-like social organization. Whether these groups can truly be classed as tribes is far from certain, but, if so, they represent a short-term experiment in organizational complexity not repeated until the Middle Archaic.

The Dalton groups in question were located in northeastern Arkansas at sites like Brand, Sloan, and Lace and date from approximately 10,700 to 10,200 years ago (Morse 1997). In the 1970s these groups became famous as being the focus of the oft-cited Morse-Schiffer debate concerning Dalton territoriality and land-use practices. According to Schiffer (1975a, b), Dalton band territories were hexagonally shaped and cross-cut river drainages to provide individuals and groups with access to several resource zones, including lithic sources in the Ozarks and on Crowley's Ridge. Morse (1997a), on the other hand, interpreted Dalton territories to be linear in shape, characterized by logistical exploitation of single watersheds by distinct local groups that occupied large base camps found near the center of those watersheds.

Anderson's (2004) contention that Dalton groups may represent an early expression of a tribal form of social organization in eastern North America is based largely on their well-developed ceremonialism. The discovery of over 100 projectile points and other objects at the Sloan site led Morse (1982) to argue that the site represents a formal cemetery with a high degree of burial inclusions represented. Condon and Ross'

(1997) analysis of 211 preserved bone fragments from the site supports the cemetery interpretation, as 63.9% could be positively identified as human. Associated with these burials were 146 Dalton points, many of which are oversized points ranging from 8 to 19 cm in length (Morse 1997b). Technological and use-wear analyses on these points and other objects from the site indicate that few had been used and that those that had been used were likely employed in rituals associated with the burial ceremony prior to their deposition in graves (Shott and Ballenger 2007, Yerkes and Gaertner 1997).

Another component of Dalton ceremonialism might be represented by the Hawkins cache, found at Site 3Lw89 in northeastern Arkansas. This cache consisted of 18 Dalton points, 3 Dalton adzes, and 16 other artifacts (Morse 1971). Objects from this cache also indicate they had not been heavily used (Shott and Ballenger 2007), and the cache itself may represent a burial that has since decayed.

Elsewhere in the Southeast, Dalton groups exhibit an economy and social organization much more reminiscent of other Late Paleoindian and Early Archaic groups. Walthall (1998b) interprets the increased use of rockshelters during Dalton times to indicate a change in settlement and subsistence patterns wherein groups began practicing a redundant seasonal round and exploiting a wider range of dispersed resources. Surveys in southern Illinois by Ahler (1984) suggest that both Dalton and Early Archaic groups were practicing a highly residentially mobile settlement pattern that took advantage of resources distributed evenly throughout all environmental zones.

One possible indication of complexity among Illinois Dalton groups is a cache of ten Dalton artifacts covered with red ochre from a feature at the Jens site in St. Clair County, Illinois. This cache is similar to the Hawkins cache in Arkansas. The authors interpret this feature as a hide processing facility whereby red ochre was used in hide preparation and argue that its size (1.2 m in diameter and 23 cm in depth) rules out a burial function (Walthall and Holley 1997:157-158).

Early Archaic (ca. 10,000 to 8000 B.P.)

The most widely cited model of Early Archaic settlement practices is Anderson and Hanson's (1988) band-macroband model. According to this model, sites in the Savannah River valley are evidence of the seasonal movements of a single band. These movements were "characterized by the use of a logistically provisioned seasonal base camp or camps during the winter and a series of short-term foraging camps throughout the remainder of the year" (Anderson 1996: 41). Cross-drainage interaction with other bands belonging to the same regional social group (or macroband) took place at aggregation sites during return trips to the winter camps and was conditioned by "the need to find and exchange mates in a landscape characterized by extremely low numbers of people" (Anderson 1996: 44). It is also at this time that other kinds of raw material and information exchanges took place (Anderson 1996).

According to Sassaman (1996, Sassaman et al. 1988), this model is generally confirmed by raw material distributional data in South Carolina (although see Daniel [2001] for an alternative interpretation). The distributions of different Early Archaic point types are not homogeneous through time, however. For instance, during the earlier Early Archaic (ca. 10,000 to 9500 B.P.), Hardaway Side Notched points are restricted to the northern portions of the state while Taylor points are restricted primarily to the southern half. By Palmer/Kirk times (ca. 9500 to 9000 B.P.) a single corner-notched tradition associated with base camps and the settlement patterns hypothesized under the

Anderson and Hanson (1988) model are found throughout the state. Finally, the restriction of the late Early Archaic Bifurcate Tradition to the northern portion of the state suggests that these groups may have been "intrusive to the Carolina Piedmont sequence, originating in the mountain regions to the north and west" (Sassaman 1996: 64).

Early Archaic settlement patterns in South Carolina, then, are complex and not merely restricted to a fine-grained foraging strategy. At least in some cases, Early Archaic groups were occupying specific home ranges and territories, possibly in a socially open manner like the way in which territories were enforced among the !Kung (Cashdan 1983). Similar patterns have been hypothesized for other regions of the eastern United States, including West Virginia (MacDonald et al. 2006), Ohio (Stothers 1996, Stothers et al. 2001), and Indiana (Cantin 1989, 2000; Moore 2008b).

Using raw material data from 23 sites in two sections of West Virginia, MacDonald et al. (2006) proposed that two long-term, stable band territories extended from the Early Archaic to the Late Woodland periods in this region. Drawing from a multiscalar model of hunter-gatherer settlement and mobility, these authors interpreted the distributions and frequencies of particular chert types in assemblages from these 23 sites to indicate a combination of short-term daily foraging activities (i.e., embedded procurement at the local scale), travel by individuals to visit contacts outside the normal settlement range of particular bands, and long-distance travel for mate selection or exploration. The specific chert types identified by these authors (Flint Ridge, Upper Mercer, Brush Creek, Uniontown, Paoli, and Upper Mercer with cobble cortex) indicate that interactions and movements were directed toward the west and the Ohio River valley (MacDonald et al. 2006:131-132).

Working with chert and projectile point type data from Ohio, Stothers (1996, Stothers et al. 2001) also posited that distributional patterns required multiple explanations. Large assemblages of extra-local cherts were explained as the result of mobility and, therefore, indicative of band territories, while smaller numbers of points manufactured from cherts from distant sources were thought to indicate social interaction at the level of down-the-line trade or mate exchange. For instance, 70 percent of the large Kirk assemblage from the Nettling site in Ontario was manufactured from Pipe Creek chert originating from outcrops 175 km to the south in Ohio. Stothers (1996:197) interpreted this as indicative of “a regular cyclic settlement cycle between the Nettling site and Pipe Creek chert outcrop locations, located on the opposite side of Lake Erie in northern Ohio.” In Ohio, the majority of Kirk and Large Bifurcate bifaces were manufactured from Upper Mercer chert, suggesting band territorial ranges of 150 to 250 km. “Specifically, the data suggest a single band occupied the 150 km zone between the Upper Mercer and Flint Ridge chert sources and northcentral Ohio, while another band may have traversed 200-250 km between these same eastcentral Ohio chert sources and the Lower and Mid-Maumee River drainage of northwestern Ohio” (Stothers 1996:198).

This proposed ‘settling in,’ or reduction in band home range size, throughout the Early Archaic is supported by Cantin (1989, 2000), who found a similar pattern in use of higher quality, long-distance chert types by Thebes groups in the Wabash Lowland region of southwestern Indiana. Later Kirk groups, on the other hand, used higher frequencies of locally available cherts, indicating a reduction in mobility (Cantin 2000). Building on Cantin’s (2000) research and incorporating data from several regions of Indiana, Moore (2008b:93) characterized the Early Archaic social landscape as consisting of “small-scale hunting and gathering groups organized into highly mobile bands characterized by group flux.” These groups periodically aggregated at high-quality lithic source areas like the Swan’s Landing site (Smith 1995) to retool, obtain information, and participate in social activities like marriage ceremonies (Moore 2008b).

This picture of highly mobile bands living in large territories during the Early Archaic also is supported by data from Kentucky (Jefferies 1996a, 2009, Jefferies et al. 2005) and Pennsylvania (Adovasio et al. 2001) (see also Dragoo 1976). However, a more complex logistical settlement strategy is proposed by Chapman (1985) and Kimball (1996) for Early Archaic groups in the Little Tennessee River valley in Tennessee. Data from this region indicate that Early Archaic groups established residential base camps near lithic sources and in riverine locations characterized by high environmental diversity. “These base sites, in turn, probably articulated with a number of field camps elsewhere on the floodplain and in the uplands” (Chapman 1985). A similar pattern of Early Archaic logistical settlement is posited by Lewis (1983) in the upper Salt Creek drainage in Illinois. Ahler (1991), on the other hand, interprets large Early Archaic sites like Modoc as evidence for periodic aggregations by groups with a high level of organizational flexibility. This pattern of flexibility in settlement strategies is consistent with the model of small-scale hunter-gatherer bands practicing a foraging mode of production discussed in chapter 2.

This degree of mobility and flexibility is reflected in Early Archaic technological organization. Early Archaic lithic technologies were formalized and curated, largely due to the high mobility of these groups (Amick and Carr 1996). Early Archaic bifaces were manufactured with a combination of percussion and direct and indirect pressure flaking techniques. Justice (2006) interprets the quantities of projectile points and debitage at sites like Swans Landing as indicating that Early Archaic "hunters were expert flintknappers who apparently created a surplus at quarries, perhaps to be cached for use at base camps for hunting surplus and extra armament, as well as for trade to surrounding regions" (Justice 2006:25). These bifacial tools were highly curated, as indicated by the high incidence of edge rejuvenation and conservation techniques like beveling and serration evident on points from this time period (Christenson 1977, Wiant and Hassen 1984) and by the widespread use of blade core and bipolar reduction techniques (Kimball 1996, Odell 1996).

While much is known concerning Early Archaic settlement strategies and lithic organization, poor preservation at most open-air Early Archaic sites limits our knowledge of the other microscalar aspects of complexity of interest in this study. Excavations of cave and rockshelter sites, however, have led to the development of a generalized picture of subsistence patterns at this time (Fowler 1959b, Meltzer and Smith 1986, Smith 1986). For instance, comparison of food refuse assemblages from Modoc Rockshelter, Black Earth, the Stanfield-Worley Bluff Shelter, Russell Cave, and the Austin and Hayes sites indicates there was a general trend from a fine-grained subsistence strategy in the Early Archaic to a more narrow-spectrum diet by the late Middle to Late Archaic (Styles and Klippel 1996). This trend is primarily evident in that Early Archaic assemblages typically contain much higher percentages of squirrels and other small mammals than do later assemblages (e.g., Goldman-Finn 1994, Styles et al. 1983). As Styles and Klippel (1996: 115) point out, "there is an evolutionary trend to a greater use of aquatic resources and an increased emphasis on white-tailed deer (when compared with other mammals) as one moves from the early to the mid-Holocene.

In addition, botanical remains from the Bacon Farm and Icehouse Bottom sites indicate that while hickory nuts are the most common plant food remains throughout the Archaic, focus on this resource increases from Kirk to Bifurcate times and into the Middle Archaic, while acorn utilization decreases after Kirk times (Chapman 1977:117-121, 1978:89). Both hickory nuts and acorns were important in the diets of Early Archaic inhabitants of Dust Cave (Hollenbach 2009). Excavations at the Longworth-Gick site indicate that certain Bifurcate groups may have been relying heavily on butternut, as this resource comprises 86% of the nutshell weight in zone III at this site (Collins 1979: 564). The Early Archaic Horizon 11 at the Koster site in Illinois contains evidence that these groups were fishing and gathering shellfish (Brown and Vierra 1983). Paleofaunal remains from the Windover site in Florida indicate that some groups were primarily utilizing riverine resources like catfish, ducks, and turtles and not the marine resources, deer, or rabbits commonly found in assemblages elsewhere in the Southeast (Tuross et al. 1994). It would seem, then, that, like the diversity in settlement systems discussed earlier, the Early Archaic period in eastern North America is also characterized by a diverse array of subsistence practices characteristic of a generalized foraging pattern.

Very little evidence for long-distance exchange exists in Early Archaic assemblages. Nevertheless, Sassaman and Nassaney (1995:343) argue that “the persistence of panregional similarities in material culture implies a significant degree of large-scale interaction” during this time. According to Kowalewski (1995), eastern North America has been a world system from the beginning of its prehistory, as the fluidity of human social groups from the Paleoindian until the Historic period facilitated the fluid movement of people and information across the half-continent (and potentially beyond). Following Sassaman and Nassaney's (1995) and Kowalewski's (1995) leads, then, the relatively limited occurrence of exotic materials like cherts (Stothers et al. 2001) and marine shell beads (Ahler 1991, Tomak 1979) far from their source areas during the Early Archaic is likely related more to the movements of individuals across the landscape and informal exchanges that occurred as a result of these movements rather than to the existence of any formal system of exchange operating at this time. One potential exception may be a formalized system of exchange of Pine Tree points manufactured from Kosciusko quartzite during the Early Archaic in Mississippi. According to Brookes (1999) the widespread movement of points made from this material may be related to raw material needs as lower stream discharge and increased sedimentation during this time resulted in the burial of chert gravel deposits.

Evidence of specialization and leadership practices is also currently lacking, partially due to the lack of data pertaining to Early Archaic mortuary behaviors. The existence of localized Early Archaic mortuary traditions is indicated by the identification of non-habitation burial sites containing Bifurcate Tradition cremations at Jerger (Tomak 1979, 1991), Steele (Tomak 1991), and McCullough's Run (Cochran et al. 1998) in Indiana and in the use of a specialized charnel pond by groups in Florida (Doran 2002). Early Archaic cremations were also identified at the Slade site in Virginia and at the Eppley Rockshelter in Ohio (Stothers et al. 2001). Early Archaic inhumation burials have been excavated at Russell Cave in Alabama (Griffin 1974), Icehouse Bottom in Tennessee (Chapman 1977), and at the Koster (Brown and Vierra 1983:183) and Stilwell

II sites in Illinois (Perino 1970). Although we currently have very limited information pertaining to who was buried at these sites, why, and where other members of Early Archaic bands were buried, none of these mortuary sites or isolated burials exhibit any indications of the existence of special status positions among these groups.

Early Middle Archaic (ca. 8000 to 6500 B.P.)

The beginning of the Middle Archaic period in eastern North America largely represents a continuation of Early Archaic forms of settlement and social organization, but is distinguished by differences in projectile point forms (Nance 1986, 1987). For instance, Brown and Vierra (1983:190) suggest that the early Middle Archaic at Koster represents a continuation of an Early Archaic settlement strategy characterized by, "the scheduled exploitation of various seasonally available resources through high residential mobility." Significant Middle Archaic I (8600 to 7000 B.P.) deposits at Rodgers Shelter and Modoc Rock Shelter, on the other hand, suggest these sites were a seasonal base camps throughout portions of this time period (Ahler and Koldehoff 2009, McMillan 1976). The variability in settlement patterning evident across eastern North America, then, continues into the early Middle Archaic.

Some of the large late Middle Archaic midden sites located in the Tennessee and Green River valley regions were first occupied during the early Middle Archaic and provide evidence of changing patterns of organizational strategies toward the end of this period. The early Middle Archaic Eva component at the Eva site in Benton County, Tennessee, for instance, was located stratigraphically below the late Middle to Late Archaic shell midden in stratum II and a sterile flood layer in stratum III. Of the components at the site, the Eva component was notable in that it contained the greatest numbers of chipped stone tools and animal bone (Lewis and Lewis 1961: 25). In addition, a broad-spectrum diet was suggested by the presence of a diverse assemblage of food acquisition and processing tools such as nutting stones, mortars, fishhooks, and one feature containing a concentration of FCR (indicative of hot-rock cooking) (Lewis and Lewis 1961). A similar pattern was noted in the early Middle Archaic horizons at Koster, which contained cylindrical pestles, milling slabs, hearths, and roasting pits (Brown and Vierra 1983).

Additional evidence pertaining to early Middle Archaic subsistence comes from the Anderson site. Although this site was not stratified, the majority of the occupation dates to the early Middle Archaic. Identification of food refuse from this site indicates a broad-spectrum diet focused primarily on white-tailed deer (NISP = 8952), turkey (NISP = 922), eastern box turtle (NISP = 651), raccoon (NISP = 389), and grey squirrels (NISP = 354) (Dowd 1989:117, see also Dye 1996:145). In addition, features 8, 9, 11, and 14 all contained “heavy concentrations” of ash, each adjacent to a “solid mass” of mollusk shells, suggesting the cooking and processing of this aquatic resource (Dowd 1989:56). It would seem, then, that the early Middle Archaic witnessed the continued practice of an established Early Archaic subsistence strategy, perhaps focused more on the utilization of white-tailed deer over certain other smaller mammal species (Styles and Klippel 1996).

Evidence for increasing complexity in the Southeast during the later parts of the early Middle Archaic can be found in changes in burial practices. For instance, sites like Eva, Mulberry Creek, and Anderson contain large numbers of burials, suggesting that certain parts of the early Middle Archaic landscape were becoming special places (Dowd 1989, Dye 1996, Lewis and Lewis 1961) that were occupied for longer periods of time and that potentially represent the beginnings of more formalized territories (see Charles and Buikstra 1983). Increasing midden accumulations and the presence of structures and storage pits around 7200 B.P. at Anderson and Mulberry Creek, respectively, suggest the use of these sites as multiseasonal base camps (Dye 1996).

Burials from the Anderson site indicate that the early Middle Archaic may have also witnessed the beginnings of formalized long-distance exchange networks in eastern North America. For instance, Burial Nos. 12, 13, 22, 30, 31, 42, and 53 all contained shell disk beads and Burial Nos. 12, 30, 31, and 53 contained artifacts manufactured from conch shell, all of which may have been imported to the site from the Gulf Coast (Dowd 1989). Dye (1996) suggests that the advent of these exchange networks and the competition that ensued resulted in an increase in interpersonal violence at this time. One particularly striking example of this are the Morrow Mountain component Burial Nos. 83, 84, and 85 at the Mulberry Creek site, all of which contained projectile points in association so as to indicate cause of death. Furthermore, Burial No. 84 was missing its hands and forearms, suggesting that these appendages were removed as trophies (Dye 1996:152, Webb and DeJarnette 1942:244-245).

In addition to evidence for increasing social interaction in the form of exchange and interpersonal violence, the manufacture of the first highly stylized stone atlatl weights during the early Middle Archaic indicates the expansion and/or formalization of prehistoric communication networks and, potentially, the advent of formal sodalities like hunting societies or clans (Burdin 2004, Lutz 2000, Sassaman and Randall 2007). The large numbers of early Middle Archaic bannerstones at the Ferry site in Hardin County, Illinois (Butler 2009:619, Fowler 1957) suggests this site was an important component of the early Middle Archaic cultural landscape, possibly the location of periodic aggregation events or ceremonies.

Late Middle to Late Archaic (ca. 7000 to 4500 B.P.)

The late Middle to Late Archaic period is eastern North America is characterized by a marked increase in the numbers of recorded archaeological sites and a significant increase in the accumulation of cultural materials at many of those sites. The distribution of riverine middens that were first occupied in some regions during the early Middle Archaic now expands throughout major river valleys across the region and into upland wetland settings as well. This increase in the archaeological signature of these groups, in part due to the better preservation encountered in many of the large midden sites, means that archaeologists have a much clearer understanding of the social, political, and economic practices of these groups. It also means that the literature pertaining to this period is massive and cannot be completely summarized herein. As such, this chapter addresses the archaeological literature and summarizes current perspectives on the complexity of groups in just a few regions that are of direct relevance to the major topic of this dissertation. These regions are: southern Illinois, the Falls of the Ohio River region in Kentucky and Indiana, the Green River region in Kentucky, and the lower Mississippi Valley in Louisiana and Mississippi.

Southern Illinois

One of the first large late Middle to Late Archaic sites to be investigated in southern Illinois was the Faulkner site, a multicomponent midden located on a ridge within the floodplain of the Ohio River in Massac County. Like many large sites dating to this time period, Faulkner is located in an area of concentrated wetland resources and high productivity. A total of fourteen pit features and eleven burials were excavated at the site, which yielded a variety of Middle Archaic side notched and Late Archaic stemmed projectile points. No exotic marine shell, copper, or other objects indicating status differentiation were recovered (MacNeish 1948).

Later investigations at late Middle to Late Archaic sites throughout the region did provide good evidence for such status distinctions, however. In a series of papers pertaining to burial practices of the Helton phase, Douglas Charles and Jane Buikstra (1983, 2002, Buikstra and Charles 1999) interpreted the use of formal mortuary areas (i.e., cemeteries) at sites like Elizabeth and Gibson to indicate that Helton phase groups occupied stable territories that were corporately owned by formal kinship groups. The differential burial of individuals in the formal cemeteries or in midden within habitation sites related, according to these authors, to the existence of a kind of status hierarchy among members of different kin groups, ages, and/or abilities This status hierarchy may have been directly related to the extra-local and interregional exchange networks that brought exotic goods into the region during this time in that higher status kin groups may have obtained their status through the control of fixed resources (via historical association with those resources, symbolized on the landscape in the form of mounds and cemeteries) included in those exchange networks (Charles and Buikstra 1983:121).

Differential burial treatment among Helton phase groups was best illustrated by Buikstra (1981) in her study of burials from Koster, Modoc Rock Shelter, and the Gibson Mound group. Individuals buried at Koster and Modoc were those who were very old, young, or crippled and who could not perform the full range of activities required of Archaic hunter-gatherers. Penecontemporaneous burials from Gibson Mound 1, however, were young and middle-aged adults in pristine health. Buikstra (1981) interpreted this pattern as evidence of a multiple track burial program, represented by these two site types and a third unidentified site type characterized by the burial of infants and children.

The Elizabeth Mounds site is another Archaic (and Middle Woodland) mortuary site that, like Gibson, contains young to middle-aged adults in good health. Differential burial practices at this site involved an elaborate set of rituals that included the deposition of socially meaningful artifacts with the deceased. This ceremonialism was perhaps best represented by Feature 4 at Elizabeth. This feature contained five individuals directly dated to 4390 B.C. Four of these were encircled with marine Leptoxis shell bead belts and had two to three Early to Middle Archaic points pressed into their chests post-mortem. All five were wearing Leptoxis shell bracelets and two had bear canine earrings (Charles and Buikstra 1983:134, Albertson and Charles 1988:33-36, Charles et al. 1988). The association of these young, healthy individuals with elaborate shell adornments and projectile point types that typically pre-date the burials by many hundreds to thousands of years suggests some form of ancestor veneration and emergent status differentiation. Similarities in size and manufacturing technique suggest that the points found embedded into the chests of the Middle Archaic individuals in Feature 4 were manufactured by the same individual (Odell 1988). If this were the case, then typical Early Archaic Kirk projectile points were being manufactured alongside Middle Archaic Helton and side notched forms during the late Middle Archaic.

An additional mortuary site type consists of floodplain cemeteries like the Bullseye site in Greene County, Illinois. This site was excavated by amateur archaeologists and the Center for American Archaeology in the early 1980s and yielded a large number of socially important artifacts, including 29 atlatl weights, 296 hafted bifaces, 43 axes, 4 copper awls, 45 drills, a plummet, and a tubular pipe (Hassen 1987:1). Although preservation was very poor and no human remains were found associated with these objects, their recovery in closely associated groups and similarity to objects commonly found in burial contexts elsewhere support the notion that Bullseye was an Archaic cemetery. The variety of artifacts and their conspicuous nature led Buikstra and Charles (1999, Charles and Buikstra 2002) to conclude that Bullseye was:

> … probably a seasonal camp where several communities of dispersed households gathered. They would have come together to discuss matters of mutual concern, to bury their dead, and to exchange mates, thus linking death and renewal, mortality and fertility. In such contexts bannerstones may have served as symbols representing group membership. These symbols may have been ritually 'killed' in competitive displays ostensibly dedicated to the ancestors but also deeply involved in negotiations for influence among the living (Buikstra and Charles 1999:208).

This increasing intensity of social interaction and exchange during the late Middle Archaic is also evident in material culture studies like Jefferies' (1995, 1997, 2004) analyses of carved and engraved bone pins from late Middle to Late Archaic sites. According to Jefferies (2004:75):

> The appearance of localized and distinct artifact styles... indicates relatively intensive social interaction among Middle and Late Holocene groups that inhabited the southern Midwest region. The spatial distribution of [bone] pins having these technological and stylistic attributes suggests that the efforts of increasingly sedentary hunter-gatherer groups to maintain or intensify their social ties with other groups in the region were successful and that the network that helped promote this social integration covered an extensive area.

This level of social interaction did not extend from the southern Midwest to groups living across the Ohio River in the Green River valley of western Kentucky, however. Additionally, a literature review of sites throughout the Southeast failed to find more than basic similarities in bone pin styles in distinct areas throughout the region (Jefferies 2004). In an earlier paper, Jefferies (1995) interpreted distinct bone pin styles as evidence that the late Middle Archaic was characterized by increasing regionalization. Bone pins, then, may have represented "'badges' of membership used to identify members of the regional group, reflecting the increased level of social circumscription in the midcontinent at this time" (Jefferies 1995:90). Even during this period of regionalization, however, the maintenance of panregional information flows, perhaps to a much more limited degree than in the earlier Archaic, is indicated by the widespread distribution of certain styles of bone pins, such as the crutch-top type (Jefferies 2004:83).

According to Jefferies (1995, 1996b, 2004), late Middle to Late Archaic exchange networks are directly related to the aforementioned shift from Early Archaic and early Middle Archaic residential mobility strategies to the logistical collector mobility strategies of the late Middle and Late Archaic. As Jefferies (1995:78-79) points out:

> Exchange networks may have been a way of maintaining intergroup affiliation and information flow that was previously accomplished during normal seasonal movement. As Middle Archaic groups became more sedentary, the flow of social and environmental information may have been maintained by individuals establishing ties, perhaps as trading partners, with members of distant groups.

Such a shift toward a logistical mobility strategy is also supported by Ahler's (1984) surveys near Modoc Rock Shelter, with Modoc serving as a base camp (Ahler 1993). Fowler (1959a) identified a row of small posts in late Middle to Late Archaic levels at Modoc, indicating the use of simple structures like a windbreak at the site at this time. Carlson (1979) and Doershuk's (1989) analyses of changing mobility strategies at Koster indicated a general shift from a residential mobility strategy to a more sedentary strategy that included the construction of substantial structures in Horizon 8C (Brown 1985, Brown and Vierra 1983, Sassaman and Ledbetter 1996). A shift to a logistical mobility strategy is also supported by large-scale surveys in the Wabash Lowland region of southern Indiana (Stafford 1994).

Excavations of thick midden sites containing hundreds of burials at Black Earth and other locales in the Carrier Mills Archaeological District indicate that some late Middle to Late Archaic hunter-gatherers in southern Illinois were intensively occupying areas of dense wetland resources, perhaps on a year-round basis (Jefferies 1982, Jefferies and Lynch 1983). Analysis of cherts from the Carrier Mills sites indicates that these groups ranged as far as the western Shawnee Hills, 60 to 70 km from the District, obtaining chert as part of an embedded procurement strategy (Morrow and Jefferies 1989), and then heavily utilizing, resharpening, and recycling these materials at the midden sites (Morrow 1982). Unlike at Helton phase sites to the west, analysis of Carrier Mills mortuary practices indicates very little status differentiation, as few objects were placed with burials and individuals were not afforded different burial treatments (Jefferies and Lynch 1983, Lynch 1982). The one possible exception was Burial No. 137 at Black Earth, a middle-aged adult interred with 45 items, including eagle talons, worked bear phalanges, a miniature grooved axe, banded slate, odd pieces of worked stone, a possible plummet, and two gorgets. These items may have been part of a medicine bundle and the individual buried with them may have been a shaman (Lynch 1982:1151).

Both Helton phase and Carrier Mills sites yielded good evidence of the diets of their prehistoric inhabitants. Asch, Ford, and Asch (1972:12) identified a variety of seed plants, including marsh-elder, chenopodium, and wild grape, at the Koster site, leading

Smith (1987, 1995) to hypothesize an increasing dependence on these seed plants resulting in the domestication of certain species by the 4th millennium B.P. Gardner (1997), following Munson (1986a), identified an intensified use of hickory and other nuts during this time, suggesting that Middle to Late Archaic hunter-gatherers throughout the Midwest and Midsouth practiced a form of silviculture, clearing areas around productive trees to maximize their production. Such an interpretation is supported by the large quantities of hickory nutshell from midden and feature contexts at Carrier Mills (Lopinot 1982). Faunal data from these sites indicate an intensified use of aquatic species like fish and shellfish during this time (Brown 1985, Styles and Klippel 1996, Styles et al. 1983), although terrestrial species like white-tailed deer were much more abundant in the Carrier Mills District (Breitburg 1982). Intensification of plant food processing is suggested by the first use of formal channel basin metates during the late Middle Archaic at Koster (Cook 1976).

Falls of the Ohio River

The Falls of the Ohio River region consists of an approximately four mile long series of rapids that, prior to the construction of a lock and dam system, impeded travel along the river (Janzen 1977). As such, the Falls acted as an important component of the prehistoric and historic cultural landscapes, simultaneously acting to impede travel up and down and facilitate travel across the river at this point. Unfortunately, very little archaeological research was accomplished in the Falls region prior to destruction of much of the area as the city of Louisville expanded (Janzen 1972).

Fortunately, several sites were investigated by E. Y. Guernsey (1939, 1942) in the late 1930s and early 1940s. Excavating at the massive shell and dirt middens at Clark's

Point and Elrod, Guernsey identified late Middle to Late Archaic buried deposits containing flexed burials, ¾ grooved axes, pestles, lignite beads, atlatl weights, and bone, antler, and stone artifacts reminiscent of materials recovered by C. B. Moore (2002) at Indian Knoll. Although no copper or marine shell objects were recovered from these sites, their size led Guernsey (1939:30) to conclude that the Falls area was a "tribal center" during the late Middle to Late Archaic. Although Guernsey (1942:63) claimed to have studied some 200 burials from the Falls, these were poorly reported. One vignette of the complexity of mortuary practices in this region comes from a description of a mass burial of five individuals, large rounded boulders, and masses of red ochre at Elrod. "Above this group of burials a layer of fragmentary, fissile limestone had been strewn to form a slightly arched mound. More precisely, as a subsequent careful examination revealed, only a quadrant of the actual mound was excavated" (Guernsey 1942:67).

Later excavations by Janzen (1971, 1977) provided additional information pertaining to these important Falls area sites. Janzen's (1977) excavations yielded burials associated with atlatl components and decorated bone pins, indicating participation in wide-ranging communication networks (Jefferies 1997, 2004). Analysis of chert raw materials from these sites indicated that local chert sources were being utilized, a pattern confirmed by later excavations at nearby sites by Collins and Driskell (1979, see also Boisvert 1979a). Faunal assemblages from Falls area sites were dominated by fish, snails, and mussels, indicating an aquatic resource focus similar to that found in southern Illinois (Janzen 1971). Janzen (1977) interpreted the large middens at Old Clarksville, Reid, Hornung, and Ferry Landing as the remains of base camps that were located in areas of high resource diversity, limiting the need for a high degree of mobility and facilitating a semi-sedentary settlement pattern.

Two of the more extensively excavated base camps in the Falls region are the Spadie (Boisvert 1979b) and Rosenberger sites (Driskell 1979), both located in Jefferson County, Kentucky. A range of artifacts and features were recovered at Spadie (Boisvert 1979b), while Rosenberger yielded 181 individuals from 164 human burials (Wolf and Brooks 1979:905), 51.7% of whom were associated with grave goods (Driskell 1979:774). These were most often utilitarian in nature and associated with males (Driskell 1979:773). Evidence of possible status distinctions occurred in the form of a single individual (Feature No. 400) associated with 41 lanceolate bifaces ranging from 72 to 124 mm in length (Boisvert 1979a:959) and of two major morphological forms such that Boisvert (1979a:970) attributed them to at least two different flintknappers.

Compiling data from throughout the Falls region, Collins and Driskell (1979:1030) identify a settlement pattern consisting of six distinct site types: 1) large mussel shell middens located in the floodplain (e.g., Breeden and Old Clarksville) (Janzen 1977), 2) large middens with very little mussel shell located in the floodplain (e.g., Rosenberger, Spadie, and Villier) (Collins and Driskell 1979), 3) smaller floodplain sites, 4) large interior lowland sites with deep middens (e.g., KYANG and Lone Hill) (Bader 1992, Bader and Granger 1989, Burnett 1963), 5) small open surface sites in the uplands, and 6) bluff shelter and cave sites (e.g., Ashworth Cave) (DiBlasi 1981). This diversity of site types reflects the complexity of the settlement pattern in the Falls at this time and is possibly a result of a marked increase in population during the Late Archaic (Collins and Driskell 1979). Faunal and botanical evidence from these sites supports an aquatic resource focus, with large amounts of deer and hickory nutshell also being utilized (Bader and Granger 1989, Duffield 1979, and Lannie 1979).

Green River

Increasing populations and more intensive use of landforms located in wetland and riparian settings is supported by surveys in the Green River region as well (Jefferies 2009). As Jefferies, Thompson, and Milner (2005, Jefferies et al. 2007) note in their survey of the Cypress Creek drainage, the number of projectile points dating to the late Middle to Late Archaic period in the Green River region increases markedly over the early Middle Archaic, perhaps indicating increased population growth at this time. Additionally, their survey indicates more intensive use of particular locations on the landscape—77% of the middens in the Cypress Creek area contain late Middle Archaic components (Jefferies, Thompson, and Milner 2005:16).

One consequence of this shift from a more mobile foraging strategy to a more logistically organized collector strategy during the late Middle to Late Archaic is the proliferation of archaeological site types. For instance, utilizing only published data, Winters (1974) was able to identify four major site types within the Green River valley, each characterized by different kinds of resource extraction and processing activities. These different site types include: 1) base camps such as Barrett, Carlston Annis, and Indian Knoll (Webb 1950a, 1974; Webb and Haag 1947); 2) settlements such as Read, Chiggerville, and Ward (Webb 1950b; Webb and Haag 1939, 1940); 3) hunting camps like Kirkland (Webb and Haag 1940); and 4) transient camps like the Butterfield site (Webb and Haag 1947).

Marquardt and Watson's (2005a) more recent surveys and excavations in the Green River region provide a more convincing picture of the late Middle to Late Archaic settlement system in this region. They argue that shell and smaller non-shell sites like 15Bt12 - 15Bt92 and 15Bt5 - 15Bt15 may be paired base camps and short-term camps, respectively, and that upland shelters may have been winter components of the warm-weather riverine settlement system. As these authors point out, however, the number and diversity of sites found within the Green River region indicates that these sites "were parts of dynamic settlement systems through time and space" (Marquardt and Watson 2005a:68). The high numbers of features and high density of burials and shell at Carlston Annis, Indian Knoll, Barrett, Read, Butterfield, and Ward led Hensley (1991b, 1994) to classify these middens as aggregation sites that, according to Marquardt and Watson (2005c), were occupied seasonally during the summer and fall.

Another potential indication of changing settlement strategies is an increase in the number of postholes and other features that may suggest the widespread use of permanent or semi-permanent structures at this time. For instance, at Indian Knoll Webb (1974:129) noted:

> While there was no evidence in the midden of any elaborate or permanent structure or dwelling, scattered individual postholes about fired areas seem to demonstrate that crude dwellings of a very simple kind may have been erected on the midden. Rarely, clean clay seems to have been brought from a distance and spread as a thick layer over an area about 15 feet in diameter, thus forming a floor upon which a fire was often built. About such a fire used for warmth as well as cooking, crude dwellings may have been erected.

Two of these prepared clay areas were identified at Indian Knoll, while four "burned clay floors" were noted at both Carlston Annis and Read (Watson 2005:518). In addition, 76 scattered post molds were identified at Read (Webb 1950b:362). While the clean clay platforms at Indian Knoll may be associated with a structure of some kind, the "burned clay floors" found at these sites are interpreted by Marquardt and Watson (2005b) as possible mussel steaming platforms.

Rather than attributing the increased size of the large 'base camps' like Indian Knoll to increasing complexity and changing settlement patterns, such large midden accumulations may result from the repeated occupation of resource-rich areas (Crothers 2004). As discussed in chapter 2, Crothers (2004, Crothers and Bernbeck 2004) argues that the Green River late Middle to Late Archaic hunter-gatherers were small-scale hunter-gatherers practicing a foraging mode of production, not the logistically organized, 'complex' hunter-gatherers proposed by Burdin (2004), Sassaman (2004) and others.

Regardless of whether the Green River midden sites were components of a complexly organized logistical settlement strategy or more loosely organized forager pattern, the large numbers of burials found in these sites indicates they were important, venerated locations on the Green River cultural landscape (Crothers 1999). According to Crothers (1999, 2008), these sites were seasonally occupied by groups claiming rights of exclusive access to the mussel shoals and other resources along the river. This switch from common property rights characteristic of most small-scale hunter-gatherers to the exclusive property rights of the Late Archaic occurred when non-local groups chose not to incur the high transaction costs necessary to maintain access to the riverine locations in the Green River region. This process was implicated in the advent of domestication in eastern Kentucky in that these groups chose to focus on second-tier resources like oily and starchy seeds, setting off a co-evolutionary process leading to the advent of a horticultural mode of production (Crothers 2008).

Claassen (1991, 1992, 1996) takes the 'shell middens as venerated places' argument to its most extreme, hypothesizing that the mounding of shell at these sites was an expression of a symbolic association between shell and death that extends beyond the Southeast to regions like Mesoamerica. At least some of the shell middens, she argues, were intentionally constructed mortuary facilities for the disposal of the dead (Claassen 1992, 1996). Several lines of evidence suggest this is not the case, however. Reanalyzing materials from the Read site, Milner and Jefferies (1998) illustrate how burials were distributed according to topography rather than shell distributions and conclude that the site was a refuse heap that accumulated on a low rise, not a burial mound. The fact that burials at Green River sites are oftentimes located in subsoil, that not all middens contain shell or very much shell, and that some sites do not contain much midden or many burials led Hensley (1991b, 1994) to the same conclusion. Gorski's (2005) microstratigraphic analysis of sediments at Carlston Annis indicated that the site accumulated on a horizontal surface rather than a mounded surface, as would be expected if the sites were intentional burial mounds. Finally, Morey and Crothers' (1998) discovery that many shell middens were located adjacent to pre-impoundment mussel shoals indicates that shell at these sites did not have to be transported long distances, as originally thought by Claassen (1991, 1996).

While it would seem that the Green River middens were not intentionally constructed burial mounds, the presence of special, exotic objects with some of these burials does suggest that some degree of status differentiation existed among these groups (Rothschild 1975, 1979; Winters 1968). As Barbara Bender (1985a) pointed out, one mechanism for this increasing status differentiation is the advent of networks of more intensive, long-distance exchange beginning in the 5th millennium B.C. According to Bender's model, Late Archaic exchange provided the catalyst for social differentiation among these egalitarian groups in that alliances and exchanges tend to incur debts that can lead to status inequities. For Bender, evidence of this increasing level of social differentiation could be found in the mortuary practices of the Middle to Late Archaic groups involved in this exchange. "Increasingly during the Late Archaic the exotic objects were placed in graves, and certain individuals were singled out" (Bender 1985:56). In addition, large caches of well made prestige goods found throughout the eastern United States at this time suggest control of certain raw material types by select individuals (Bender 1985:57).

According to Marquardt (1985:81), these "alliances made by traveler-diplomats would contribute to the society's production, by guaranteeing access to alternative resource zones in times of periodic stress, and to the society's reproduction, by providing the forum for negotiating marriage alliances." The interregional exchange networks characteristic of the late Middle and Late Archaic periods, then, were maintained both to provide individuals and groups with socially valued prestige goods and to provide those groups with access to resources from a variety of areas that could be relied upon in times of environmental stress in a kind of risk management strategy (Brown 1985, Jefferies 1996b). Another potential leadership role was that of shaman, indicated by the presence of medicine bags in several Green River burials (Marquardt and Watson 2005c:634). As Marquardt and Watson (2005c) point out, however, none of these leadership roles were likely very well-defined or permanent during this time period.

Whether orchestrated by short-term traveler-diplomats or more permanent leaders, the association of numerous burials with ornately carved bone pins and other bone tools, marine shell artifacts, and bannerstones (atlatl weights) all suggest that Green River groups were participating in long-distance exchange networks that were directly linked to the production of socially valued artifacts related to the maintenance and public expression of group identities (Burdin 2004). For instance, Burdin (2004) and Jefferies (1995, 1996b, 1997, 2004) interpret the distributions of particular atlatl weight and bone pin styles, respectively, as evidence for the presence of distinct social groups in the lower Illinois River valley and middle Green River valley regions. This regionalization pattern is supported by Moore's (2008a) study of fishhook manufacturing trajectories and suggests that tribal-like social formations may have been developing in the Green River and nearby regions at this time.

Most of the evidence for long-distance exchange in the Green River region comes from numerous burials from the Green River sites that contain exotic marine shell and other objects. According to Webb (1974: 229), 25,125 shell artifacts (both marine and freshwater varieties) were recovered as a result of the Indian Knoll excavations. Of these, 24, 975 were found in burial associations, suggesting the ritual importance of shell artifacts (Webb 1974, see also Claassen 2010). Most notably among the shell associations are: Burial No. 310, which contained a conch shell cup and disc bead necklace; Burial No. 116, which contained a number of freshwater Leptoxis shell beads arranged as though sewn into a cloth (similar to those found at the Elizabeth site, discussed above); and Burial No. 515, which contained a conch shell pendant under the individual's skull, two columella pins or earplugs, and a shell and cannel coal bead necklace (Webb 1974). Evidence from other Green River sites include four burials from the Chiggerville site with conch shell gorgets or masks, including one with a conch shell composite atlatl weight (Webb and Haag 1939); four burials with conch shell gorgets or masks from the Barrett Site (Webb and Haag 1947); and a number of similar burials from both Carlston Annis and Read (Webb 1950a, b). Evidence of copper at these sites is limited to just a few occurrences, including Burial No. 632 from Indian Knoll, which contained two small copper ornaments, and Burial No. 1 from Barrett, which contained a flat, expanded center bar pendant similar to one found in earlier excavations by C. B. Moore (2002) at Indian Knoll (Rolingson and Schwartz 1966:89-91, Webb 1974:280).

Although Goad (1980) has hypothesized that the marine shell and copper found at the Green River sites arrived as part of an inter-regional exchange network that linked the Gulf Coast to the upper Great Lakes with the Green River populations acting as middlemen, the small quantities of copper in burials at these sites suggest that this was not the case. Instead, it would seem that inter-regional exchange along the Green River was conducted by leaders who acted to secure marine shell objects from the Gulf Coast through participation in networks of down-the-line trade (Wright and Zeder 1977). These activities likely emphasized status differences that arose through the exchange of more locally socially valued goods like cannel coal beads, various kinds of atlatl weights, decorated bone pins, and perhaps a plethora of other long-disintegrated perishable goods (Jefferies 1997). It is interesting to note that the large numbers of burials containing exotic marine shell and other artifacts found in the Green River shell middens are generally absent at sites north of the Ohio River, suggesting the existence of a geographic barrier to the immediate north of the Green River region (Brown and Vierra 1983, Jefferies and Lynch 1983, Miller 1941).

Subsistence practices in the Green River region are similar to those discussed above for southern Illinois and the Falls of the Ohio River regions. Winters (1974) originally interpreted the large quantities of freshwater mussels, deer bone, and nutshell in the Green River middens as evidence for a narrow-spectrum harvesting economy. However, more recent analyses have demonstrated that a broad range of aquatic and terrestrial resources were being utilized at these sites (Crawford 2005; Crothers 1999, 2005; Gardner 1994; Glore 2005; Wagner 1996, 2005). Of particular note is the fact that, at certain sites like Carlston Annis, "the quantity of hickory nutshell is overwhelming" (Marquardt and Watson 1983:335), confirming Gardner's (1997) mast exploitation hypothesis. The presence of pit features, manos, grinding stones, and large numbers of pestles, and other plant processing tools at many of the large base camps suggests that these food resources were being processed in bulk and presumably stored, possibly for use during the winter months. Finally, the recovery of 80 chenopodium and 37 purslane seeds by Jefferies et al. (2007) at the Ward site suggests that certain Green River individuals were "experimenting with an early stage of plant cultivation where wild plants were tolerated, or even encouraged, to grow in the organic-enriched and continually disturbed soil of a frequently occupied site" (Jefferies et al. 2007:62).

One additional line of evidence for an increase in cultural complexity during the late Middle to Late Archaic in the Green River region is the number of individual burials containing some kind of evidence for violent death, dismemberment, and trophy taking (Mensforth 2001). In his analysis of the Green River sites, Winters (1974) associates this evidence for violent death to the rise in external conflict in high resource areas during periods of resource stress in areas adjacent to these sites. Sassaman (1995), on the other hand, attributes increased violence to competition for mates as a result of the expansion of the economic system. "The establishment of long-distance exchange coincides with evidence of violent death, suggesting that the development of formal alliances, and the ethnic boundaries that are its precondition, arose from efforts to regulate competition among groups" (Sassaman 1995:187). Claassen (2010) argues that victims of violence represent ritual sacrifices performed as part of renewal ceremonies held at the shell middens. Clearly additional research is needed to better understand the role and significance of violence in the Late Archaic and evaluate these hypotheses.

Lower Mississippi Valley

Discussions of complexity in the lower Mississippi River valley focus primarily on the recent discovery that moundbuilding in this region dates to as early as the Middle Archaic period (Russo 1996). According to Saunders et al. (2005:662), a total of fourteen mound sites in the lower Mississippi valley have been dated to the Middle Archaic. Of the eleven discussed by Sassaman (2004:259), two are single mound sites, four are paired mounds, and one each has three, five, six, and eleven mounds. All mounds exhibit evidence of staged construction, and some include evidence of pre-mound architecture at their bases.

The largest and best studied of the Middle Archaic mound sites is the Watson Brake site in northern Louisiana. This site consists of an oval arrangement of eleven mounds and connecting ridges forming two rows of earthworks. The tallest mound at Watson Brake is 7.5 m high (Saunders et al. 2005:632).

A range of explanations and interpretations of have been posited regarding moundbuilding in the lower Mississippi River valley. Most extreme among these is Sassaman and Heckenberger's (2004a, b) contention that the architecture of the mound sites indicates an inner/outer dichotomy that, when internalized by social groups provides *a priori* evidence for their construction by hierarchically ranked kinship groups. These arguments draw from Clark (2004), who rightfully argues that advanced mathematical and engineering skills were required to build such elaborate sites. Sassaman and Heckenberger (2004a, b) and Clark (2004) both overstep the available data when they assert that a pan-American sacred numerology and 'ethnophysics' are evident in the layouts of these sites. As Saunders et al. (2005) point out, the fact that sites like Watson Brake were built over a 500 year period weighs heavily against the notion that these sites were built according to some widespread cosmological blueprint (see also Milner 2004).

Reviewing the evidence for complexity in the lower Mississippi River valley, Saunders (2004) argues that the lack of evidence for plant domestication, sedentism, trade, craft specialization, feasting, and burial ceremonialism at these sites suggests a lack of status differentiation during this time. Evidence of trade is limited to a few objects manufactured from novaculite, quartz crystals, copper, marine shell, and Fort Payne chert. Although limited in scale, Gibson (1994a) interprets evidence for a well-developed zoomorphic bead lapidary industry at sites like Denton as indicating the presence of managers or incipient 'big men' who directed trade throughout the region. The recovery of 154 microdrills, 93 microdrill preforms, 70 blades, 16 blade cores, and 7 chert beads in varying stages of production at Watson Brake suggests that part-time craft specialists were involved in trade at this site as well (Saunders 2004:153-154, Saunders et al. 2005).

David Anderson (2003, 2004) interprets Middle Archaic moundbuilding as evidence for the existence of tribal-like social formations in the lower Mississippi River valley. According to Anderson (2003, 2004), the mounds were constructed during ritual events, possibly as territorial markers, as a means of asserting group cohesion. Widmer (2004) supports this position, arguing that rising sea levels during the Middle Archaic created a situation of localized abundance in the lower Mississippi valley that resulted in increasing population densities and created an opportunity for groups to become fairly sedentary (Russo 1996) and form kin-based corporate groups (i.e., lineages) that built the mounds as shrines to apical ancestors (Widmer 2004). Such a scenario, while speculative, is supported by the high frequencies of fish and other aquatic resources in faunal assemblages from sites like Watson Brake (Saunders et al. 2005).

Whether the mounds were constructed by powerful leaders as argued by Sassaman and Heckenberger (2004a, b) or as a communal effort as a means of providing thanks to the spirits and other intangible forces as argued by Gibson (2004), the mounded landscape of the lower Mississippi River valley certainly represented a sacred landscape. As a result, Middle Archaic mounds may be symbols of identity and protective forces in the lives of Louisiana's prehistoric inhabitants (Gibson 2004) and likely provided the historical basis for the later construction of the much larger mound complex at Poverty Point (Clark 2004).

Terminal Archaic (ca. 4500 to 2500 B.P.)

The Terminal Archaic period in eastern North America witnessed a continuing regionalization as local groups took on unique characteristics, networks of interregional exchange expanded and intensified in scale, and mortuary activities became ever more ritualized and labor intensive. After a brief hiatus, moundbuilding resumed in the lower Mississippi River valley, resulting in the construction of the second largest mounded site in eastern North America. Finally, experimentation with plants culminated in the advent of a horticultural system involving both domesticated and non-domesticated cultigens and identified in the archaeological literature as the Eastern Agricultural Complex.

Evidence for increased regionalization is particularly evident north of the Ohio River, where the Terminal Archaic is marked by a diversification in projectile point and other material culture forms. The American Bottom region near modern-day St. Louis, Missouri was a cultural border zone during the Terminal Archaic, and the region was occupied by several oftentimes contemporaneous groups practicing different lifeways and manufacturing distinct forms of material culture (Emerson and McElrath 2001). Each of these groups was characterized by differing settlement patterns and utilized the American Bottom in different ways. For instance, the Prairie Lake phase (1400-900 cal. B.C.) consisted of relatively stable base camp occupations around lowland oxbow lakes (Emerson and McElrath 1983). Sites like Missouri Pacific #2 contain non-overlapping pit clusters interpreted as several permanent or semipermanent occupations spanning a period of 300 years. These pit clusters are interpreted as the spatial remnants of discrete family or band-level domestic areas that served as base camps for the logistically organized exploitation of surrounding floodplain resources (McElrath and Fortier 1983). Emerson and McElrath (1983) interpret the settlement-subsistence pattern of these groups as focusing on the resources of the Prairie Lake margins, supplemented by seasonal exploitation of upland and floodplain zones by logistical task groups.

The slightly earlier Mule Road phase (ca. 2100 cal. B.C.) is interpreted as a northern intrusion of groups who manufactured Ledbetter and Pickwick points, found in large numbers at sites along the Tennessee River during the late Middle to Late Archaic (McElrath 1993). The presence of Pickwick/Ledbetter groups in the region illustrates the dynamic nature of social movements and interactions during the later Archaic (Emerson and McElrath 2001).

The Labras Lake phase (ca. 1800-1400 cal. B.C.) is a local manifestation of the widespread but regionally distinct Riverton (Merom-Trimble) Culture. Occupation of the type site at Labras Lake consisted of a series of non-overlapping, contemporaneous structures, each associated with storage/refuse pits, hearths, and other domestic features and activity areas (Phillips and Gladfelter 1983). A similar form of multi-seasonal village organization is evident at the Chapman site in Tennessee (Bentz 1986).

A complex site organization also characterizes the Riverton type sites in the Wabash River valley of eastern Illinois. A total of 163 subsoil postmolds was identified at the Robeson Hills site. Arrangements of postmolds included segments of arcs, suggesting circular or oval houses from seven to thirty feet (three to ten meters) in size (Sassaman and Ledbetter 1996:78, Winters 1969:92). Other alignments suggested small rectangular structures were also present (Winters 1969:92).

At least ten clay floors between four and six inches thick were identified at the Riverton sites, some of which were occupation surfaces surrounding hearths (Sassaman and Ledbetter 1996:78, Winters 1969:93). Yellow clay floors, one of which was over nine feet long, were also present at Swan Island, where a portion of a sandstone slab floor was also exposed. This sandstone slab floor was associated with at least two posts (Winters 1969:93).

Riverton burials exhibit a high incidence of trauma, indicative of high levels of interpersonal violence. A total of six burials were identified at Robeson Hills. One of these had a Merom-Trimble point embedded in its femur (Winter 1969:94). Of the five burials from the Riverton site, two contained Merom-Trimble points in positions that suggest they were in the individuals' bodies at the time of interment (Winters 1969:95-96). Additional evidence of Riverton Culture violence consists of an individual with several embedded projectiles and another that was possibly a victim of violence at Site 12D563 in Dearborn County, Indiana (Christopher W. Schmidt, personal communication 2009) and an individual at the Panther Rock site in Carroll County, Kentucky who had a Merom-Trimble point embedded in his rib cage (Ross-Stallings 2009).

To date, all Riverton Culture burials, including those with no evidence of being victims of violence, have been recovered at habitation sites in midden and refuse pit contexts. Elsewhere during the Terminal Archaic, groups were burying their dead in a variety of special contexts. Terminal Archaic burials in the lower Illinois River valley have been identified at sites like Snyders Mound $C^0$114, Pete Klunk Mound 7, Hagen, and Bell Farm. These burials were associated with lanceolate bifaces, plummets, a cloudblower pipe, a slate bannerstone, a marine shell gorget, and a copper celt. Several were covered with red ochre (Charles et al. 1986:460-461).

A total of 110 individuals of Terminal Archaic affiliation was recovered from Klunk Mound 7, including one with a projectile point embedded in a lumbar vertebra and one with an amputated right hand and a point fragment in a healed wound in his left parietal. This burial assemblage was associated with several Terminal Archaic crematory features that were mounded over with soil and limestone slabs after use (Charles et al. 1986). Both the cremations and the inhumations at this site are considered penecontemporaneous:

> The fact that a large cremation containing a male over 50 years of age was the initial mortuary event, and the fact that what may have been the final inhumation—Burials 46-50—consisted entirely of subadults and contained the only unambiguously Archaic extended burials, do suggest a cyclical component to the mortuary ritual behavior. This in turn suggests that the mortuary ritual had a significance beyond the immediate disposal of the dead (Charles et al. 1986:464).

The Williams Cemetery and Sidecut Crematory sites, located on opposite banks of the Maumee River in northwestern Ohio, are considered components of the Williams Mortuary Complex. A minimum of 656 Terminal Archaic cremated and inhumed individuals were recovered from burial features at the Williams Cemetery. These individuals are interpreted as annual interments by small, localized to large, regional bands during regional trade fairs sponsored by local Big Men. Body processing is thought to have taken place at the Sidecut Crematory, characterized by cremated remains and artifacts in association with burned limestone crematory platforms. Many burial features at the Williams Cemetery are associated with both locally produced and exotic artifacts, interpreted as gifts removed from circulation and provided by Big Men. These gifts, then, indebted the deceased individuals' lineages to these Big Men, thus reproducing the system (Abel et al. 2001).

The widespread Terminal Archaic/Early Woodland Red Ochre/Glacial Kame culture exhibits elaborate mortuary ceremonialism. Dozens of mortuary sites in Wisconsin, Illinois, Indiana, Michigan, Ohio, Iowa, and Ontario have yielded burials associated with the diagnostic marine shell gorgets, Turkey-tail points, oversized bifaces, large caches of shorter bifaces, copper and marine shell beads, copper awls, copper knives and points, and copper celts characteristic of these groups (Cunningham 1948, Ritzenthaler and Quimby 1962). Included among these are several dozen burials associated with exotic grave goods, the use of red ochre, and burial in mounds at the Morton Mound Group in Fulton County, Illinois (Cole and Deuel 1937). Shamanistic practices and the presence of ritual specialists are suggested by the recovery of items like the wolf mask-headdress recovered from a Glacial Kame burial at the Williams site (Baby 1961), and the high degree of workmanship evident on Turkey-tail points suggests that some individuals, "adopted a cottage industry where expert craftsmen were free from subsistence tasks to devote large amounts of time to manufacturing fine Turkey-tail cache blades for trade" (Justice 2006:42). Evidence from the Lake Superior region indicates that an extensive and complex mining operation was in place to provide the raw material needed for the copper objects incorporated in this trade (Halsey 2008).

The most extensive trade network present in eastern North America during the Terminal Archaic period was the Poverty Point exchange system. According to Gibson (1990:284), Poverty Point exchange occurred within a short period of time around 1100 B.C. The Poverty Point site itself supported a large, relatively sedentary population that obtained chert and other raw materials from the interior via a complex network of down-the-line exchanges. Once materials entered the Poverty Point region, they were utilized by all members of the local community for a variety of mundane tasks (Gibson 1990, Gibson and Griffing 1990).

The magnitude of Poverty Point exchange is difficult to adequately describe. Stone and other materials were transported in bulk quantities and included local gravel cherts; novaculite, hematite, magnetite, crystal quartz, slate, calcite, hornblende-basalt porphyry, fluorite, and other minerals from the Ouachita Mountains in Arkansas; Burlington chert and galena from Missouri; galena from Iowa, Wisconsin, and Illinois; copper from the Great Lakes region; Mill Creek and Cobden/Dongola cherts and fluorite from the Shawnee Hills of southern Illinois; Wyandotte and Harrodsburg cherts from the Knobs region of Kentucky and southern Indiana; Flint Ridge Flint from Ohio; Dover, Fort Payne, Camden, and Pickwick cherts and phyllite and schist from the Tennessee River region; Tallahatta quartzite from along the Tennessee and Tombigbee River drainages; soapstone and greenstone from the piedmont of Alabama and Georgia; and obsidian from Wyoming (Gibson 2001). The presence of primary cortex on many of these materials indicates that raw stone was being imported to the site, not just finished tools (Carr and Stewart 2004). Such a large scale of accumulation of bulk materials led Jackson (1991) to suggest that Poverty Point was the site of intersocietal trade fairs and that the mounds were constructed to promote group cohesion during these fairs.

Jackson's (1991) hypothesis is challenged by Gibson (1999) on the basis that Poverty Point was a residential site and that the exotic materials found in the lower Mississippi River valley rarely left the region. Likewise, Gibson (1999) argues that exchange was not part of regional alliance building strategies, in that the logistical difficulties involved in giving aid to groups located as far away as the trade network stretched would have limited the function of such alliances. Rather, he argues that trade was conducted by taking advantage of canoe travel along the rivers of the interior

Midwest and Midsouth (Gibson 1999). Once goods reached the Poverty Point site, they were then redistributed by leaders and traders among outlying groups for utilitarian purposes on an as-needed basis (Gibson 1994b, 2001).

Some evidence for the existence of part-time craft specialists is present at Poverty Point sites. For instance, the Slate site, located in Humphreys County, Mississippi, yielded numerous beads, effigies, bannerstones and other objects related to the highly developed Poverty Point lapidary industry. Production of slate artifacts at the site is indicated by the range of items found in various stages of production. The lack of domestic refuse indicates that the site is a special purpose lapidary workshop site, and the fact that the raw materials used to manufacture these high-quality zoomorphic beads and other objects are from several regions as distant as Arkansas and Missouri illustrates the complexity of the Poverty Point bead manufacturing economy (Lehmann 1981). Additional evidence of Poverty Point craft specialization comes in the form of the Keenan bead cache, consisting of 469 jasper discoidal, tubular, and effigy beads in varying stages of manufacture from a field in Jefferson Davis County, Mississippi (Connaway 1981:57). This cache is interpreted by Connaway (1981) as a lapidary kit belonging to a single craftsman and deposited in a completely disintegrated burial or stored in a pit but never recovered.

Although the nature of Poverty Point exchange suggests that it was orchestrated by leaders of an otherwise egalitarian society (Gibson 2001), the sheer scale of the Poverty Point site and the kinds of organizational and engineering skills that would have been required to construct it provides evidence for some degree of complex social organization (Clark 2004). The design of the site is not as precise as some maps have suggested, however, as demonstrated by Kidder's (2002) recent maps of the site's earthworks and mounds.

In terms of the layout of the site, Poverty Point consists of a single large mound (Mound A) and six concentric earthen embankments divided by five cross-cutting corridors into six sectors, with Mound A at one end of the central corridor (Carr and Stewart 2004:129). Estimates of the volume of mound fill required to construct this massive site range from 667,000 to 750,000 cubic meters of fill, an amazing feat of construction considering the next largest mound site in the area (Watson Brake) consists of only 33,900 cubic meters of fill (Gibson 2004:265). In fact, Poverty Point is the second largest mound site in the eastern United States, with the largest being the Late Prehistoric Cahokia site (consisting of 1,007,190 cubic meters of fill). Poverty Point dwarfs the second largest Mississippian paramount chiefdom at Moundville (153,377 cubic meters) (Muller 1997:274). It is significant to note that this entire large Mississippian site, then, is smaller in terms of volume of fill than the single Mound A at Poverty Point (180,000 cubic meters), which is the second largest mound in North America (Gibson 1987:17).

If Poverty Point society was indeed egalitarian and the construction of the site not orchestrated by hierarchically ranked elites, then the reason for its construction remains to be determined. Gibson (1996) connects Poverty Point iconography with historical Southeastern mythologies to provide a direct historical analogy that identifies Poverty Point religion as animistic, communal, and shamanistic. According to Gibson (2004), like the Middle Archaic mounds that came before them, the mounds at Poverty Point were part of a communally constructed ritual landscape that was symbolic of a shared identity and ideology. As such, the mounds acted as protective forces that provided safeguards against the spiritual dangers of interacting with distant groups (Gibson 2001, 2004).

Unfortunately, very little is known about Poverty Point subsistence. Subsistence practices elsewhere during the Terminal Archaic and into the succeeding Early Woodland period represent a continuation of the earlier late Middle to Late Archaic hunting and gathering pattern, with the important addition of domestic garden crops in some regions. For instance, floral remains from the Riverton Culture Villier site consisted predominately of hickory nutshell, with no eastern domesticates present (Lannie 1979). Plant remains from the Riverton site itself, on the other hand, indicated a heavy reliance on nuts, particularly black walnuts, with large quantities of chenopodium seeds, a single domesticated sunflower seed, gourd and squash rind, and two marshelder kernels also present (Smith and Yarnell 2009, Yarnell 1976, 2004). Smith and Yarnell (2009) interpreted the Riverton assemblage as indicating the first evidence of a well established low-level food production complex in eastern North America.

Faunal remains from Riverton, Swan Island, and Robeson Hills indicate use of a wide range of species, including freshwater mussels, aquatic snails, white-tailed deer, raccoon, turkey, beaver, bullhead, and catfish (Parmalee 1969). Initial use of garden crops like chenopodium, little barley, maygrass, erect knotweed, sumpweed, squash, and barnyard grass is indicated at several Terminal Archaic sites in the American Bottom (Simon and Parker 2006).

Morphological changes in three species of seed crops indicate domestication of these species by 4000 to 3000 B.P.—sumpweed (*Iva annua*), sunflower (*Helianthus* *annuus*), and chenopodium (*Chenopodium berlandieri*). Bottle gourds and squashes were also likely cultigens at this time, as were a series of non-domesticated grains and seed crops (Smith 1987, Yarnell 1993). The use of both domesticated and non-domesticated plants as garden crops by 3000 B.P. is indicated by the recovery of caches of seed stock at sites like Marble Bluff in Searcy County, Arkansas. Here, five bags of seeds and a mixed bundle deposit were recovered in 1934. Contained within these bags were seeds of the following species: gourd/squash, thin-testa chenopodium, sumpweed, sunflower, and ragweed. These were AMS dated to cal. 1122-898, 1259-995, and 1301-1114 B.C. (2 sigma) (Fritz 1997:46).

Some of the best evidence for eastern domesticates comes from cave and rockshelter sites in Kentucky. Analysis of seeds from paleofeces and non-fecal samples from sites like Newt Kash Hollow Shelter, Cloudsplitter Rockshelter, Cold Oak Shelter, and Hooton Hollow Shelter in Menifee County, eastern Kentucky led to the discovery of domesticated chenopodium, sunflower, and sumpweed dating to as early as 3400 B.P. (Gremillion 1995, 1996, 1997; Smith and Cowan 1987:355). Terminal Archaic dates from Cold Oak Shelter and Hooton Hollow cluster around 3000 B.P., indicating that Terminal Archaic groups were growing quantities of garden crops by this time (Gremillion 1995, 1996, 1997). Gremillion (1996, 2004) suggests this process was related to a risk reduction strategy and that seed crops were being stored in the shelters in the event that the more productive fall nut harvests failed. The increased frequency of domesticates in Early Woodland contexts at Cold Oak suggests a greater emphasis on food production at this time (Gremillion 1997), a trend confirmed by the recovery of large quantities Eastern Agricultural Complex seeds in Early Woodland paleofecal samples from Salts and Mammoth Caves to the west (Gardner 1987, Gremillion and Sobolik 1996, Yarnell 1974).

Thus far, this chapter has illustrated the nature of social, political, and economic changes in eastern North American prehistory as they are currently understood in the literature from this region. In general, the changes identified herein from the small-scale generalized foragers of the Paleoindian period to the logistically organized mound builders of the Terminal Archaic have been interpreted as evidence for increasing complexity among these groups. That is to say, through time groups in eastern North America apparently were becoming more politically differentiated, forming localized regional tribal-like social formations, while at the same time they were becoming more integrated at the extra-regional scale, participating in increasingly more complex and widespread exchange networks and ritual systems. Unfortunately, testing of this complexity hypothesis cannot be adequately performed at the scale of a single site or region. As such, what follows is a discussion of the specific microscalar aspects of complexity that are addressed by this research to test the relative complexity of the Middle Archaic Baker and Late Archaic Chiggerville sites. Having evaluated the relative complexity of these sites using the criteria outlined below, at the end of this dissertation I return to these larger scale patterns to discuss the position of Baker and Chiggerville in the larger scope of eastern North American social, political, and economic developments.

Addressing Microscalar Aspects of Complexity at Baker and Chiggerville

Evaluation of the relative complexity of technological organization at Baker and Chiggerville is based primarily on a detailed study of chipped stone tools and production debitage from these sites, supplemented by the study of stages of bone tool production. The existing literature on the organization of lithic tool production typically interprets more complex stone tool technologies as being characterized by evidence for curation, multifunctionality, and scheduling activities that facilitate the use of high quality lithic resources from select sources. However, technological organization is also affected by mobility, with increased complexity typically being associated with the advent of logistically organized settlement systems and decreased mobility. The latter may lead to an increased diversity in tool forms, stockpiling of raw materials, an increased use of expedient core technologies, and a maximization of raw material utility through the adoption of bipolar or blade core technologies.

The relative degree of curation at Baker and Chiggerville is addressed through 1) an analysis of the extent to which bone tools were reshaped and recycled into different tool forms and 2) through a detailed metric analysis of biface blade shapes and sizes relative to hafting characteristics. The diversity of tool forms is addressed through a typological analysis of stone tool morphological characteristics. Stockpiling and core reduction technologies are evaluated through a combination of metric and typological studies of cores and debitage from these sites that are designed to determine the kinds of core reduction present and the degree to which these reduction strategies represent raw material conservation indicative of differing mobility strategies. The site whose stone and bone tools are characterized by the greatest degree of curation and with the greatest number of indicators of decreased mobility is considered to be the most ‘complex’.

Evaluation of the complexity of subsistence organization is based on a typological analysis of morphological variability in groundstone plant processing tools. The relative complexity of Baker and Chiggerville is addressed through comparison of the size and diversity of plant processing assemblages. The site with the greatest diversity of plant processing equipment and the best evidence for increased labor input in the manufacture of plant and animal production and processing tools is considered the most complex.

Specialization is addressed through a detailed metric and non-metric analysis of chipped stone tools from Baker and Chiggerville. Specialization in the production of utilitarian tools among hunter-gatherers differs from specialization found in more complex chiefdom and state-level societies in that specialization is part-time and based upon skill and differing interests. Nevertheless, the production of chipped stone tools by a select portion of the population may indicate the existence of logistical task groups whose duties include the direct procurement of toolstone and is likely to lead to economic inter-dependencies not found among immediate-return hunter-gatherers who produce all of their own equipment.

Potential evidence for specialization in the production of chipped stone tools includes 1) greater numbers of steps in production, 2) a spatial or temporal separation of production stages, 3) increased storage of production stages, 4) uniformity in the products and by-products of tool manufacture, 5) increased distances to raw materials (controlling for band ranges), 6) increased time spent in production, and 7) an increased number of items produced. Analysis of specialization at Baker and Chiggerville includes 1) non-metric evaluation of flaking techniques in an attempt to discern whether a tool was knapped by more than one individual (i.e., producer and consumer), 2) debitage analysis to determine whether completed bifaces were being brought to and curated at these sites, 3) raw materials analysis to determine distance to source locations, and 4) technological analysis to determine the degree to which the chipped stone assemblages were based on the production and use of formal versus expedient or opportunistic tools. The site with the greatest number of these indicators of specialization is considered the most complex.

Evaluation of the complexity of leadership at these sites is based upon an analysis of mortuary behaviors. Evidence for the presence of special status positions is addressed through an evaluation of differential treatment of individuals in burials and the burial of individuals with items that might be part of ritually or socially meaningful paraphernalia. This involves a typological analysis of marine shell and other burial associations and a detailed study of intra-site distributions of individuals. Comparison is then made between Baker and Chiggerville and other Middle to Late Archaic sites in the Midwest and Midsouth. Evidence for special status positions, control of esoteric knowledge in the form of differential access to ritual items or items from distant sources, or differential labor investment in burial (e.g., body processing, construction of mounds, etc.) are considered evidence for complexity. The site with the greatest number and/or degree of these material correlates is considered the most complex.

Communication networks and exchange are evaluated by placing the Baker and Chiggerville artifact assemblages within a regional framework of interaction and trade. The extent and success of communication networks largely depends on the effectiveness of communicated messages, indicating that participation in networks of information flow will be marked by the presence of social identity markers like highly decorated and visually appealing material objects. Widespread similarities in artifact manufacturing techniques provide an additional line of evidence suggesting interregional interaction and communication. The primary indicator of exchange used in this study is raw material type. Evaluation of the degree to which inter-regional communication and exchange are evident at these sites includes 1) the degree to which objects are decorated and the forms those decorations take, indicating different kinds of stylistic messaging; 2) similarities in artifact forms and manufacturing techniques over regions; 3) raw materials analysis of all objects from these sites; 4) analysis of excavation photographs and other documents to assess the quantity of exchanged items present (e.g., shell beads are assessed as numbers of necklaces or bracelets rather than numbers of beads); and 5) evaluation of the role of exchange in the Green River region and at Baker and Chiggerville more generally through a comparison of the types and numbers of exotic goods at these sites relative to other excavated sites described in the literature. The site with evidence for the greatest diversity of items exchanged from the greatest number of sources and in the largest quantities is considered the most complex.

Chapter Four

The Baker Site

The Baker site is a Middle Archaic dirt/rock and shell midden located just north of Andrew's Run approximately 2 miles northwest of the town of Rochester and about 3 ½ river miles upstream from Indian Knoll. The site was originally surveyed on January 16th 1938, at which time disturbance in the form of pits dug to obtain shells for chicken feed were noted (Figure 4-1). The original dimensions of the site were recorded as 130 x 50 to 60 feet (Stout 1938c). Although owned by the Wickliffe Coal Company of Greenville, the site was named the Baker site after Mr. Harry Baker, who owned the adjacent property (Stout 1938a). The name Andrew's Run has also been applied to the site.

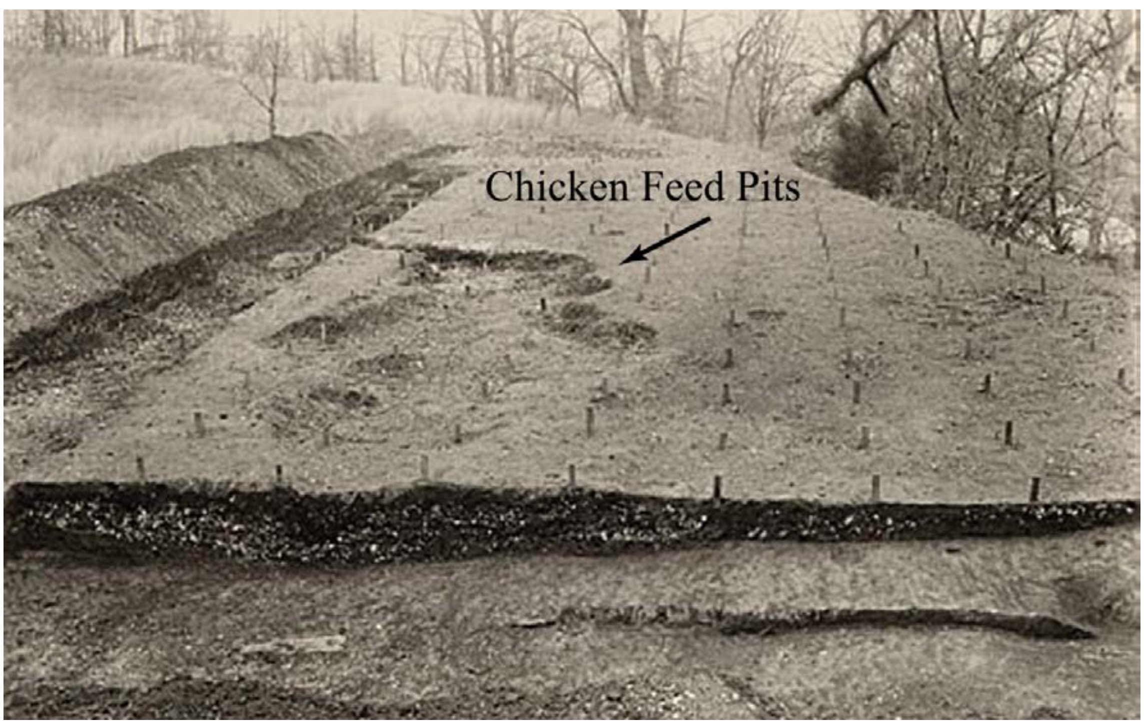


Figure 4-1. Chicken Feed Pits behind the 45 Foot Profile. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

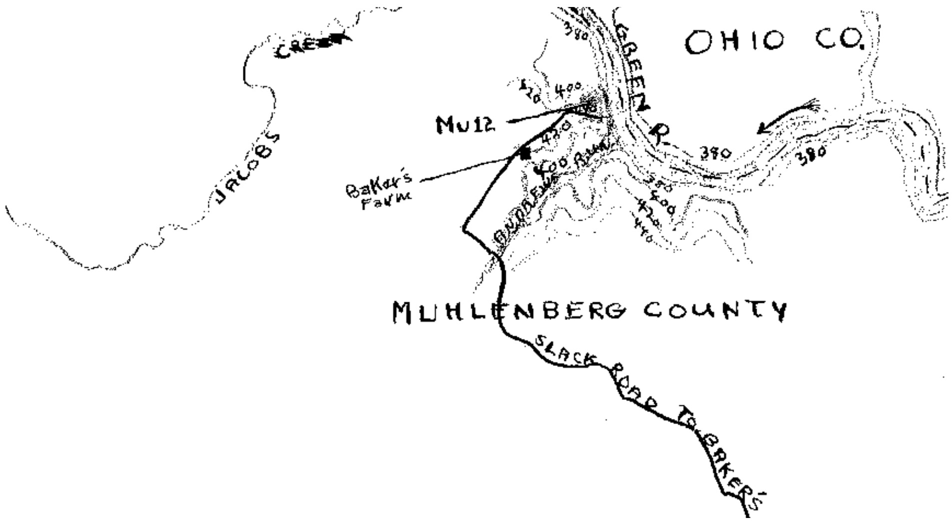


Figure 4-2. Map of Baker Site Location Provided by WPA.

Figure 4-3. Location of the Baker Site (Mu-12) as depicted on the OSA Site Form. The site has been circled in the center of the figure. Scale is 1:24000.

Figure 4-4. Satellite Image depicting Location of Chiggerville and Baker Sites.

As originally recorded, Baker sits on a bluff of the west bank of the Green River at an elevation of 430 +/- 5 feet (Figure 4-2). This location is confirmed by the map included with the original site form and positions the site across the river and immediately downstream from the Chiggerville shell midden. However, revisitation of the site by Kentucky Heritage Commission personnel in April 1979 led to the repositioning of the site approximately 50 m west of Andrew's Run (Figure 4-3). Survey notes from this visitation indicate that the site had been nearly totally destroyed by 'mining' for agricultural purposes. According to these notes, "The site was not destroyed by strip mining or 'pot hunting'. The current distribution of shell is approximately 100 meters east to west and 60 meters north to south. The entire center of this area has been excavated to a depth of about 10 feet, and the spoil dirt piled up around the periphery for an additional 10 feet, creating a ‘crater’ effect for the site” (Sanders 1979). These are the exact conditions observed by the author, but this destruction is located considerably farther west of Andrew’s Run in the location noted on the original 1938 survey map. According to notes provided by Sanders (1979) in the updated site form, KHC personnel were aware of the discrepancy between the location reported by the WPA and the site location recorded during their survey, but the source of the discrepancy is unknown.

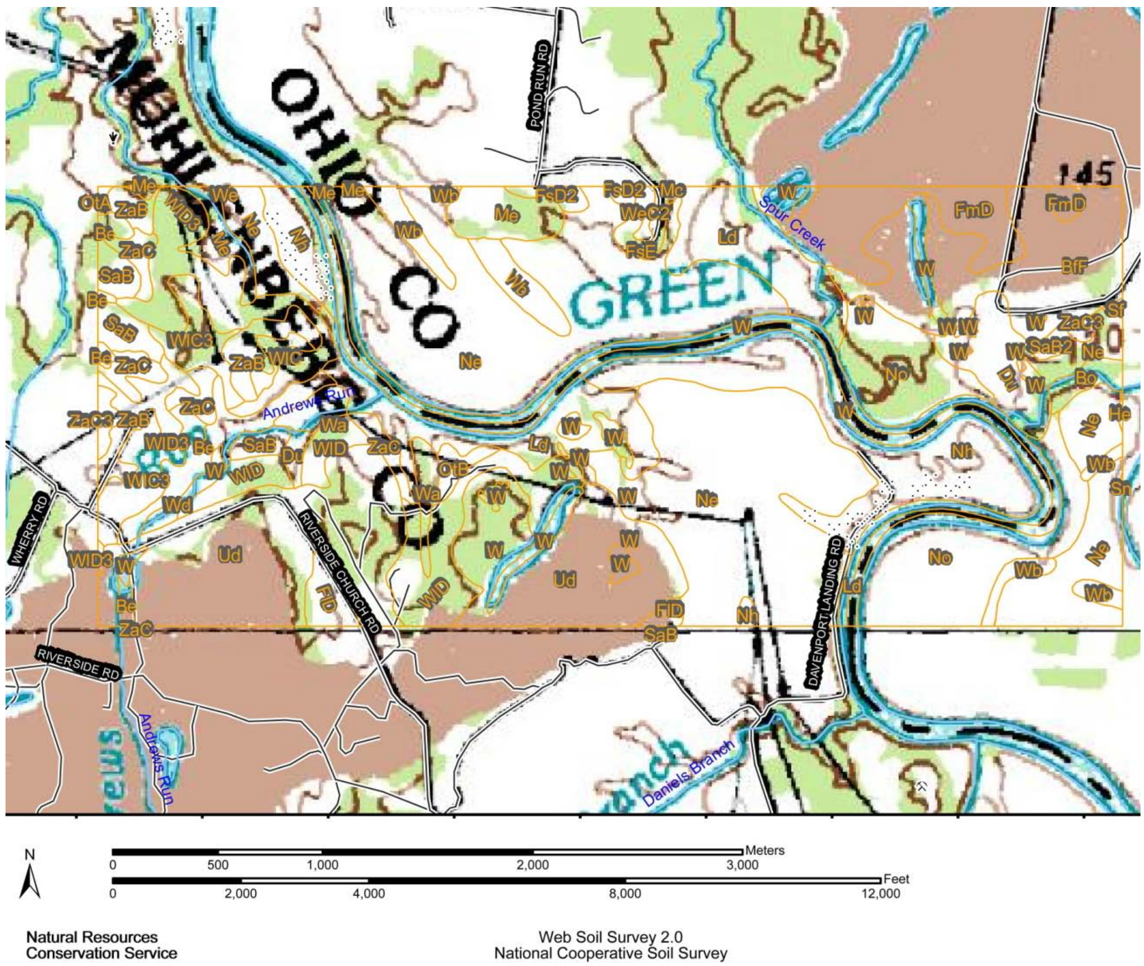


Figure 4-5. Soil Survey Map for Chiggerville and Baker.

Based on the author’s most recent survey and excavations at Baker, the original WPA location is now confirmed as the correct location for the site (Figure 4-4). This location is just downstream from the Chiggerville site and adjacent to an area of stable mussel shoals identified by Morey et al. (2002) on pre-impoundment (1829) Green River survey maps and known as Andrew's Run (which is also the name of a stream that flows into the Green between Baker and Chiggerville). The soils at the Baker site consist of Wellston silt loam, 6 to 12 percent slopes (WIC) and Wellston silt loam, 12 to 30 percent slopes, severely eroded (WID3) (Figure 4-5). These soils developed from thin fine-silty noncalcareous loess over loamy residuum weathered from the local sandstone and consist of 0 to 52 inches of silt loam and/or loam over unweathered bedrock (Soil Survey Staff 2007).

History of Investigations

The Baker site was first excavated by Works Progress Administration personnel from February to March 1938. Approximately 4300 sq. ft of the site was excavated at this time (Rolingson 1967), resulting in the recovery of several hundred artifacts, four human burials, three dog burials, and an unrecorded number of cultural features (Moore and Crothers 2010, Stout 1938a). More detailed discussion of these excavations is provided below.

Unfortunately, the artifacts from Baker were never analyzed by Works Progress Administration personnel and William S. Webb never wrote a report concerning the excavations. It was not until Martha Rolingson's (1967) dissertation that any information about Baker was published, and a full report of the site was not completed until David McBride's (2000) master's thesis. No additional visitations were made to the site by professional archaeologists until the 1979 KHC survey discussed above, and by this time much of the site had been destroyed. A small assemblage of artifacts was collected at this time, including 9 diagnostic Middle Archaic Godar/Raddatz projectile points and hafted scrapers. These artifacts are curated at the WSW Museum of Anthropology in Lexington (Sanders 1979).

WPA Excavations at Baker

Initial excavations at Baker consisted of digging a series of test pits around the margins of the site to delineate boundaries since it was not in cultivation at the time of excavation. After the edges of the site were identified in this manner, the site was gridded in 5 foot intervals and elevations were collected at each of these grid stakes. To maximize effort, two trenches were begun, one at the 20 foot line at the south edge of the site and one running along the L7 line at the western edge of the site. Both trenches were dug simultaneously, and all shell midden, save “a very small portion” remaining to the south and west of these initial trenches, was excavated (Stout 1938a:5). Artifacts were recovered by 5 x 5 foot units and 1 foot vertical levels (Stout 1938a:). A map depicting the extent of the shell midden, locations of burials and features, and the WPA grid system is provided in Figure 4-6.

Site stratigraphy differed from the south to the north end of the site. The southernmost (25 foot) profile (Figure 4-7) depicts the westernmost edge of the shell midden, which begins at about the L3 line. Overlying this shell midden is a zone of ‘plowed and washed heap’ that likely represents both plow-disturbed shell midden and shell free dirt/rock midden, given that this zone dips to the west away from the shell. Below both of these strata lies undisturbed subsoil. At the L5 line east for about 4 feet, this dirt/rock midden is overlain by ‘washed surface soil from uphill’ that likely represents recent colluvium. This mixed plowzone and dirt/rock midden can be seen overlying the deeper shell midden in the western portion of the 40 foot profile, provided in Figure 4-8.

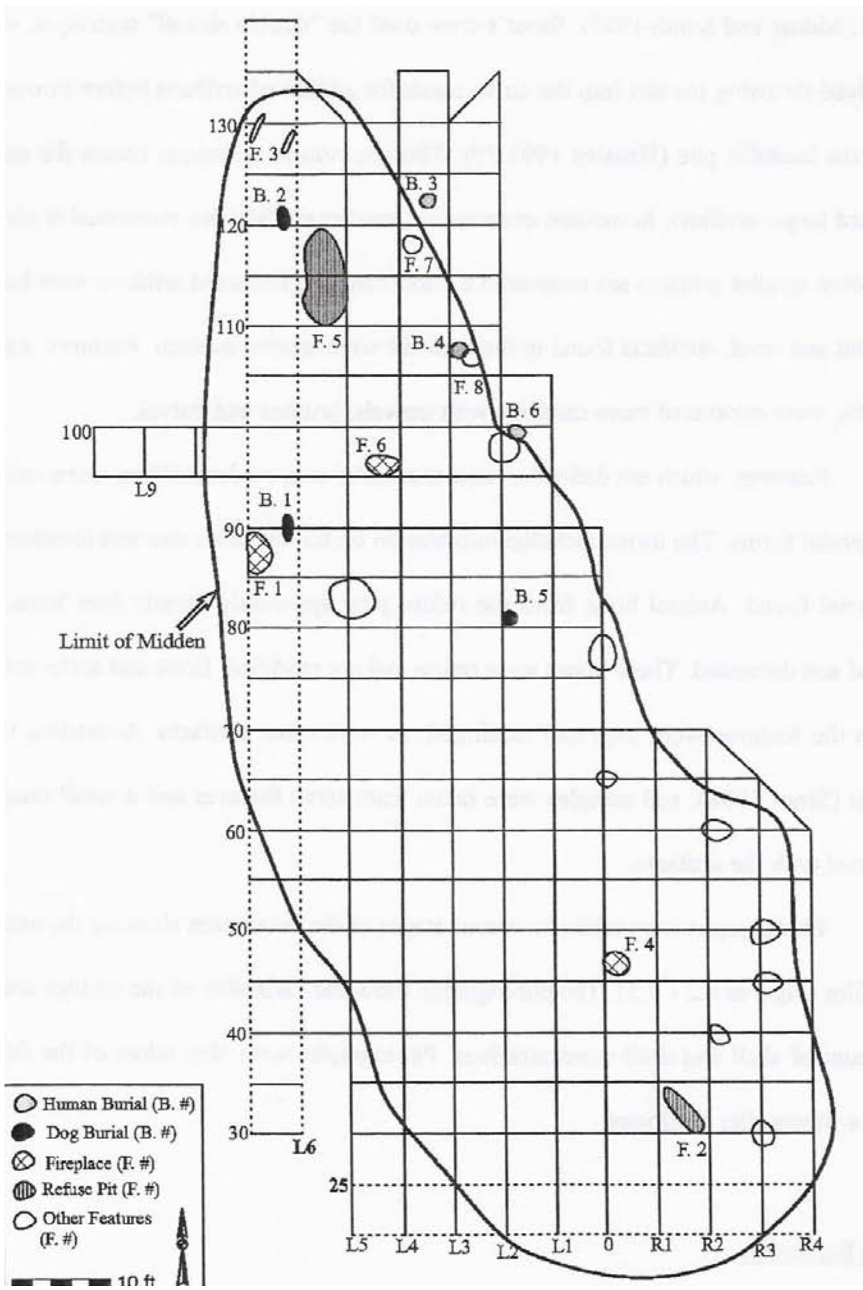


Figure 4-6. Map of Baker Excavation Trenches and Features. From McBride (2000:Figure 4.1), used with permission of the author.

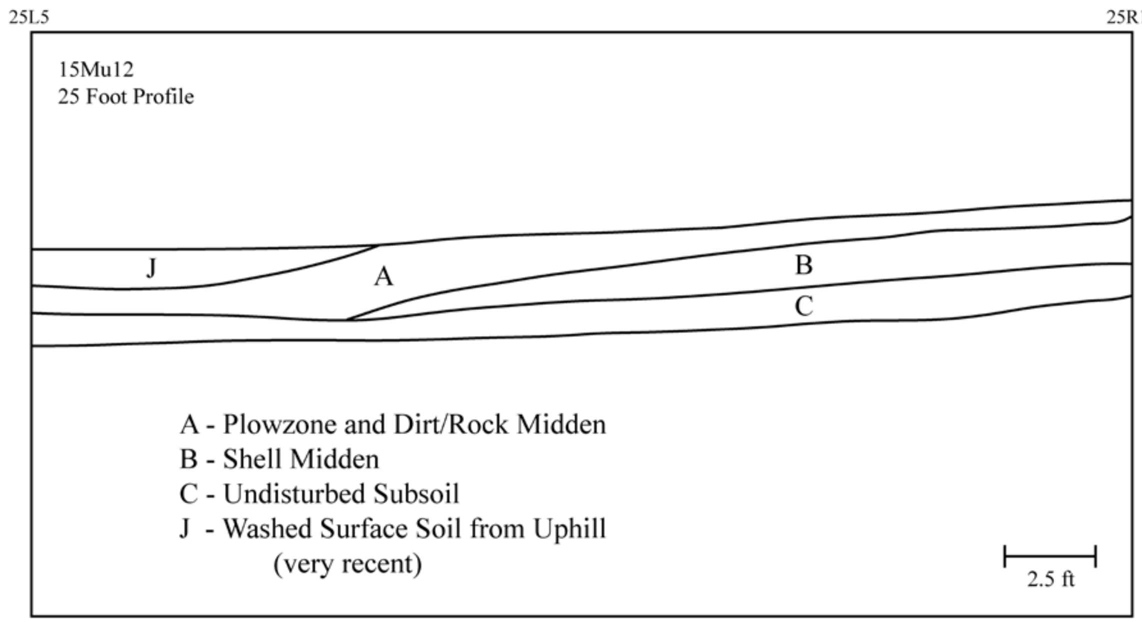


Figure 4-7. The 25 Foot Profile at Baker from 25L5 to 25R1. Redrawn from original WPA profile.

Figure 4-8. Dirt/Rock Midden over Shell Midden in Western Portion of the Site at the 40 Foot Profile. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

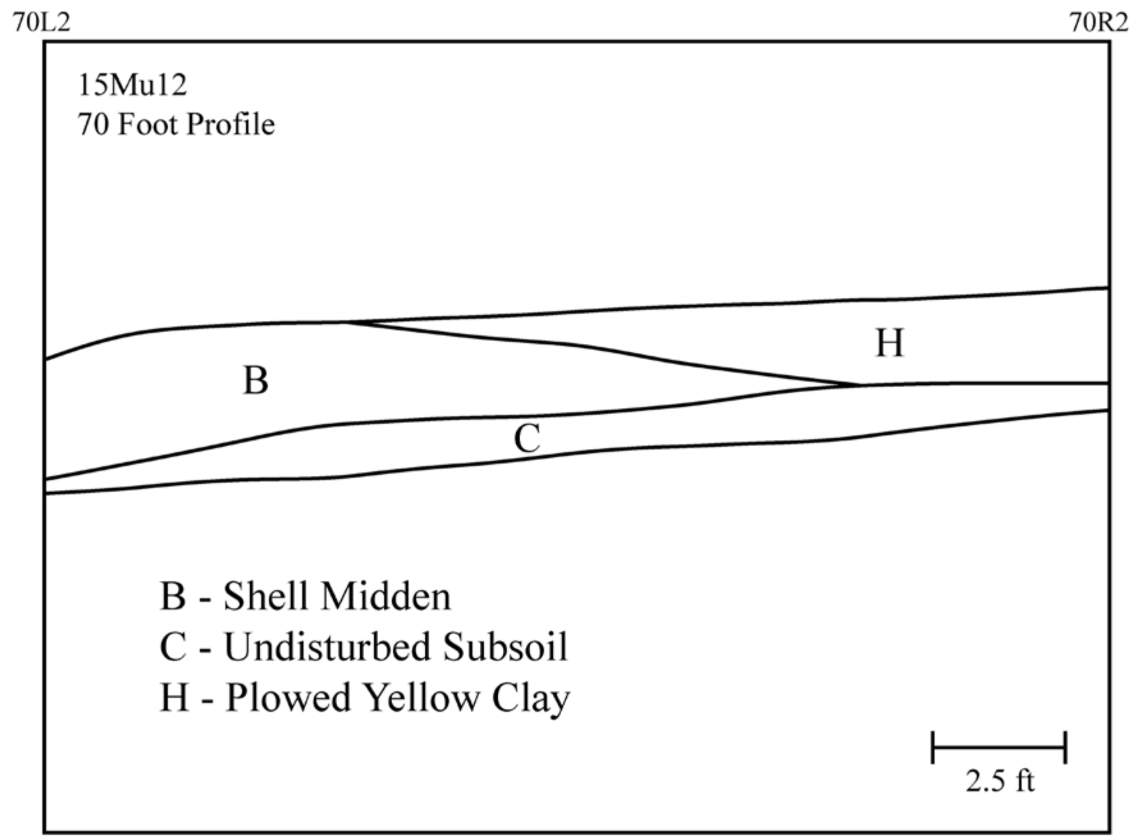


Figure 4-9. The 70 Foot Profile at Baker from 70L2 to 70R2. Redrawn from original WPA profiles.

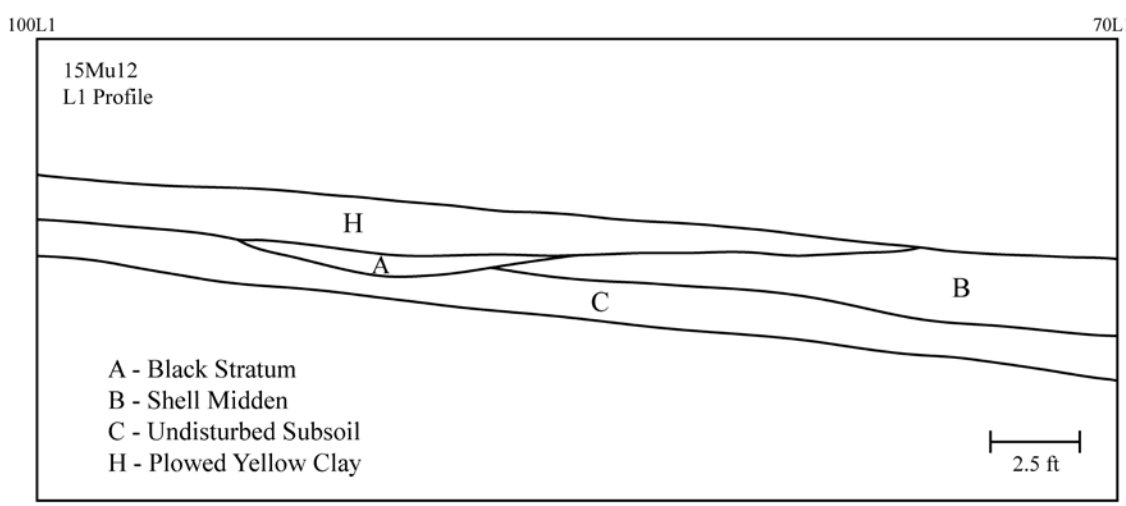


Figure 4-10. The L1 Profile at Baker from 100L1 to 70L1. Redrawn from original WPA profiles.

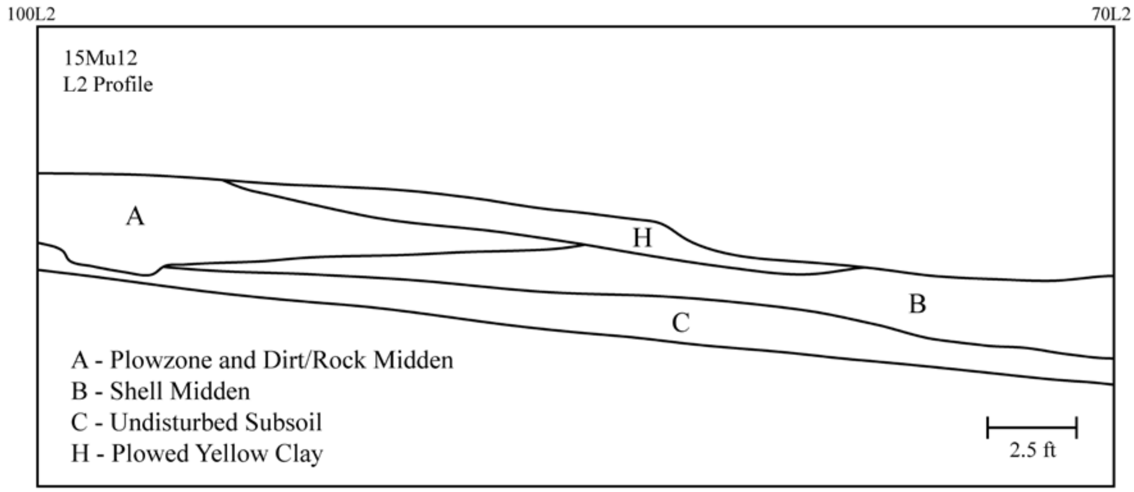


Figure 4-11. The L2 Profile at Baker from 100L2 to 70L2. Redrawn from original WPA profiles.

The shell midden at the Baker site ran upslope roughly parallel to the bluff in a NNW-SSE direction (Stout 1938a). At approximately the 60 foot profile line, the shell turned sharply to the west, leaving a zone of ‘plowed and washed yellow clay’ over the subsoil from where the shell midden pinches out to the bluff’s edge (Figure 4-9). The northeastern edge of the site along the L1 profile is depicted in Figure 4-10, which also depicts a lens of ‘black soil’ grading from the shell midden to the north under the presumably culturally sterile yellow clay stratum.

In the L2 Profile (Figures 4-11 and 4-12), this zone of yellow clay overlies both the shell midden and the zone of ‘plowed and washed heap’, which represents intact dirt/rock midden to the north of the shell. This stratigraphic relationship confirms that the yellow clay was deposited after the cultural zones at the site and supports Stout’s (1938a) interpretation of the material as “a wash of soil from farther uphill.” The dirt/rock midden was interpreted by Stout (1938a) as shell midden from which all shell had been weathered by plowing and percolation of water. However, it is clear from the WPA profile drawings and field photographs that this midden is intact dirt/rock midden that never contained shell. Given that the shell midden is found primarily along the southern slope of the site and the dirt/rock midden on the higher, more level ground, it seems reasonable to conclude that the dirt/rock midden represents the site's main habitation area, while the shell midden is a refuse dump and burial area. This same conclusion has been drawn from Moore and Leger's (2009) analysis of the dirt/rock and shell midden areas at the penecontemporaneous Jackson Bluff site in Ohio County, Kentucky. Unfortunately, this presumed habitation area was considered of little interest by Stout, who excavated both sites, and only small portions of this area were excavated at either site.

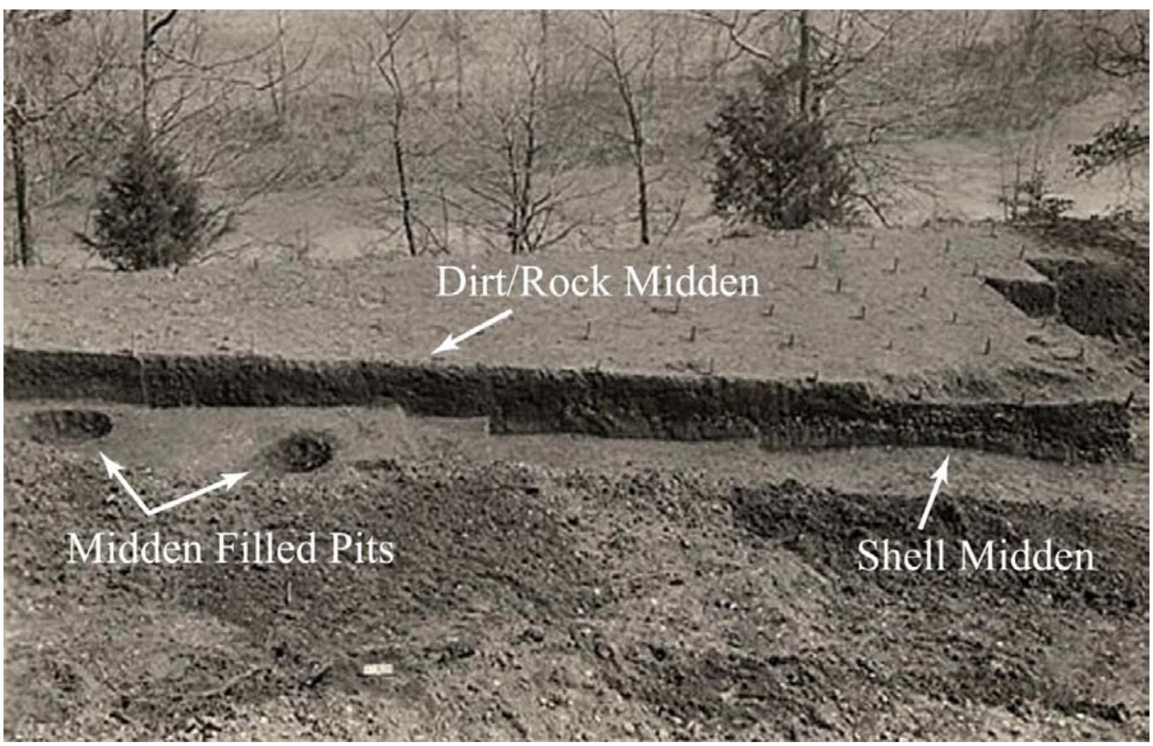


Figure 4-12. Midden Filled Pits and Dirt/Rock Midden at the North End of the Site in the L2 Profile. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Figure 4-13. Midden Filled Pit in the 30 Foot Profile. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

In addition to the four human and three dog burials (including one human burial designated Feature No. 7 by the WPA) described in chapter 8, eight cultural features and several 'midden pits' were identified at Baker. Not all midden pits were mapped and none were designated as separate features because they "were not important enough – because of their indefinite quality and smallness" (Stout 1938a). David McBride's (2000) map of the site depicts many of these pits as discussed in the field notes and illustrated on the field map (Figure 4-6). A profile of one of the midden pits can been seen in the 30 foot profile (Figure 4-13).

One of the midden pits recorded at Baker was deep and the others were shallow, although the difference between the shallow and deep pits in terms of size is not explicitly stated in the field notes. All pits contained shells, debitage, bone and chipped stone artifacts, and animal bones identical to those found in the general midden deposits. Some of these 'pits' may have been depressions in the original ground surface, while others were obviously dug into the subsoil, likely "for purposes of disposal of refuse" (Stout 1938a). Although Stout (1938a) considers these pits to represent the first occupation of the site since there was no "evidence whatever that they were dug down from the present surface or from an old surface within the heap," a similar pit was identified during the author's excavations that did extend into the midden proper. The edges of this latter pit (described below) were difficult to discern in the field, suggesting that some or all of the pits noted by the WPA could have also originated in the upper portions of the midden but were not identified until subsoil was reached.

Figure 4-14. Plan Views of Feature Nos. 4 and 6. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

All features recorded at the site, including the midden pits and those features provided feature numbers, can be associated with refuse deposal activities, with the possible exception of Feature No. 3. Feature Nos. 1, 4, and 6 were classified as 'fireplaces' due to the association of burned soil, burned shells, charcoal, fire-cracked rock (FCR), and fired clay. It is possible these features are hearths, but the field notes fail to note whether the burned soil represents *in situ* burning. Field photographs taken of

Feature Nos. 4 and 6 suggest that they are dumps from cleaning out hearths or cooking pits (Figure 4-14).

Feature Nos. 2 and 5 consist of scattered concentrations of animal bones located immediately below the shell midden on the surface of the subsoil and within the shell midden proper, respectively. These are interpreted by the author as dump episodes rather than *in situ* activity areas. Feature Nos. 7 and 8 are pits associated with human burials that are described in chapter 8.

Feature No. 3 is a unique feature consisting of two upright sandstone slabs with dark sediment and animal bones filling the area between them. This feature rests on the shell midden and is located at the northern edge of the shell near the interface with the dirt/rock midden (Figure 4-6). It is possible that these slabs represent an activity area of unknown purpose, or they may have rested at the bottom of a pit of unknown function. According to the field excavation form for this feature:

> Careful search was made to discover evidence of intrusive pit here [sic]. None was found except the dark soil between the slabs. Yet this feature is out of character with the rest of the site that it may be intrusive [sic]" (Stout 1938a).

Additional descriptions of the individual features can be found in McBride (2000).

A total of 1582 artifacts was recovered by the WPA at the Baker site, of which 1533 were available for analysis at the time of this study. These objects are listed by material type in Table 4-1. Bone and antler implements are described in chapter 6, chipped stone and groundstone implements are described in chapter 7, and the one copper pin from Baker is described in chapter 8. In addition to these objects, 14 freshwater bivalve shells were recovered from Feature Nos. 4 (n = 6) and 6 (n = 7) and from the plowzone of unit 50L2 (n = 1). The only ceramic object in the site collection is a single pottery trowel that is described as having been found on the surface near the site. This object originates either from an ephemeral Late Prehistoric component at Baker or from an unidentified Late Prehistoric site nearby.

Table 4-1. WPA Artifacts from Baker Classified by Material Type.

<table>
<tr><th></th><th>Analyzed</th><th>Missing</th></tr>
<tr><td>Antler</td><td>180</td><td rowspan="2">21</td></tr>
<tr><td>Bone</td><td>363</td></tr>
<tr><td>Chipped Stone</td><td>905</td><td>13</td></tr>
<tr><td>Groundstone</td><td>80</td><td>4</td></tr>
<tr><td>Copper</td><td>1</td><td>0</td></tr>
<tr><td>Shell</td><td>14</td><td>0</td></tr>
<tr><td>Ceramics</td><td>1</td><td>0</td></tr>
</table>

A total of 211 of the 905 analyzed chipped stone objects from Baker were diagnostic hafted bifaces. Of these, 178 were assigned to the Middle Archaic Large Side Notched Cluster and most were classified as Godar/Raddatz projectile points or hafted scrapers (Table 4-2). As can be seen from Figure 4-15, the Baker assemblage consists primarily of Middle Archaic point forms, with a minor Early Archaic presence also noted. Based on these data and the distribution of Large Side Notched cluster points across the entire site (Figure 4-16) and at all depths (Table 4-2), it can be reasonably concluded that most of the dirt/rock and shell midden at the Baker site dates to the Middle Archaic period. The small sample of diagnostic points dating to other time periods precludes any meaningful interpretations of similar distribution maps. No localized concentrations of other temporal components can be identified by plotting these points.

Table 4-2. Projectile Points by Cluster and Depth from the Baker WPA Collection.

Cluster	Level				
	0-1 foot	1-2 foot	2-3 foot	3-4 foot	Unknown
Benton	1	0	0	0	0
Clovis	1	0	0	0	0
Kirk	9	4	0	0	0
Kirk Stemmed	1	1	0	0	0
Large Side Notched	127	31	9	1	10
Late Archaic Stemmed	4	0	0	0	0
Matanzas	0	1	0	0	0
Saratoga	2	0	0	0	0
Snyders	1	0	0	0	0
Susquehanna	1	0	0	0	0
Thebes	6	0	0	0	0
Turkey-tail	1	0	0	0	0
Total	159	37	9	1	10

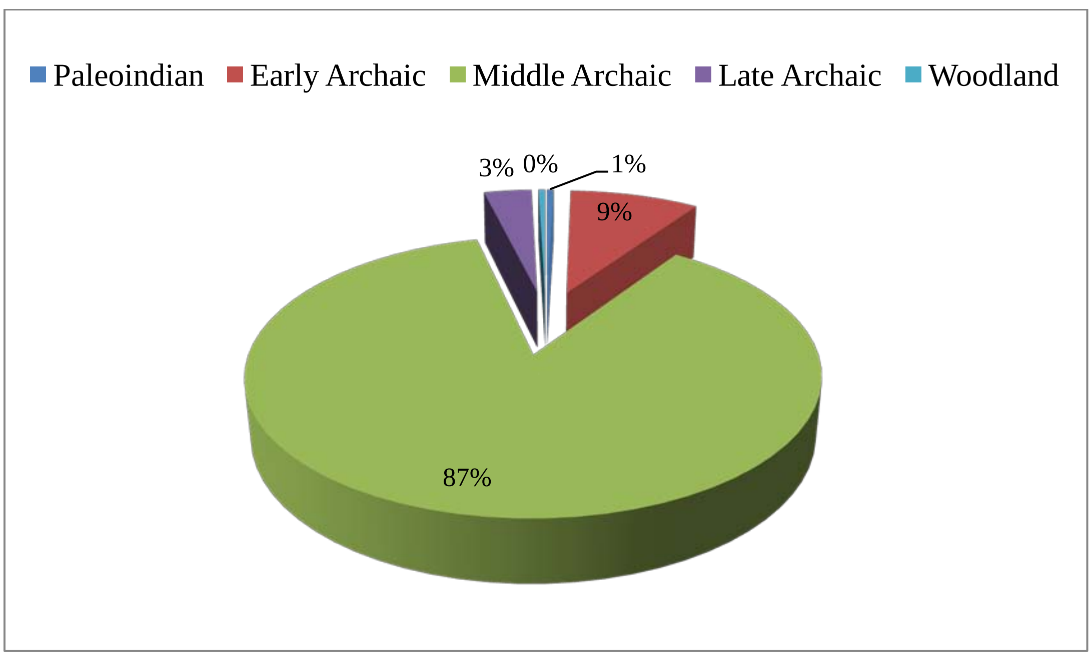


Figure 4-15. Diagnostic Projectile Points from Baker by Time Period.

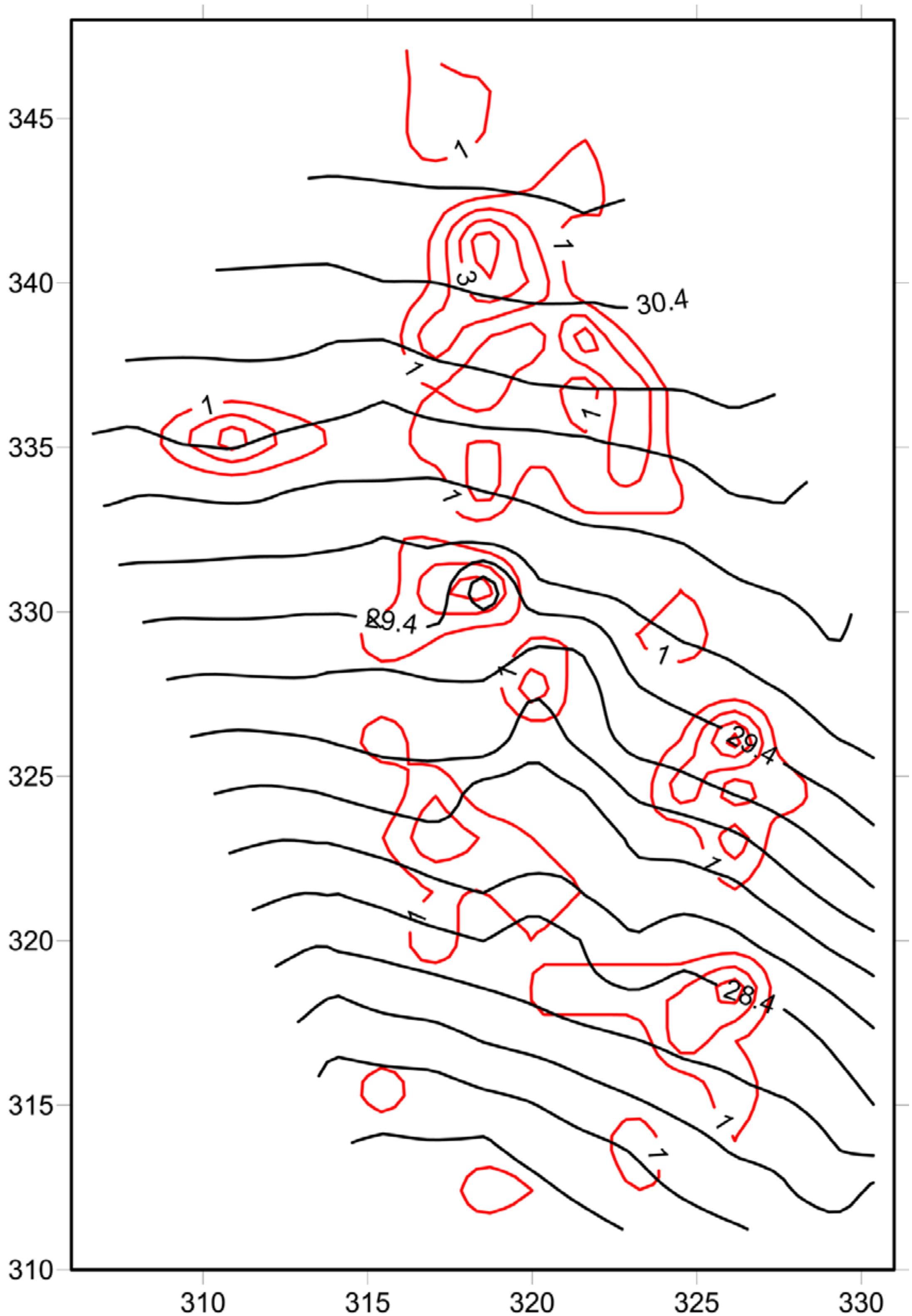


Figure 4-16. Distribution of Large Side Notched Cluster Points at Baker. Topographic map is derived from WPA survey data. Units are in feet.

The 2009 Excavations at Baker

The author's first visit to Baker was made on April 11 and 12, 2008. George Crothers and two undergraduate students from the University of Kentucky comprised the field crew for this trip to the site, which was made as a substitute for conducting geophysical work at Chiggerville. The latter work was prevented by flooding of the Green River.

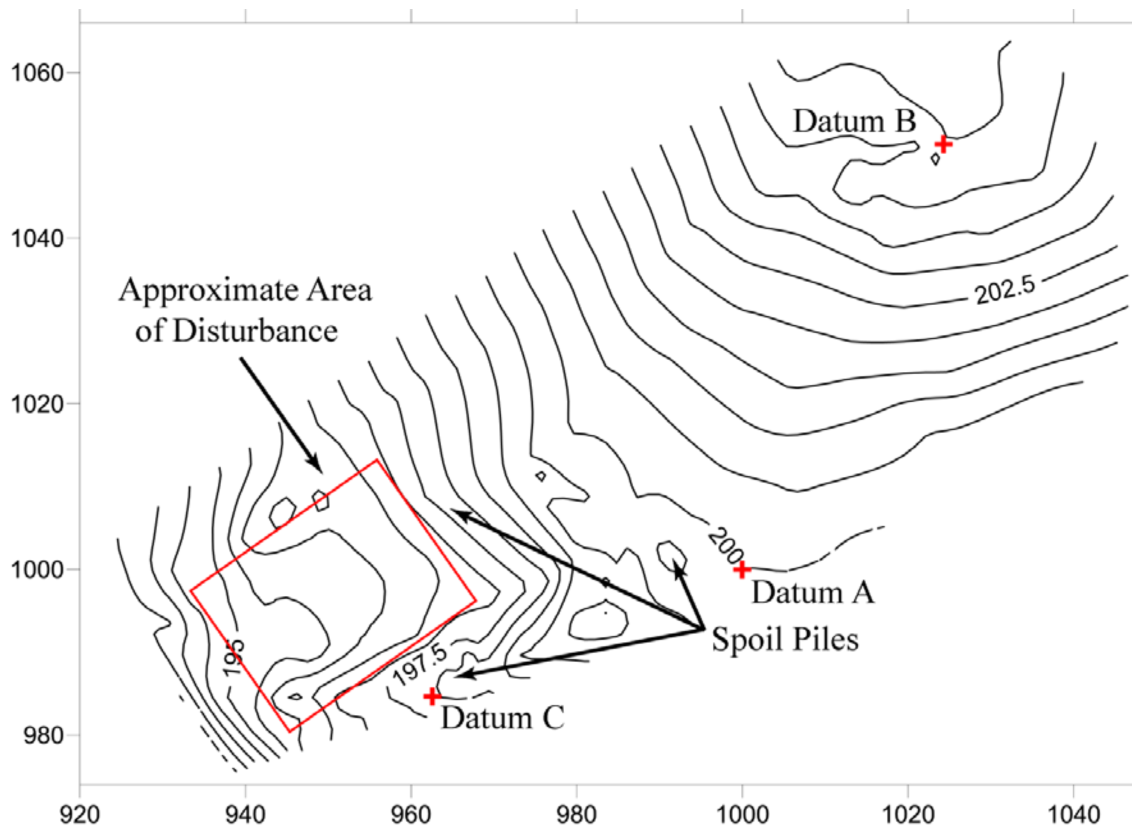


Figure 4-17. Topographic Map of Baker with the 2008-09 Datums and Site Disturbance Areas Identified. Magnetic North is to the right. Units are in meters.

Upon reaching Baker, a datum (Datum A) was set immediately north of what was thought to be the northern site boundary and just southeast of Site 15Mu81. The latter site is a multicomponent prehistoric and historic site located near a road cut on a flat portion of the highest elevation on the Baker site bluff. Visual survey at Site 15Mu81resulted in the identification of a small depression that may be a well, two flakes, flat glass, bottle glass, whiteware, and ironstone fragments, none of which were collected.

Initial visual survey at Baker indicated that the site had been heavily disturbed by both looting and some kind of major earth moving operations, which had been previously identified by KHC personnel (Figure 4-17). The disturbed area removed much of what was once the central portion of the site's shell midden. Around this disturbance were screens, beer cans, and a plastic chair, suggesting that illegal digging had been recently conducted at the site. Eric Williams, a Wildlife Officer for the Peabody Wildlife Management Area, confirmed that the most recent digging had occurred after the Peabody security gates had been closed for the summer about a year and a half prior to our visit. Fortunately, this most recent looting episode had been restricted to previously disturbed midden that had been piled from the central portion of the site into a series of spoil piles around the periphery of the disturbance (Figure 4-17).

Although Sanders (1979) clearly states that the major disturbance at the site was related to agricultural activities and not mining, observations made during this most recent work at Baker suggest otherwise. The damage to the site covers most of the slope from the most level portions of the site to a small ravine located just south of the site's southern boundary. Leading from this disturbance to a location on the river bank that has been artificially sloped, likely for use as a boat or barge landing area, is a small rutted road that crosses a portion of the ravine that has been filled to facilitate passage of heavy equipment. Along with the disturbance itself, a large cable and a portion of a tire from a piece of heavy machinery was found in the flattened area created by the digging. Finally, a coal seam can still be observed in the bluff face running under the site. Taken together, the most logical conclusion is that the site was bulldozed to expose and excavate this coal seam, the coal being removed along the dirt road that leads away from the seam.

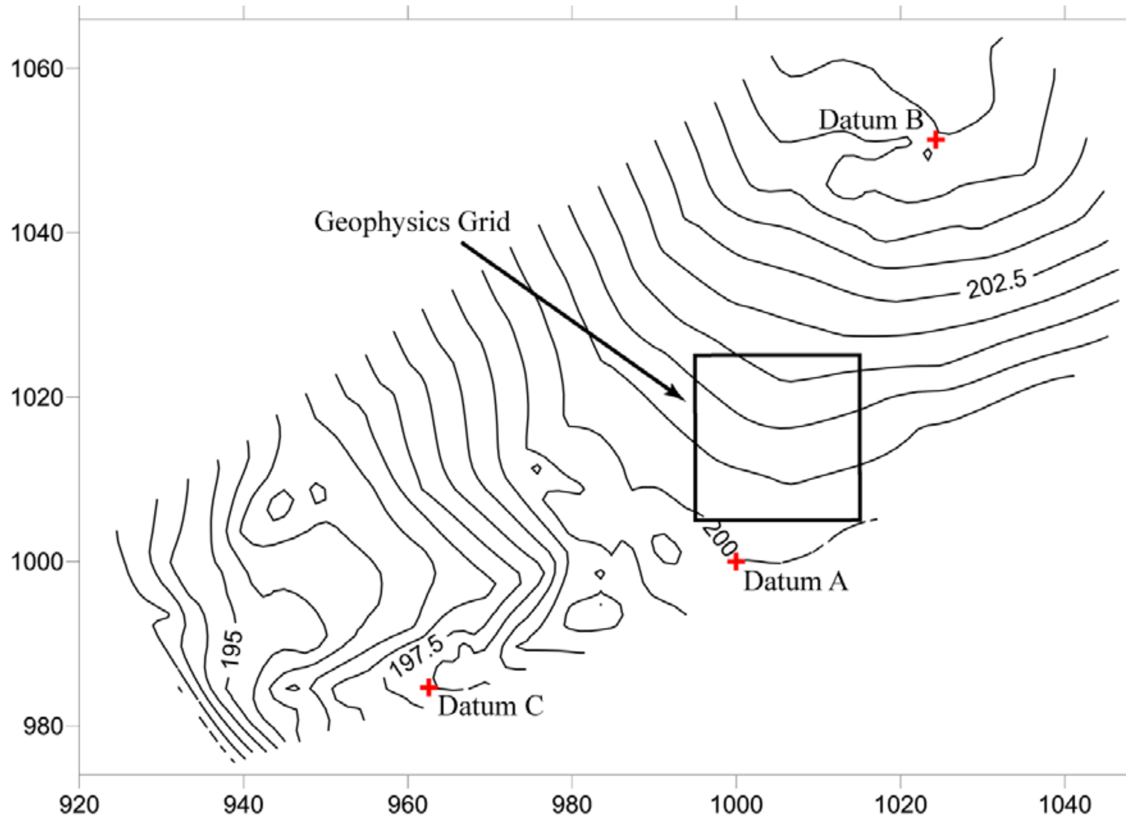


Figure 4-18. Location of the Resistivity Grid at Baker. Magnetic North is to the right. Units are in meters

After establishing Datum A and magnetic north with a Brunton compass, a digital transit was set up over Datum A and used to set in Datum B approximately two meters north of the possible well at Site 15Mu81 and Datum C to the south of Datum A on one of the spoil ridges located along the bluff's edge. From these three datums, the data points used to construct the topographic map depicted in Figure 4-17 were collected.

After finishing the topographic mapping, a 20 x 20 m resistivity grid was established immediately west of Datum A. This grid was oriented toward the river and upslope (Figure 4-18). This resistivity survey was conducted in 50 cm intervals and resulted in the identification of several anomalies that were thought to possibly represent prehistoric features (Figure 4-19), several of which were found north of the shell midden by the WPA. As a result, a trip to Baker was scheduled for March 13 through 18, 2009 for purposes of coring these features and excavating any intact deposits that were discerned.

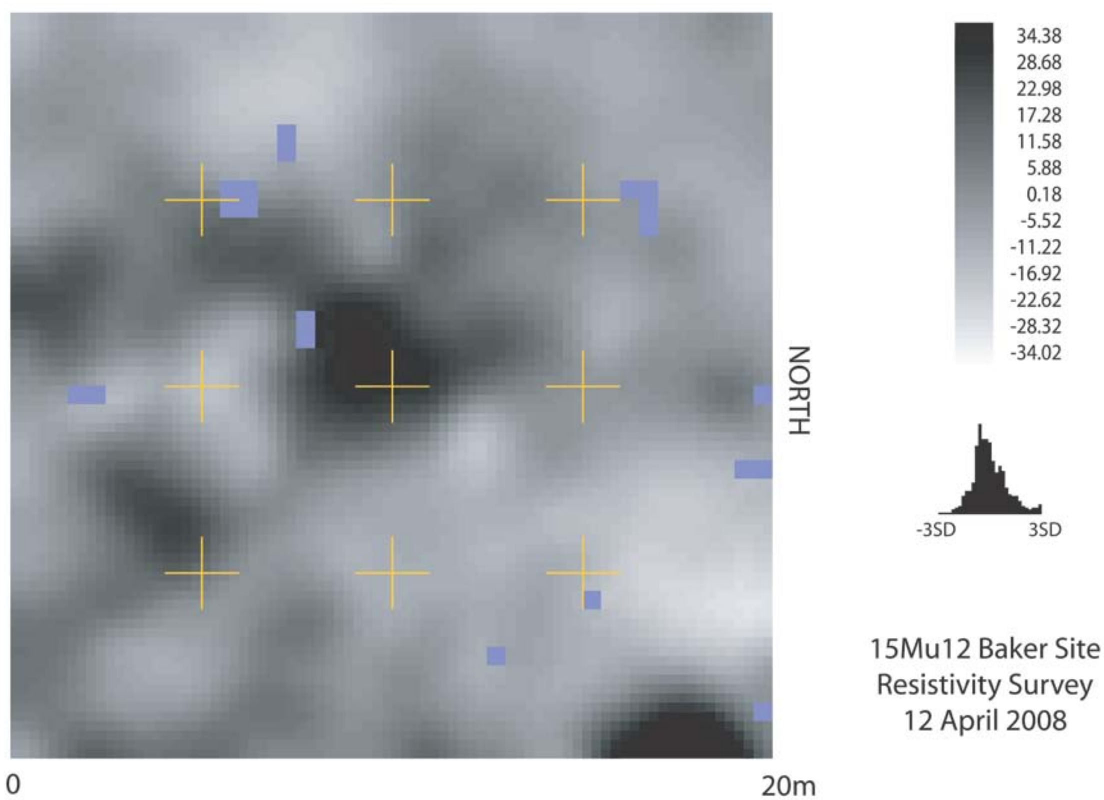


Figure 4-19. Results of the 20 x 20 m Resistivity Survey at Baker. Image provided by George Crothers.

This second trip began by reestablishing the resistivity grid and coring the locations of the previously recorded anomalies. The first anomaly to be tested was the large semi-circular feature located in the northeast corner of the grid just above a small rockshelter at the base of the bluff along the Green River. Core 1 was found to contain wet soil with a shallow A horizon overlying a gleyed silty clay loam. Additional cores were placed in the large anomaly in the center of the resistance grid, in the smaller anomaly in the southeast corner of the grid, and in the areas of high resistance located to the west of the large central anomaly and between this anomaly and the southeastern anomaly. All of these cores yielded wet soils with gleying and abundant evidence of redox (reduction-oxidation) in the form of reduced margins around oxidized cores. Charcoal flecking was observed in two cores in the central anomaly, but none exhibited evidence of intact subsurface midden. These anomalies have all been interpreted as pockets of water-saturated soil overlying shallow bedrock.

Although the resistance survey failed to locate intact cultural deposits, continued coring by George Crothers around the disturbed midden piles led to the location of a small area of preserved midden under a spoil pile. Two units containing intact subsurface midden (one 1 x 1 m and one 1 x 2 m) were excavated in this area (Figure 4-20). These are described in detail below.

<u>Unit 1 (1 x 1 m)</u>

Unit 1 was a 1 x 1 m unit located northwest of Datum A on the west side of a small spoil pile. A temporary datum was placed in the northwest corner of this unit. The upper 2 to 37 cm of Unit 1 (Zone A) consisted of loose spoil containing a low density of artifacts (Figures 4-21 and 4-22). Zone A was removed as a single unit and consisted of 10YR3/4 dark yellowish brown silt loam. Below this all zones were excavated in 10 cm arbitrary levels.

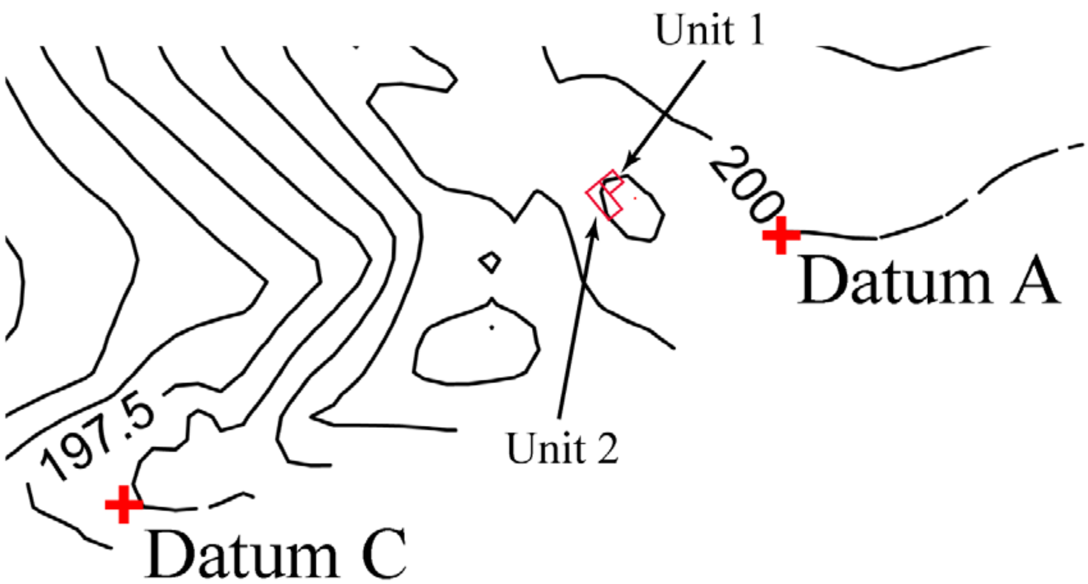


Figure 4-20. Location of Units 1 (1 x 1 m) and 2 (1 x 2 m) at Baker. Magnetic North is to the right. Units are in meters.

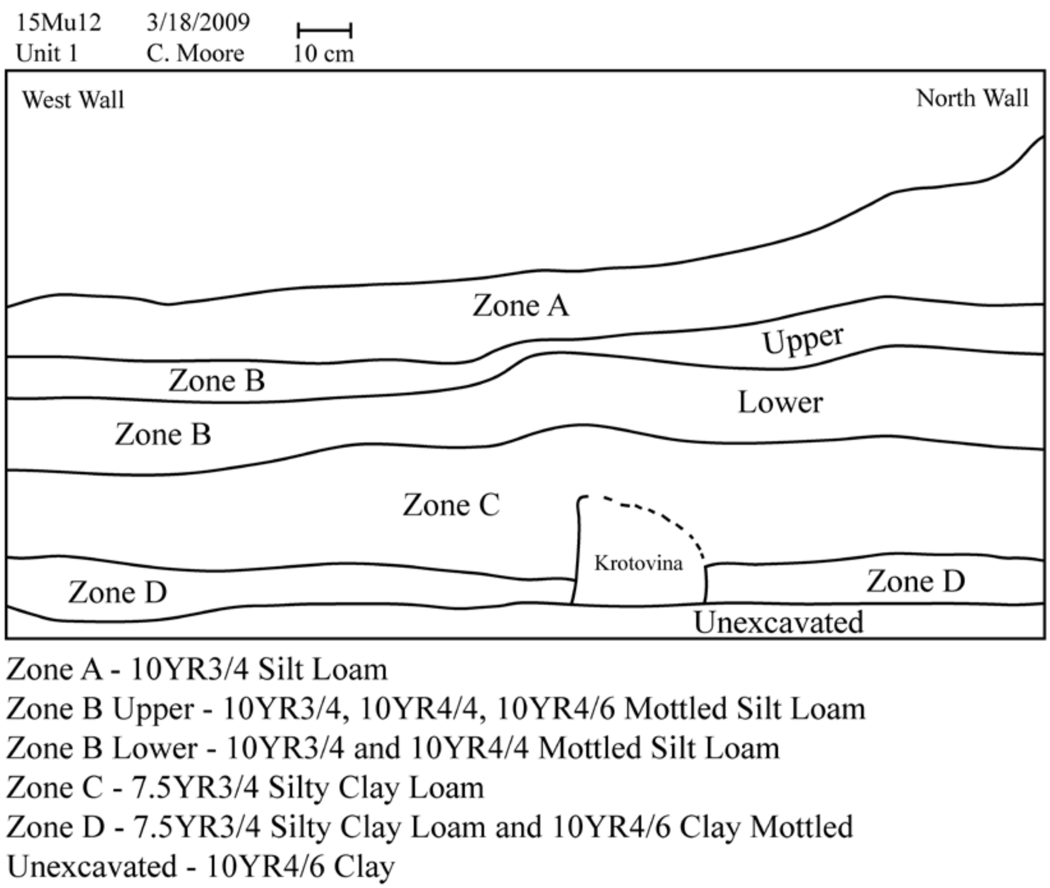


Figure 4-21. Unit 1 North and West Walls.

Zone B was excavated in three arbitrary levels and was about 28 cm thick. This zone consisted of mottled 10YR3/4 and 4/4 or 4/6 dark yellowish brown silt loam and contained a fair amount of sandstone and flakes, particularly in the lower levels. Based on excavations in Unit 1 and the adjacent Unit 2, Zone B is interpreted as a buried plowzone, with the lighter upper portion of Zone B possibly representing the redeposited colluvium identified by the WPA.

Figure 4-22. North Wall of Unit 1.

Zone C represents intact subsurface dirt/rock midden. Although evident in the profile as a darker red 7.5YR3/3 and 3/4 dark brown silty clay loam, this zone was differentiated while excavating due to its high concentration of charcoal flecking. Two bulk flotation samples were collected from the upper portion of this zone in Unit 1. A dense sandstone layer was noted in Zone C at approximately 40 cm below the surface. This layer was amorphous and varied in depth, likely indicating a dumping episode rather than a feature. Zone C was about 20 cm thick in Unit 1 and was excavated in two arbitrary 10 cm levels.

Table 4-3. Artifacts by Depth Recovered from Unit 1, 1/4 inch mesh screen.

Zone/Depth	Material	Count
A	Charcoal	7
A	Debitage	53
A	Fired Clay	1
A	Flake Tools	2
A	Gastropod	1
B1-B3	Bifaces and Biface Fragments	3
B1-B3	Bipolar Cores and Fragments	3
B1-B3	Bone Fragment	1
B1-B3	Charcoal	1
B1-B3	Cores and Fragments	2
B1-B3	Debitage	148
B1-B3	Flake Tools	3
B1-B3	Godar/Raddatz Projectile Points and Fragments	4
B1-B3	Microdrill	1
B1-B3	Nutshell	33
B1-B3	Sandstone Spalls	1
B1-B3	Siderite Concretion Fragments	2
B1-B3	UID Burned Substance	1
B1-B3	UID White Substance	1
C1-C2	Biface	1
C1-C2	Charcoal	3
C1-C2	Debitage	86
C1-C2	Fired Clay	1
C1-C2	Nutshell	4
C1-C2	Siderite Concretion Fragments	5
C1-C2	Thebes Projectile Point	1
C1-C2	UID Projectile Point Fragments	1
D	Debitage	30
D	Nutshell	9
D	Pitted Stone	1
D	Siderite Concretion Fragments	6
D	UID Projectile Point Fragment	1
Wall Scrapings	Debitage	2

Zone D consisted of a 9 to 11 cm thick 7.5YR3/4 dark brown and 10YR4/6 dark yellowish brown silty clay loam and clay mottled midden/subsoil transition zone immediately below Zone C. This zone was excavated as a single unit and contained a low density of artifacts. It is likely that a very low density of artifacts would have continued to have been encountered below Zone D as a result of downward relocation due to bioturbation (note the root displacement in Figure 4-22) and other site formation processes, but the unit was left unexcavated below Zone D to maximize effort excavating the intact dirt/rock midden.

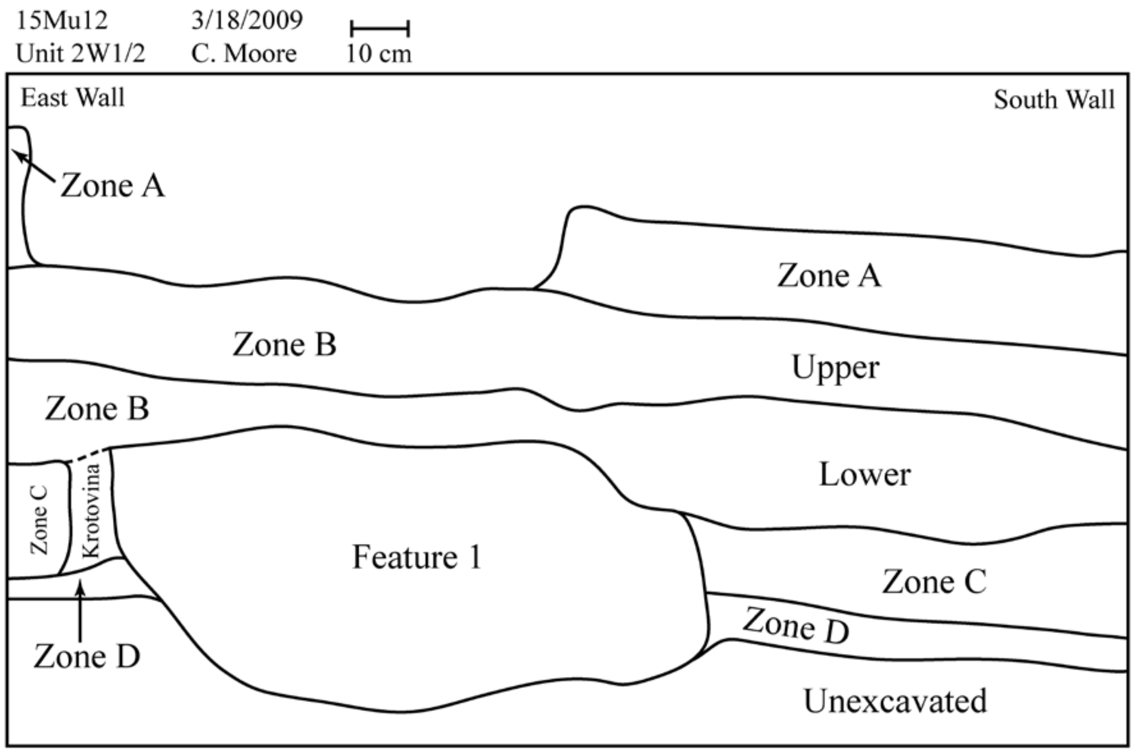
Artifacts recovered from Unit 1 are listed in Tables 4-3 and 4-4. As can be seen, most artifacts were recovered from Zones B and C, with all diagnostic projectile points coming from these two zones. Zone B contained four Large Side Notched Cluster Godar/Raddatz projectile points, consistent with the temporal placement of the site based on the WPA collection. One Early Archaic Thebes point was recovered from Zone C.

Unit 2

With the exception of the spoil in Zone A, Unit 2 was excavated into two 1 x 1 m (east and west) halves. A 10 x 10 x 10 cm soil flotation column was collected from the southwest and northeast corners of this unit. Zone descriptions of Unit 2 are consistent with the adjacent Unit 1, with the exception of some slight differences in color due to differences in soil moisture content (Figures 4-23 through 4-26). One 5 to 7 cm level was removed from the subsoil of the east half of Unit 2 to test whether the unit was sterile of cultural materials below Zone D. This 10YR4/6 dark yellowish brown clay stratum contained a few large flakes and about a half a kilogram of sandstone that was discarded in the field. These materials may indicate that the deposits continue into the subsoil, but the presence of a large trench-like krotovina trending across the bottom of the level from the northwest to the southeast corners of the unit may also have been the source of the artifacts. The west half of Unit 2 was excavated in March 2009 and the east half excavated after returning to the site for a third time in April 2009.

Table 4-4. Artifacts Recovered from Unit 1 Flotation.

Zone/Depth	Material	Count	Weight (g)
C1	Debitage	133	10.7
C1	Unmodified Sandstone	65	514.2
C1	Unsorted Heavy Fraction	-	195.9
C1	Unsorted Light Fraction	-	30.4



Zone A - 10YR3/4 Silt Loam
Zone B Upper - 10YR4/6 and 10YR3/4 Mottled Silt Loam
Zone B Lower - 10YR3/4 and 10YR4/6 Mottled Silt Loam
Zone C - 7.5YR3/3 Silty Clay Loam
Zone D - 7.5YR3/3 Silty Clay Loam and 10YR4/6 Clay Mottled
Feature 1 - 7.5YR3/3 Silt Loam with Sandstone Inclusions
Unexcavated - 10YR4/6 Clay

Figure 4-23. Unit 2 West Half East and South Wall Profiles.

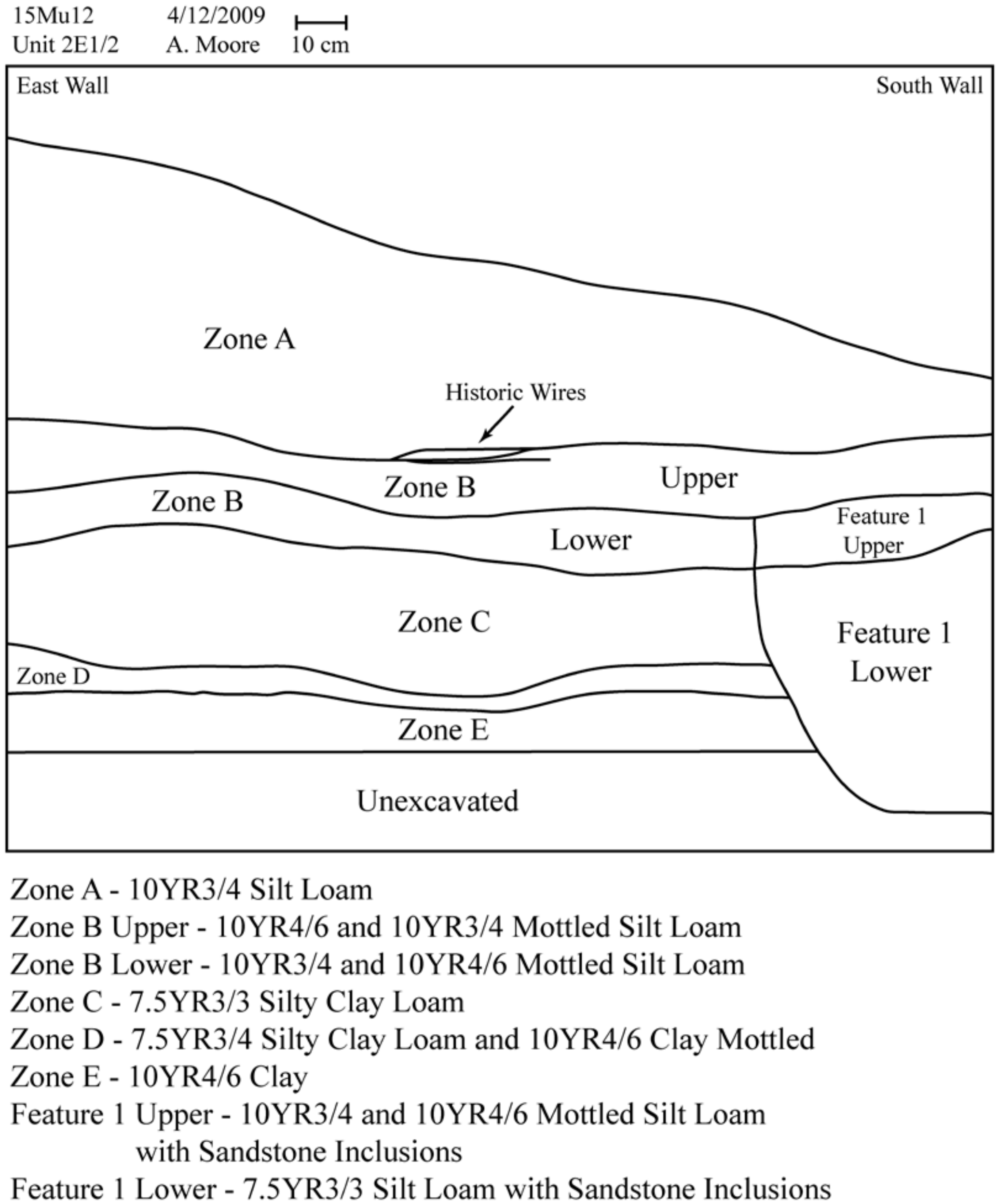


Figure 4-24. Unit 2 East Half East and South Wall Profiles.

Tables 4-5 and 4-6 list artifacts recovered from both the west and east halves of Unit 2. Zone E was excavated only in the east half. The presence of Godar/Raddatz projectile points in all but the lowest levels confirms the Middle Archaic date for the site, as do two radiocarbon dates obtained on charred nutshell from the west half of Unit 2. These dates, obtained from Zone C Level 1 and Zone D provide an age range of 6740 +/-

70 (ISGS #6584; $\delta^{13}C$ = -25.3‰) and 5770 +/-70 (ISGS #6585; $\delta^{13}C$ = -25.2‰) uncalibrated radiocarbon years before present for the Zone C and D midden. These dates solidly place the Baker site in the earlier portion of the Middle Archaic and are contemporaneous with the earlier Middle Archaic Large Side Notched component at Modoc Rock Shelter in Illinois (Ahler 1993). The small prehistoric ceramic fragments found in Zone D of Unit 2 are attributed to downward displacement due to bioturbation.

Table 4-5. Artifacts by Depth Recovered from Unit 2, 1/4 inch mesh screen.

Zone/Depth	Material	Count
A	Bifaces and Fragments	4
A	Bipolar Cores and Fragments	2
A	Charcoal	2
A	Debitage	219
A	Fired Clay	5
A	Flake Tools	3
A	Godar/Raddatz Projectile Points and Fragments	2
A	Knife Fragment	1
A	Piece of Metal	1
A	Siderite Concretion Fragments	3
A	UID Projectile Points and Fragments	2
A	Wire Nail	1
B1-B3	Bifaces and Fragments	11
B1-B3	Bipolar Cores and Fragments	2
B1-B3	Charcoal	1
B1-B3	Cores and Fragments	6
B1-B3	Debitage	375
B1-B3	Fired Clay	6
B1-B3	Flake Tools	11
B1-B3	Godar/Raddatz Projectile Points and Fragments	1
B1-B3	Lead Shot	1
B1-B3	Nutshell	39
B1-B3	Piece Esquillée Fragment	1
B1-B3	Pitted Stone	1
B1-B3	Sandstone Spalls	3
B1-B3	Siderite Concretion Fragments	41
B1-B3	Smashed Quartzite Pebble	1
B1-B3	UID Metallic Rock	1
B1-B3	UID Projectile Points and Fragments	4

Table 4.5 (continued)

B1-B3	Uniface Fragment	1
C1-C2	Bifaces and Fragments	7
C1-C2	Bipolar Cores and Fragments	3
C1-C2	Charcoal	3
C1-C2	Cores and Fragments	3
C1-C2	Debitage	278
C1-C2	Fired Clay	4
C1-C2	Flake Tools	4
C1-C2	Godar/Raddatz Hafted Scraper	1
C1-C2	Godar/Raddatz Projectile Points and Fragments	3
C1-C2	Graver	2
C1-C2	Kirk Corner Notched Projectile Point	1
C1-C2	Nutshell	57
C1-C2	Sandstone Spalls	3
C1-C2	Siderite Concretion Fragments	19
C1-C2	Small Quartz Crystals	1
C1-C2	Smashed Quartzite Pebble	1
C1-C2	UID Botanicals	2
C1-C2	UID Projectile Points and Fragments	1
D	Bifaces and Fragments	3
D	Charcoal	5
D	Debitage	134
D	Flake Tool	1
D	Nutshell	14
D	Siderite Concretion Fragments	9
D	UID Prehistoric Ceramics	3
E	Charcoal	1
E	Debitage	30
E	Nutshell	1
E	Siderite Concretion Fragments	2
Wall Scrapings	Debitage	9
Wall Scrapings	Sandstone Spalls	1
Wall Scrapings	UID Projectile Point Fragment	1

Table 4-6. Artifacts Recovered from Unit 2 Flotation.

Zone/Depth	Material	Count	Weight (g)
B1-B3	Bifaces and Fragments	1	25.1
B1-B3	Debitage	221	32.6
B1-B3	Unmodified Sandstone	196	2133.8
B1-B3	Unsorted Heavy Fraction	-	543.5
B1-B3	Unsorted Light Fraction	-	111.8
C1-C2	Bifaces and Fragments	1	1.5
C1-C2	Debitage	197	28.6
C1-C2	Grooved Stone (Siderite)	1	3.7

Table 4.6 (continued)

C1-C2	Nutshell/charcoal	-	23.0
C1-C2	UID Chipped Stone Tool Fragment	1	1.0
C1-C2	Unmodified Sandstone	111	3359.1
C1-C2	Unsorted Heavy Fraction	-	408.2
C1-C2	Unsorted Light Fraction	-	49.1
D	Debitage	57	3.9
D	Nutshell/charcoal	-	4.0
D	Unmodified Sandstone	25	357.6
D	Unsorted Heavy Fraction	-	145.9
D	Unsorted Light Fraction	-	12.1
E	Debitage	21	0.8
E	Nutshell/charcoal	-	0.8
E	Unsorted Heavy Fraction	-	143.2
E	Unsorted Light Fraction	-	3.2

Figure 4-25. South Wall of Unit 2 West Half.

Figure 4-26. East Wall of Unit 2 East Half.

Figure 4-27. Feature No. 1 at the Base of Zone C in the West Half of Unit 2.

Feature No. 1

Feature No. 1 was first encountered at the base of Zone C in the west half of Unit 2. Upon clearing the floor of Unit 2 at the top of Zone D, it became clear that a pit containing 7.5YR3/3 dark brown silty clay loam, sandstone, and artifacts was present in the southwest corner of the unit (Figure 4-27). Cleaning of the south and east wall profiles indicated that this feature was a deep refuse pit that continued up into the midden zone and that the feature was present in the east half of Unit 2 and in unexcavated areas to the south of the unit (Figures 4-22, 4-23, and 4-28). The fact that Feature No. 1 apparently originates at the base of Zone B provides additional support for the hypothesis that Zone B is a plowzone. If this is the case, then plowing truncated the top of the feature.

Figure 4-28. Profile of Feature No. 1 as depicted in the East Wall of Unit 2 West Half.

Even with the profile of Feature No. 1 exposed, identifying the feature's boundaries in the east half of Unit 2 proved impossible due to the lack of difference in color or texture between the pit and the surrounding dirt/rock midden. As a result, only those portions of the feature found intruding into Zones D and E were excavated separate from the midden. All such material was retained for flotation. Unfortunately, no diagnostic artifacts were recovered from these portions of the midden (Table 4-7). Nevertheless, the feature's color and textural similarities to the Middle Archaic dirt/rock midden and the fact that many identical features were identified by the WPA indicates that the pit also is Middle Archaic in age. The size of the feature and the amount of sandstone present in the feature's profile suggests that many of the artifacts and much of the sandstone recorded in the unit levels of Unit 2 originated in this pit. Fortunately, neither of the flotation columns in Unit 2 was impacted by the feature.

Table 4-7. Artifacts Recovered from Flotation of Feature 1 Fill.

Material	Count	Weight (g)
Debitage	442	117.9
Flake Tool	1	0.5
Groundstone Fragment	1	44.5
Mortar Fragment	1	74.0
Unmodified Sandstone	247	1880.0
Unsorted Heavy Fraction	-	857.2
Unsorted Light Fraction	-	51.6

Table 4-8. Artifacts Recovered from Spoil Piles and Surface Contexts.

Material	Count
Bifaces and Fragments	6
Bipolar Cores and Fragments	2
Bone	3
Bone Implement Fragment	1
Cores and Fragments	5
Debitage	58
Drill Tip	1
Flake Tools	2
Godar/Raddatz Projectile Points and Fragments	1
Microperforator	1
Siderite Concretion Fragments	3
Turtle Shell	2
UID Projectile Point Fragments	1

In addition to the artifacts collected from the unit excavations, some artifacts were recovered from the surface of the spoil piles, and a portion of the disturbed shell midden was screened to provide a sample of artifacts from this zone. One Godar/Raddatz projectile point fragment, debitage, and several other tools were recovered as a result of these efforts (Table 4-8).

Chapter Five

The Chiggerville Site

The Chiggerville site is a Late Archaic shell midden located within the floodplain of the Green River about ¼ mile east of the Baker site at an elevation of approximately 395 feet (Figures 4-4 and 5-1). When surveyed by the WPA, the site dimensions were recorded as 100 x 200 feet (~30 x 60 m), but survey of the site by Kentucky Heritage Council personnel indicated that these dimensions pertained only to the area of densest shell concentration at the site's center. The total dimensions of the surface midden scatter at the site are closer to 50 x 110 meters (Hockensmith 1983), of which only about 8900 sq. ft (~825 sq. m) was excavated by the WPA (Rolingson 1967:58). Major excavations at the site were conducted by the WPA from April 21, 1938 until July 26, 1938. Although Funkhouser and Webb (1928) named the site after the nearby village of Chiggerville, which had built up around a landing at the Green River Post Office, Moore (2002) referred to Chiggerville as the Newton Brown site after its owner.

Like Baker, prior to impoundment Chiggerville was located adjacent to an area of stable mussel shoals known as Nun's Ripple. According to Morey et al. (2002:526), these shoals "appear to be formed where the river crosses the Browder Fault System creating a 7.5 ft (2.29 m) offset at Baker and an 11 ft (3.35 m) offset at Nun's Ripple." Soils at the Chiggerville site consist of Newark Silt Loam. These soils are up to 60 inches deep and develop from mixed fine-silty alluvium (Soil Survey Staff 2007) (Figure 4-5).

History of Investigations

Clarence B. Moore's famous travels along the rivers of eastern North America included a stop at Indian Knoll, Chiggerville, and several other shell middens along the Green River. Chiggerville, which Moore referred to as the Newton Brown place, was investigated by Moore (2002) but not discussed in much detail. According to Moore (2002:477), Chiggerville, the Austin Place, the Rhone Place, and the DeWeese Place all "had much more solid and deeper deposits of shell than is at the Indian Knoll." However, burials impacted by Moore at these sites yielded no artifacts. The Austin Place is likely the Haynes Mound (15Bt11), as this site was owned by Hub Austin and his family at the turn of the century (Watson and Marquardt 2005:9). DeWeese may refer to the DeWeese site, but the WPA also referred to Carlston Annis as the DeWeese mound when it was originally recorded in 1939 (Watson and Marquardt 2005:8). It is uncertain which site is the Rhone Place, but if DeWeese Place is the DeWeese Mound, then the Rhone Place is most likely Carlston Annis given that these are the largest shell middens along this stretch of the Green (Crothers 1999:14).

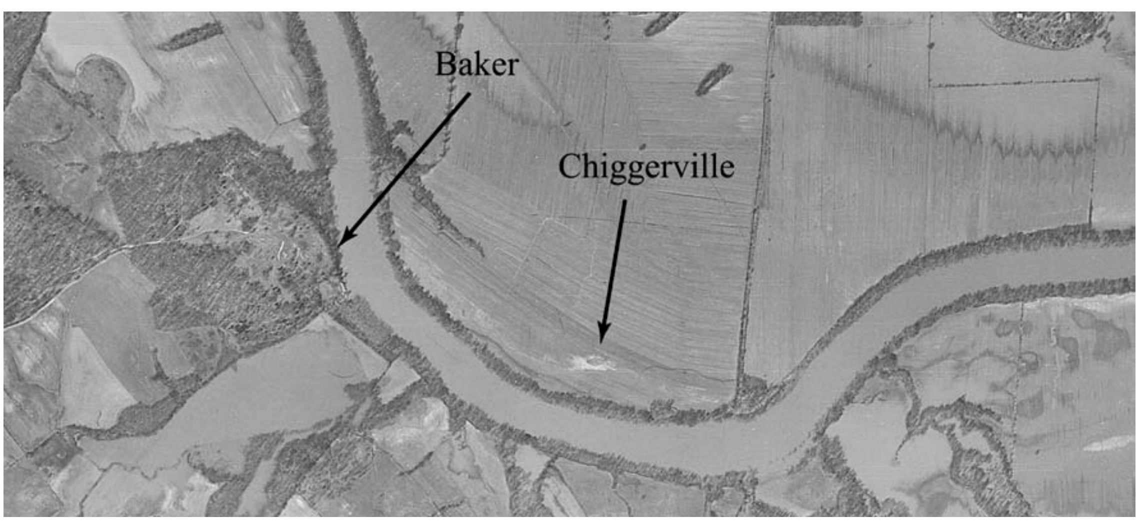


Figure 5-1. Aerial Photograph (1951) of Baker and Chiggerville.

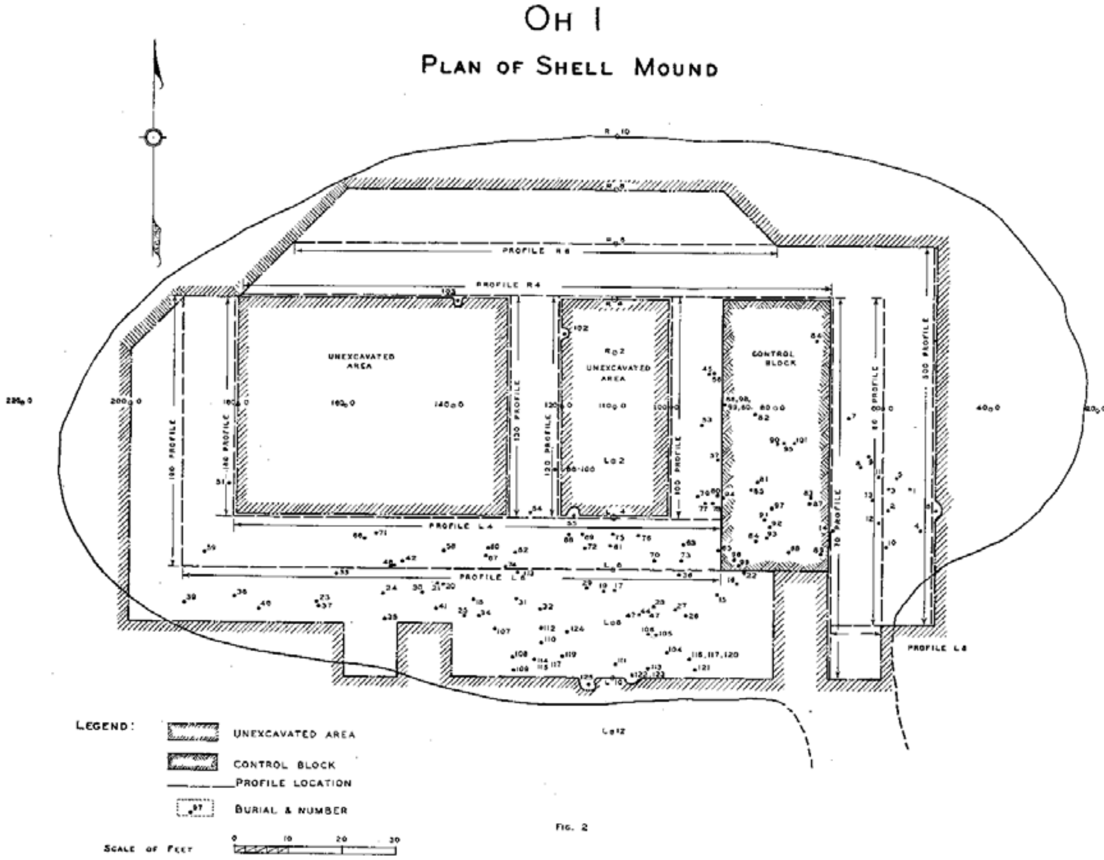


Figure 5-2. WPA Map of the Chiggerville Site. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

In 1924, William S. Webb, William D. Funkhouser, and W. J. Curtis became the first to report details of excavations at Chiggerville. Although Indian Knoll and DeWeese also were visited at this time, Chiggerville was considered the largest of the three sites and was chosen for investigation. According to Funkhouser and Webb (1928), the 1924 investigations began with several "exploratory holes," after which a trench was cut across the entire mound from north to south. At the ends of this initial trench, additional trenches were placed running east to west. These trench excavations yielded "an almost solid bed of mussel-shells for a depth of six feet," along with numerous human and animal bones and artifacts but no complete human burials (Funkhouser and

Webb 1928:157). Only a single poorly preserved burial of a child was encountered, and no artifacts were found in association. Apparently Funkhouser and Webb (1928) excavated at other shell middens (possibly Indian Knoll and DeWeese since these two are mentioned) in the area since other middens are said to have "showed the same structure," but details of these investigations are not reported (Funkhouser and Webb 1928).

The most extensive excavations at Chiggerville were conducted by the WPA under the direction of David B. Stout from April until July 1938. A total of 8900 sq. feet of the site was excavated at this time (Rolingson 1967:58). An unexcavated block in the center of the site contained Funkhouser and Webb's (1928) test trench (Figure 5-2), which was visible as an 8 sq. ft irregular rectangle near the center of the site at the time of the WPA excavations (Stout 1938b:2). The WPA work, described in detail below, was the first WPA excavation at an Archaic site to be reported in print, confirming the widespread presence of pre-ceramic cultures in eastern North America and adding to a growing body of data concerning the eastern Archaic (e.g., Ford and Willey 1941:332-334). Webb and Haag's (1939) Chiggerville site report was also the first time Webb discussed the association of stone weights with antler hooks in burial contexts, concluding that these objects are parts of composite atlatls.

Very little work has been conducted at Chiggerville since the 1930s. In a class paper Barbara Thiel (1971) used data from Chiggerville to conclude that none of three sampling techniques – 1) random sampling, 2) excavation of a single trench with randomly distributed units around the trench, and 3) excavation of one quarter of the site – would have accurately reflected the range of variation of burials recovered by the WPA. Several bioarchaeologists have included burials from Chiggerville in a number of studies since the 1930s (see chapter 8). Finally, Charles Hockensmith from the Kentucky Heritage Council revisited the site in 1983, recovering one shell tempered, plain ceramic sherd; a sample of bivalve and gastropod shells; and a few non-diagnostic artifacts. According to Hockensmith (1983), at that time two small looter pits were evident near the center of the site in a previously excavated area.

George Crothers, Patty Jo Watson, and Julie Stein visited Chiggerville in 1999 and 2002 as part of the Shell Mound Archaeological Project. Through a combination of coring, mapping, and geophysical survey, Crothers had hoped to relocate the WPA excavation blocks and trenches and locate intact midden for radiocarbon dating. Unfortunately, the north arrow on the published WPA map of the site was based on grid north rather than true north or magnetic north and was not useful in relocating the WPA excavation trenches. Coring failed to yield unequivocal evidence of intact midden, and the conductivity map produced as a result of the geophysical survey did not initially yield readily interpretable results. As a result, research at the site was postponed until the 2009 investigations reported herein (George Crothers, personal communication 2009).

WPA Excavations

Prior to the WPA excavations, the only disturbances noted at the Chiggerville site were Funkhouser and Webb's (1928) original excavation unit, rodent disturbances, and pits dug to obtain shell for chicken feed. Due to its size, the site was staked at 10 foot intervals, with the baseline running east to west roughly through the center of the site. Units to the north of this baseline were labeled R2, R4, R6, and so on, and units to the south were labeled L2, L4, L6, etc. The '0' range line was placed at the east edge of the site and units to the west of this line were numbered in 10 foot intervals. All bags were labeled according to the northwest corner stake of each 10 x 10 ft unit, thus artifact provenience was recorded only at a 100 ft^2 resolution. Elevations were taken at each of these stakes from the top of the midden (Figure 5-3). Units were excavated in 6 inch levels (Stout 1938b:3).

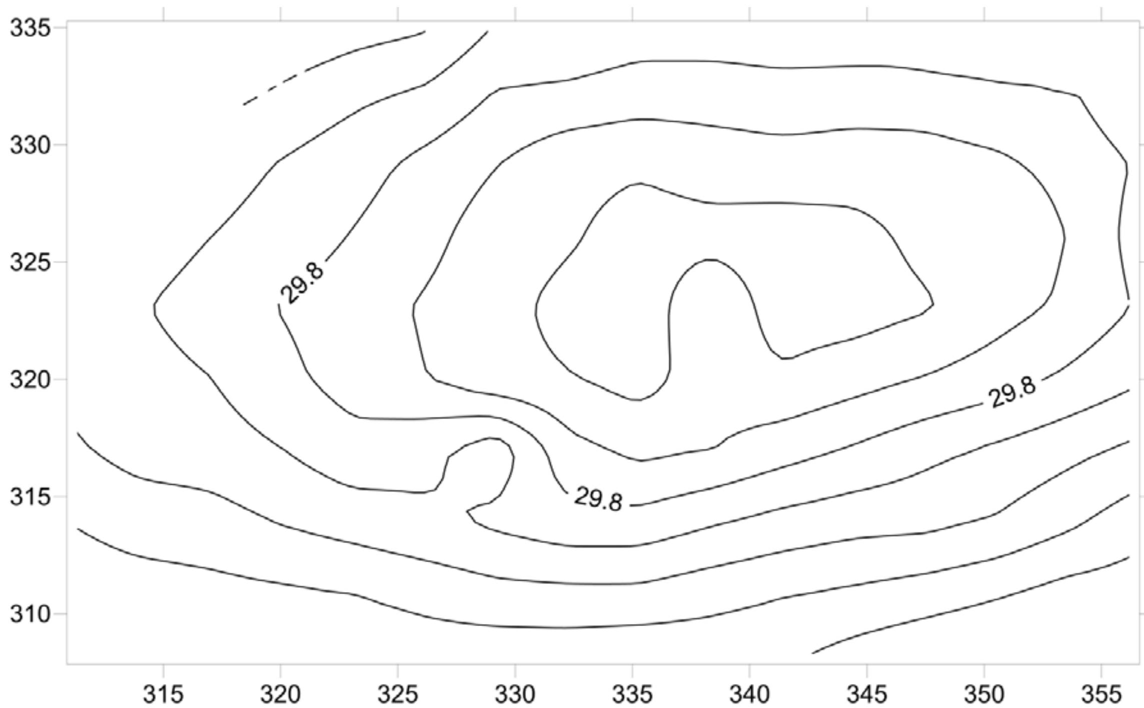


Figure 5-3. WPA Topographic Map of the Chiggerville Site. Units are in feet.

Excavation began by digging a trench at the eastern end of the site to expose the 60 ft profile. After this, additional trenches were placed on the north, south, and west ends of the site, followed by two trenches being cut through the center of the site between the 120 and 130 foot line and the 90 and 100 foot line. These north-south oriented trenches isolated three blocks. The easternmost 'control' block was excavated "as a unit in six inch levels in order to ascertain whatever cultural stratigraphy there might be in the heap" (Stout 1938b:4). The second eastern block contained many disturbances, including Funkhouser and Webb's 1924 trench, and was therefore left unexcavated. The larger western block was also left unexcavated because Stout "felt that it contained little of real significance for it lay outside of the zone containing burials and what village site material it might produce had already been obtained from the remainder of the heap" (Stout 1938b:4). As can be seen in Figure 5-2, burials at Chiggerville were concentrated in the southeastern corner of the site (see also chapter 8).

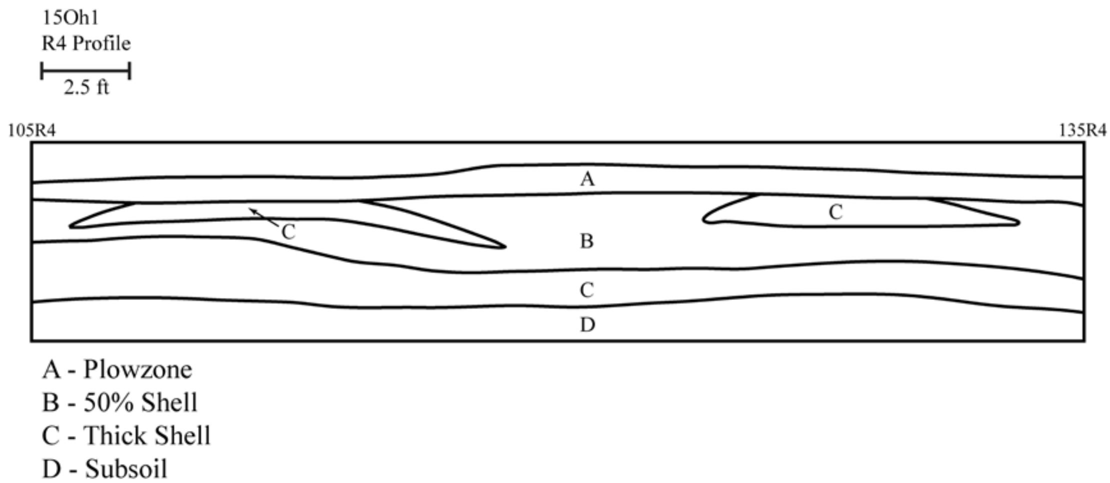


Figure 5-4. The R4 Profile at Chiggerville. Redrawn from original WPA profile.

Figure 5-5. The 40 Foot Profile at Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Figure 5-6. The R4 Profile at Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

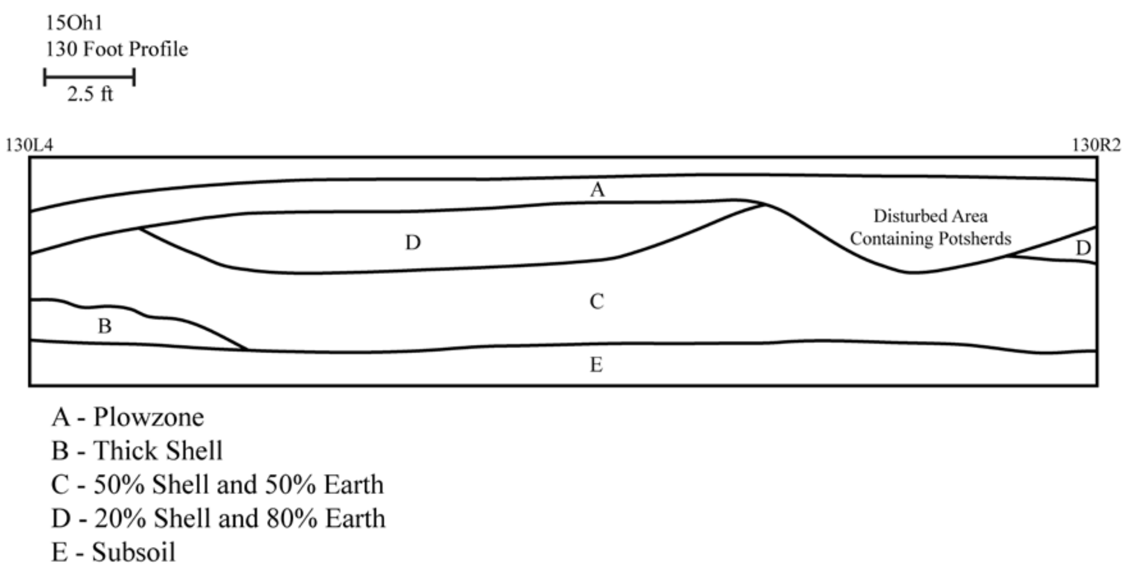
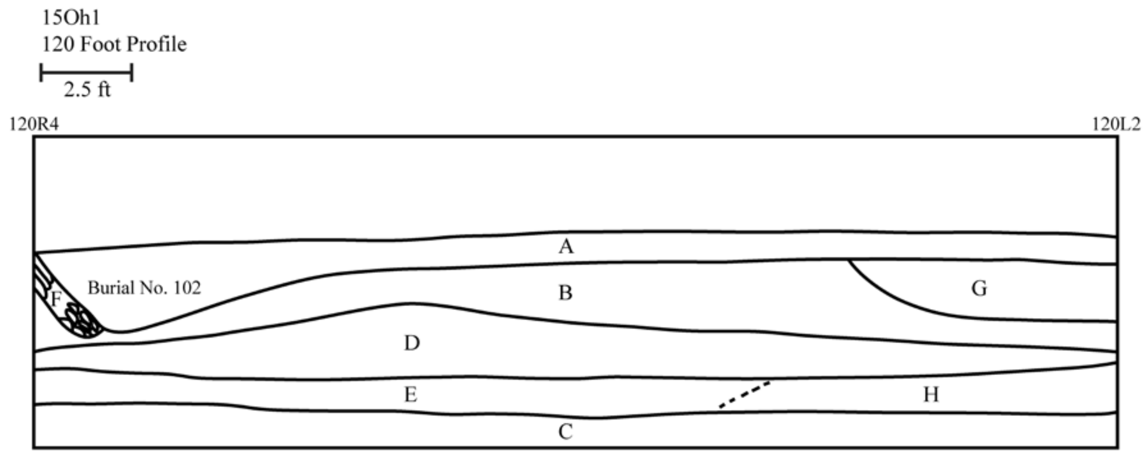


Figure 5-7. The 130 Foot Profile at Chiggerville. Redrawn from original WPA profile.



A - Plowzone
B - 50% Shell and 50% Earth
C - Subsoil
D - Thick Shell
E - 20% Shell
F - Paired Mussels Lying on Edge
G - 30 to 40% Shell
H - 80 to 90% Shell

Figure 5-8. The 120 Foot Profile at Chiggerville. Redrawn from original WPA profile.

Stratigraphy at the site was relatively uncomplicated, consisting primarily of thick bands of shell and earth punctuated in places by concentrated lenses of shell (Figures 5-4 and 5-5). Some areas exhibited large zones of relatively little shell surrounded by zones of thicker shell (Figure 5-6), and some profiles exhibited disturbances, presumably either from farmers digging shell for chicken feed or from later prehistoric uses of the site (Figure 5-7). The 120 foot profile exhibits a zone of paired mussel shells that were likely associated with Burial No. 102, although the field burial form does not connect the dipping ‘plowzone’ at this location with the burial (Figure 5-8). Also depicted in this profile is a zone of concentrated shell that was recorded near the base of most of the shell heap (Stout 1938b:7).

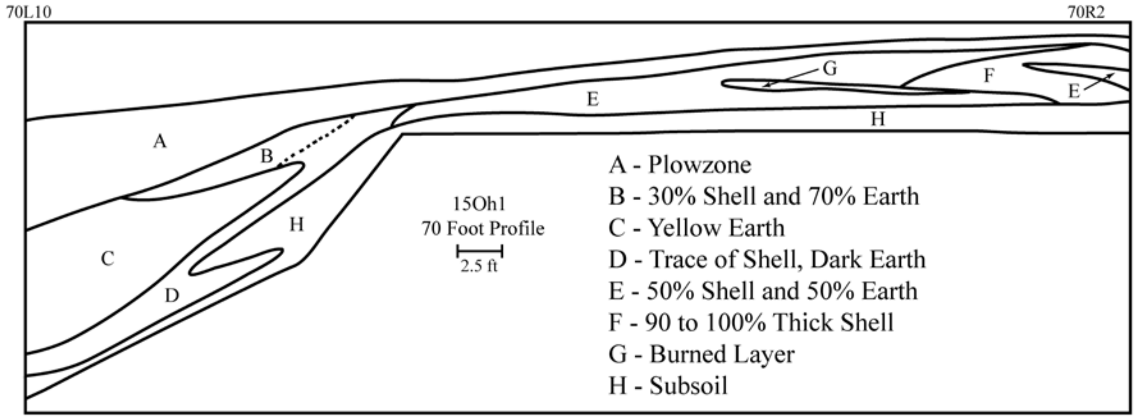


Figure 5-9. The 70 Foot Profile at Chiggerville. Redrawn from original WPA profile.

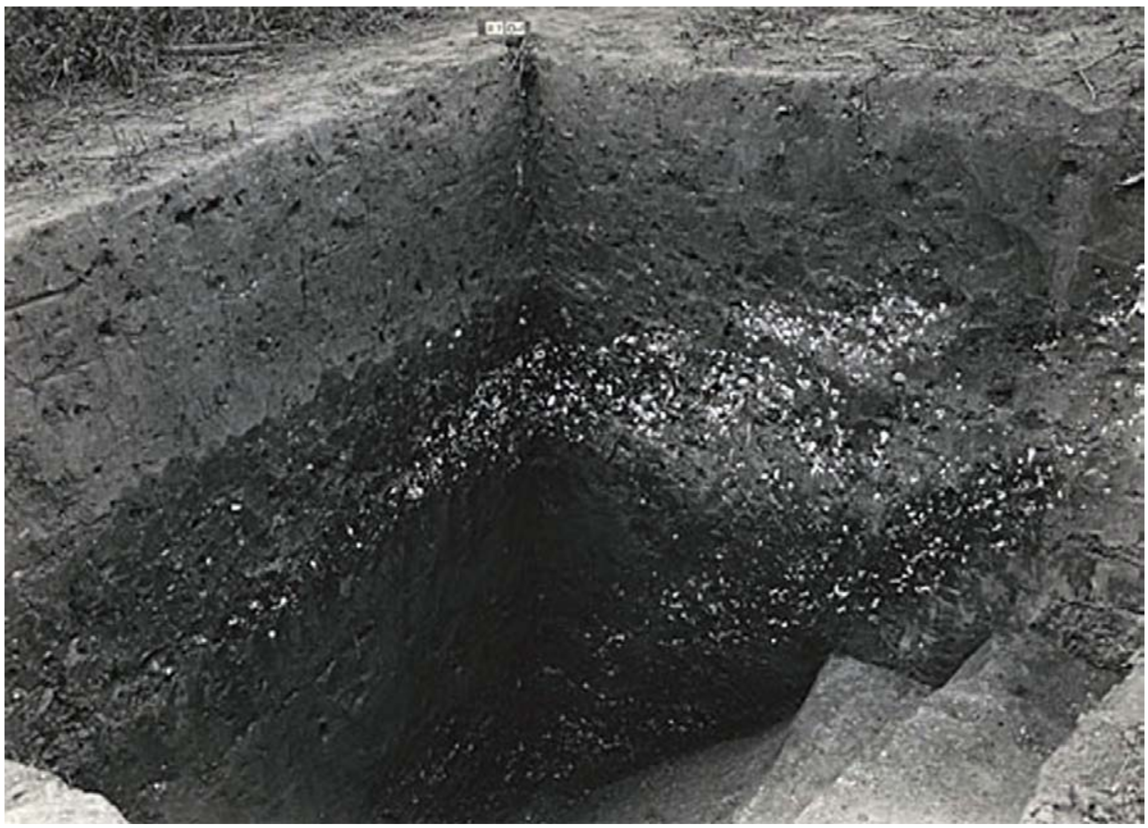


Figure 5-10. Shell Midden Plunging under the 70 Foot Profile at Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

The most interesting aspect of Chiggerville's stratigraphy occurred in the 70 foot profile at the southeastern corner of the site south from the L6 line (Figure 5-9). At this location the shell midden dips abruptly, indicating that this portion of the shell midden bordered a slough, stream, or part of the river bank at the time of midden accumulation (Figure 5-10). According to Stout (1938b:8), the shell continued into the 70L10 profile, but Webb halted excavation since removal of more than 15 feet of overburden was required to reach the shell midden stratum at this location. As can be seen in Figure 5-9, this overburden most likely consisted of floodplain sediments. This is supported by Stout's (1938b:8) field notes, which state that "the southern edge of the shell midden had been subjected to considerable washing in the past for there was found along this edge a layer of redeposited dirt lying over the uppermost shell strata." It should be noted that the stratum boundaries depicted on the WPA field profiles were not as abrupt as suggested by the drawings themselves (Stout 1938b:8).

Table 5-1. WPA Artifacts from Chiggerville Classified by Material Type.

	Analyzed	Missing
Antler	435	52
Bone	788	
Chipped Stone	1464	21
Groundstone	363	25
Non-Mortuary Shell	4	0
Ceramics	280	9

Not including the large numbers of individual shell beads and other marine and freshwater shell artifacts recovered from burials (described in detail in chapter 8), a total of 3441 artifacts were recovered by the WPA from the Chiggerville site, of which 3334 were available for analysis at the time of this study. These objects are listed by material type in Table 5-1. Bone and antler implements are described in chapter 6, chipped stone and groundstone implements are described in chapter 7, and the marine and freshwater shell objects are described in chapter 8. In addition to these, four unmodified freshwater shells were collected from various unit contexts. Of these, three are bivalves and one is a freshwater gastropod. According to their catalogue cards, the gastropod and one of the bivalves (both from Unit 190, Level 3) are samples of shells that were collected for incorporation into the museum's "study material," but the remainder of the shells from these contexts could not be located at the time of this study.

Of the 280 ceramic objects available for study, two are large pieces of fired clay recovered from the 2 foot level of Unit 180L6 and the 3 foot level of Unit 100-0. A third is a 48.6 g piece of daub recovered from the 2 foot level of Unit 140L6. Three objects are all fragments of the same shell-tempered pottery trowel from the plowzone in Unit 100-0. The remaining 274 objects are all shell-tempered pottery sherds, of which 254 are Plain, 10 are Fabric Impressed, 4 are Burnished Plain, 1 is Cord-marked, 4 are eroded, and one is a strap handle. According to Stout (1938b:8), all of these sherds were recovered from plowzone and disturbed contexts in the upper portion of the site, although some of these disturbed contexts apparently included the upper 5 feet of the midden (Figure 5-11). The recovery of small sherds throughout all levels of the midden during the 2009 excavations (discussed below) indicates that some downward migration of sherds due to bioturbation or other site formation processes is likely present throughout much of the midden.

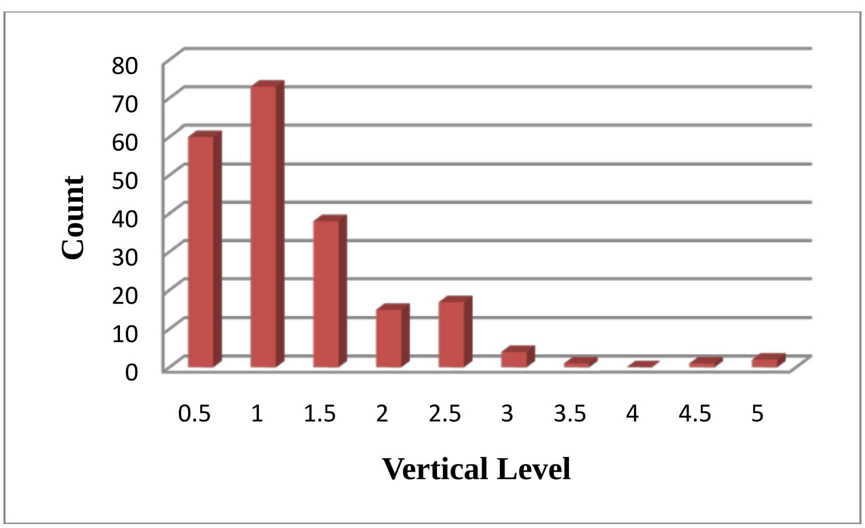


Figure 5-11. Counts of Shell Tempered Sherds by Vertical Level.

Table 5-2. Points by Cluster and Depth from the Chiggerville WPA Collection.

Cluster	**Level** 0-1 foot	1-2 foot	2-3 foot	3-4 foot	4-5 foot	5-6 foot	6-7 foot	7-8 foot	8-9 foot	Unknown
Benton	12	9	6	1	2	0	0	0	0	4
Brewerton	1	2	0	0	0	0	0	0	0	1
Dalton	1	1	1	0	1	0	0	0	0	0
Dickson	4	0	0	1	0	0	0	0	0	1
Etley	3	5	1	1	0	0	0	0	0	1
Eva	1	0	0	0	0	0	0	0	0	0
Hardin Barbed	1	0	0	0	0	0	0	0	0	0
Kirk	10	7	2	0	0	0	0	1	0	3
Kirk Stemmed	1	0	0	0	0	0	0	0	0	0
Large Side Notched	3	3	4	1	1	0	0	0	0	4
Late Archaic Stemmed	30	14	13	2	2	0	0	0	0	7
Ledbetter	13	3	3	2	4	0	0	0	0	3
Lowe	0	0	0	1	0	0	0	0	0	0
LW/MS Triangular	3	1	0	0	0	0	0	0	0	1
Matanzas	4	0	1	0	1	1	0	0	1	6
Merom	3	0	1	0	0	0	0	0	0	0
Motley	2	3	2	0	0	0	0	0	0	1
Rice Lobed	1	0	1	0	0	0	0	0	0	0
Saratoga	117	74	37	12	4	0	0	0	1	32
Snyders	1	0	1	0	0	0	0	0	0	0
Stanley Stemmed	0	1	0	0	0	0	0	0	0	0
Terminal Archaic Barbed	7	4	1	0	0	0	0	0	0	1
Thebes	2	5	1	0	0	0	0	0	0	0
Turkey-tail	0	1	0	0	0	0	0	0	0	1
Wadlow	0	0	0	0	0	0	0	0	0	1
White Springs	1	1	0	0	0	0	0	0	0	0
Total	221	134	75	21	15	1	0	1	2	67

The recovery of nearly 300 shell tempered sherds at Chiggerville indicates the presence of a significant Late Prehistoric component at the site. However, only 5 Late Prehistoric chipped stone projectile points and one Late Prehistoric antler projectile point (described in chapter 6) were associated with this component. No Late Prehistoric structures were recorded by the WPA, and no features or burials at Chiggerville could be assigned to the Late Prehistoric component. As a result, the nature of Late Prehistoric site use at Chiggerville is unknown, although it is likely they were using the site as a short-term camp for the procurement of shell and/or game either for consumption or for use in pottery production. It is possible that some of the disturbance to the upper levels of the midden was created by Late Prehistoric inhabitants digging shell for pottery production. This hypothesis is supported by the presence of a deep disturbance or pit in the 130 Foot Profile (Figure 5-7) that contained some of the Late Prehistoric ceramics recorded in Figure 5-11. It is also possible that the Chiggerville midden was selected for garden plots during the Late Prehistoric, as hypothesized by Jefferies (2006) for the Black Earth site in Illinois.

A total of 537 of the 1464 analyzed chipped stone objects from Chiggerville were diagnostic hafted bifaces. Of these, 464 were Late Archaic forms, and the majority (n = 277) were classifiable to the Late Archaic Saratoga Cluster. Table 5-2 provides the distribution of the various diagnostic projectile points, hafted scrapers, and hafted drills by cluster and depth. The ½ foot levels recorded at Chiggerville have been combined into 1 foot levels for purposes of display and comparison with the Baker site. As can be seen from Table 5-2, all point types, regardless of age, were concentrated in the upper levels of the site and no vertical patterns can be discerned.

Figure 5-12 graphically depicts the diagnostic objects from Chiggerville by time period and indicates that the gross majority of the points date to the Late or Terminal Archaic (combined in this sample). Although minor Early Archaic and Middle Archaic components are present at the site, these components could not be isolated. Based upon the vertical and horizontal distribution of Saratoga and other Late Archaic point forms at the site (Figure 5-13), it can reasonably be concluded that all or most of the shell midden and features at Chiggerville date to the Late Archaic period. No localized concentrations of other temporal components can be identified by plotting these points on similar distribution maps.

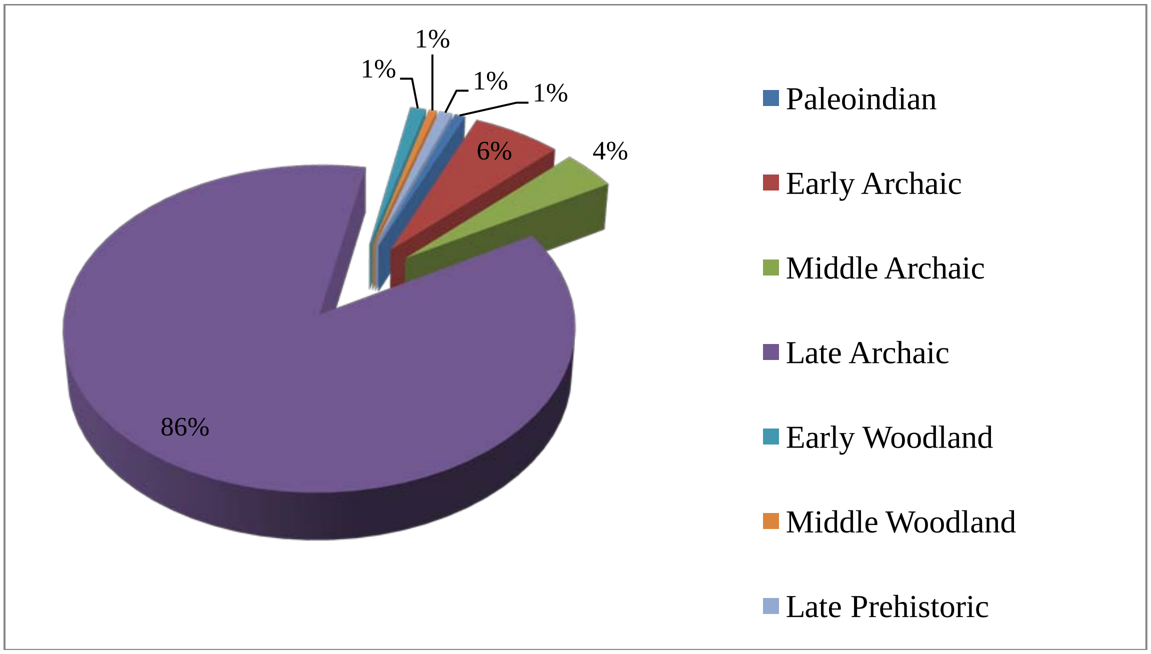


Figure 5-12. Diagnostic Projectile Points from Chiggerville by Time Period.

In addition to the human and dog burials described in chapter 8, a total of 52[1] cultural features were recorded during the WPA excavations at Chiggerville. Unlike the human and dog burials at Chiggerville, the features are more evenly distributed throughout the excavated portions of the site (Figure 5-14). Based upon the projectile point distributions discussed above, it is reasonable to conclude that all of these features are Late Archaic in age. Webb and Haag (1939:10) followed Stout (1938b) in classifying all but three of the features as 'fireplaces', which Stout (1938b:7) described as "irregular

[1] Webb and Haag (1939) list 53 features at Chiggerville, but feature data forms are available for only 52. The photograph of Feature No. 52 (based on the feature data form) is labeled as feature 53, which may be the source of the inconsistency.

to round areas of scattered rocks and pebbles, all firecracked and burned," but analysis of the WPA feature data forms indicates that more variability exists among these features than is suggested by this classification. Stout (1938b:7) did observe that, while most of the fireplaces consisted of "patches of rock [that] look as though they had been thrown out as refuse," some "appeared to have been definitely placed on the ground as a sort of pavement." Fireplaces, as defined by the WPA, typically included burned wood, shell, earth, and animal bone in association.

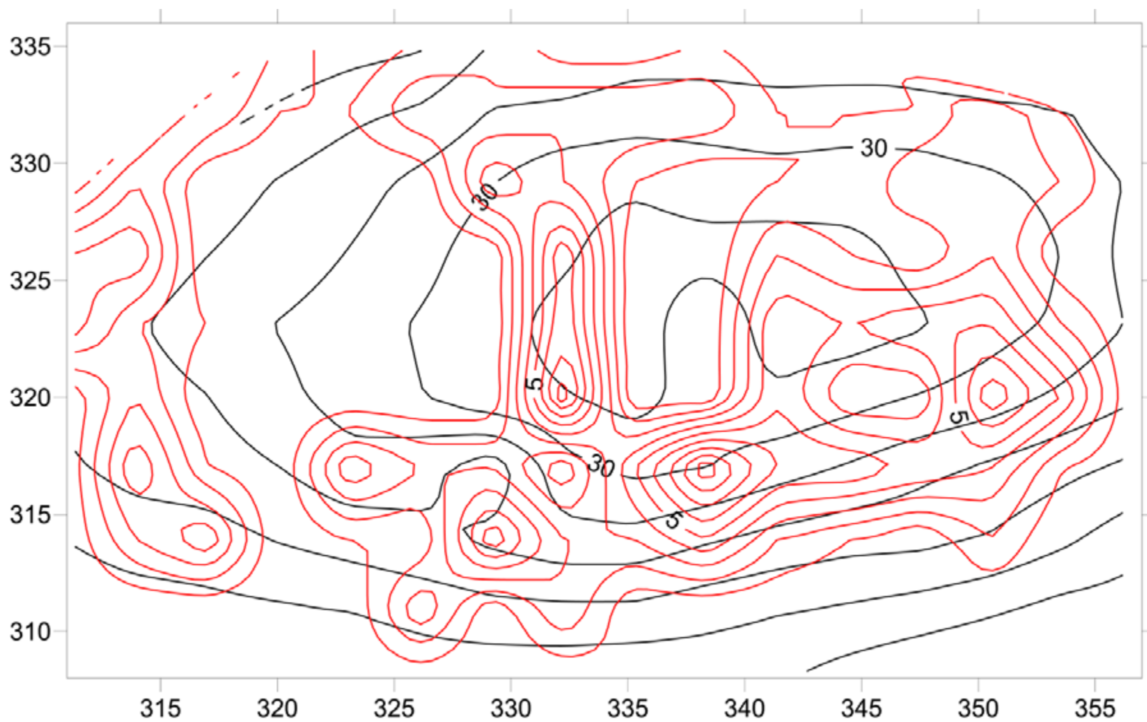


Figure 5-13. WPA Elevation Contours overlain by the Distribution of Saratoga Cluster Points (in red) at Chiggerville. Units are in feet.

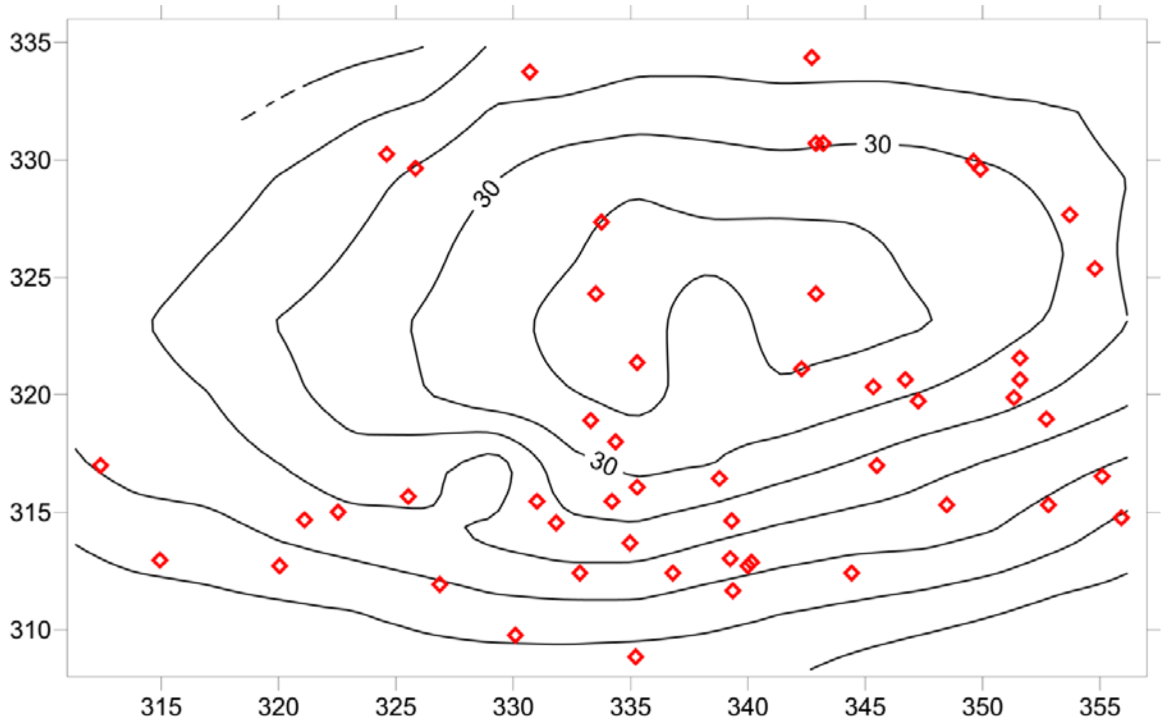


Figure 5-14. Distribution of Feature Center Points at Chiggerville. Units are in feet.

This description of fireplaces as areas of scattered firecracked rocks and other burned materials is sufficient to describe 44 of the features at the Chiggerville site. For purposes of brevity, only select examples of these features will be described in detail and illustrated, although the location and dimensions of all 44 are provided in Table 5-3.

Table 5-3. Refuse Scatters ('Fireplaces') at the Chiggerville Site.

Feature No.	East Grid (metric)	North Grid (metric)	Elevation (metric)	Length (ft)	Width (ft)
2	353.7	327.7	29.47	19	10
3	349.6	329.9	29.40	8	4.5
4	342.7	334.4	28.77	4	3.6
6	355.9	314.8	28.53	6	4.6
7	355.1	316.5	28.54	10	3.5
8	330.7	333.8	29.38	10	10
9	351.6	320.6	29.38	15	7
10	351.3	319.9	29.26	5	4
11	352.8	315.3	29.23	4	5
12	351.6	321.6	29.02	8.5	6
13	325.8	329.6	29.49	8	3

Table 5-3 (continued)

14	352.7	319.0	28.99	6	3
15	343.2	330.7	29.73	10	8
16	324.6	330.3	29.26	7	6
17	342.9	330.7	29.32	20	10
18	335.0	313.7	29.43	1.2	1
19	336.8	312.4	29.46	9	9
20	332.8	312.4	29.28	9	5
21	339.2	313.0	29.47	4	6
22	344.4	312.4	29.11	20	10
23	340.0	312.7	29.17	8	8
24	314.9	313.0	29.08	5	5.5
25	320.0	312.7	29.17	8	4
27	312.4	317.0	29.14	18	10
28	326.9	311.9	28.90	5	5
29	340.2	312.9	28.90	8	7
30	342.3	321.1	29.75	4.7	5
31	338.8	316.4	29.52	2.9	2.3
32	342.9	324.3	29.87	7	6
34	331.8	314.6	29.32	2	3.6
35	325.5	315.7	29.29	6	5
36	321.1	314.7	29.23	5	4.5
37	334.2	315.5	29.17	8	7
38	322.5	315.0	28.88	5.5	5.5
39	331.0	315.5	28.71	8	6
40	335.3	316.1	28.93	12	4 to 7
43	333.5	324.3	29.73	5	4
45	333.3	318.9	29.37	5	6
46	346.7	320.6	29.47	5	4
47	345.5	317.0	Not Available	13	7.5
48	345.3	320.3	Not Available	6	3
49	334.4	318.0	28.76	6	5
50	333.8	327.4	28.85	8	10
52	335.2	308.9	28.50	3.2	2.5


Figure 5-15. Chiggerville Feature No. 2. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.


Figure 5-16. Chiggerville Feature No. 8. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature No. 2 (Figure 5-15) was a large fireplace consisting of an approximately 200 ft^2 area of scattered FCR, burned soil, and charcoal found lying within the shell midden. Feature No. 6 was an area of FCR found lying atop the subsoil and overlying a shell filled pit dug into the subsoil. Two cylindrical pestles (Cat. #s 1570 and 1603) and a bifacial core (Cat. #1094) were found associated with this feature. Feature No. 8 was a thin layer of FCR found covering a 100 ft^2 area of the shell midden (Figure 5-16).

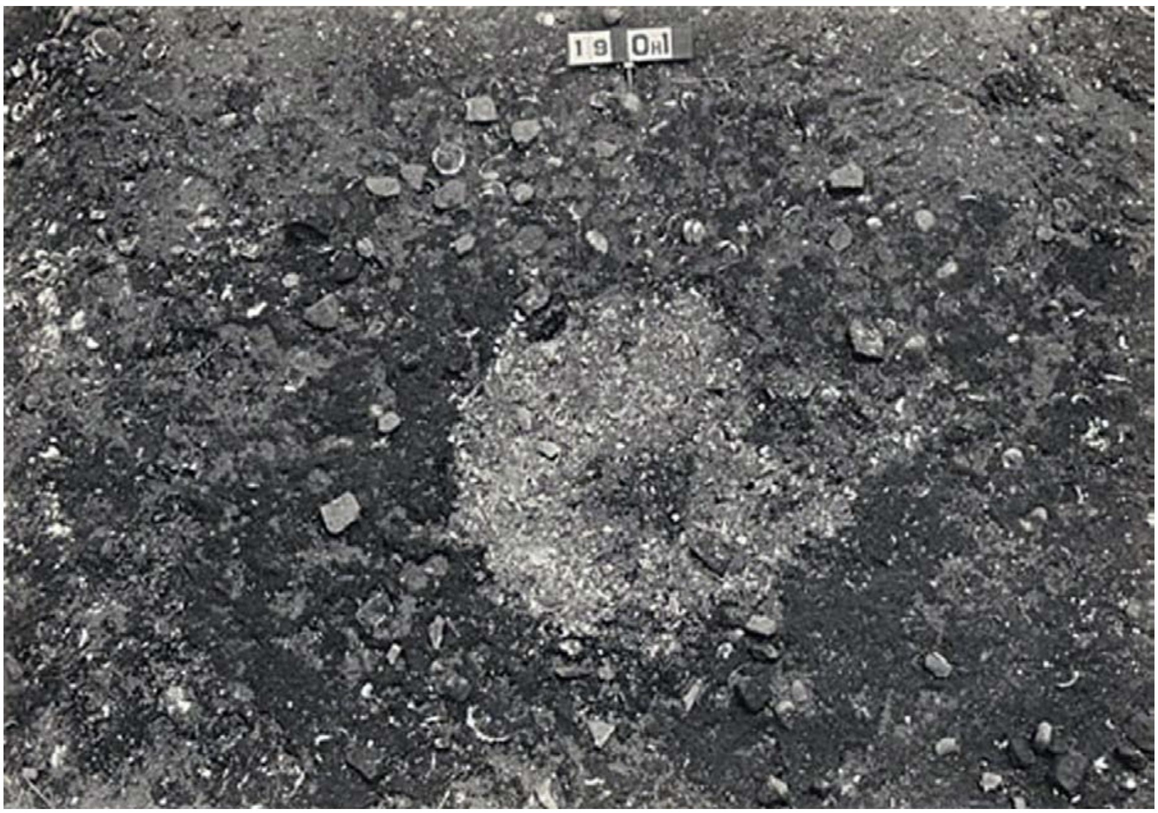


Figure 5-17. Chiggerville Feature No. 10. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature No. 10 was a fireplace consisting of an approximately 20 ft^2 area of FCR and charcoal (Figure 5-17). Associated with this feature was a central circular concentration of burned shells. Some paired mussel shells were associated with this feature. Similar concentrations of shell were found in Feature No. 13 (Feature 5-18).

Figure 5-18. Chiggerville Feature No. 13. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

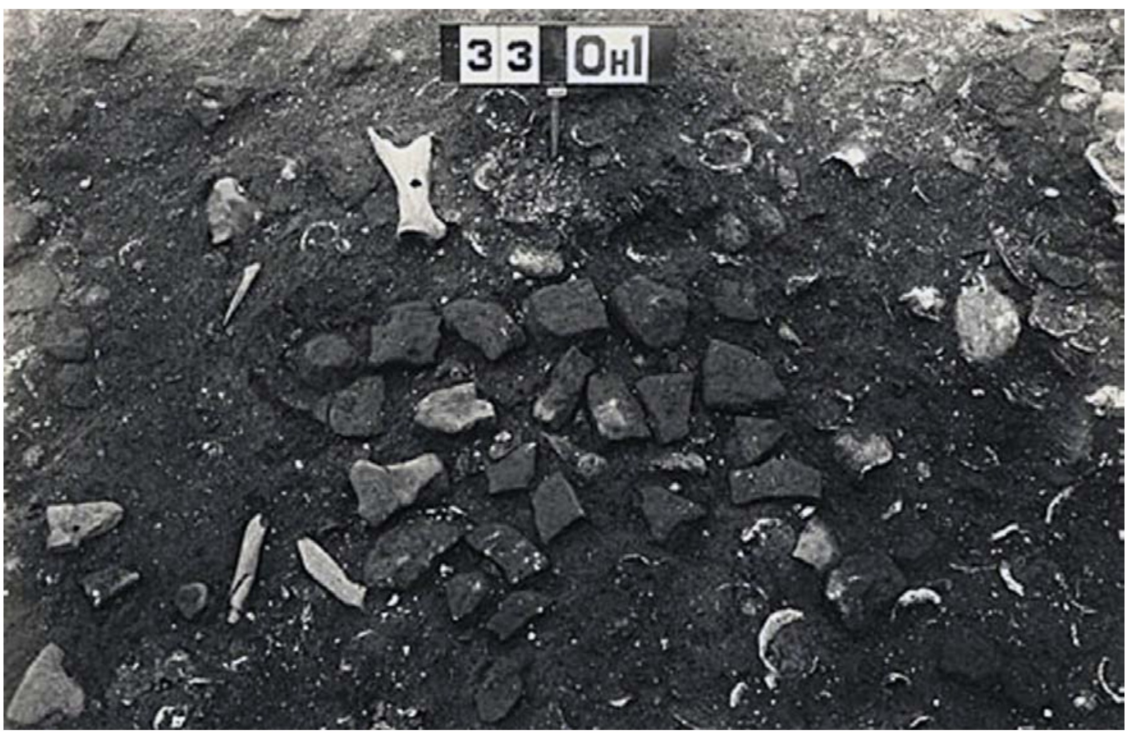


Figure 5-19. Close-up of Rock-lined Hearth Component of Feature No. 17 at Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

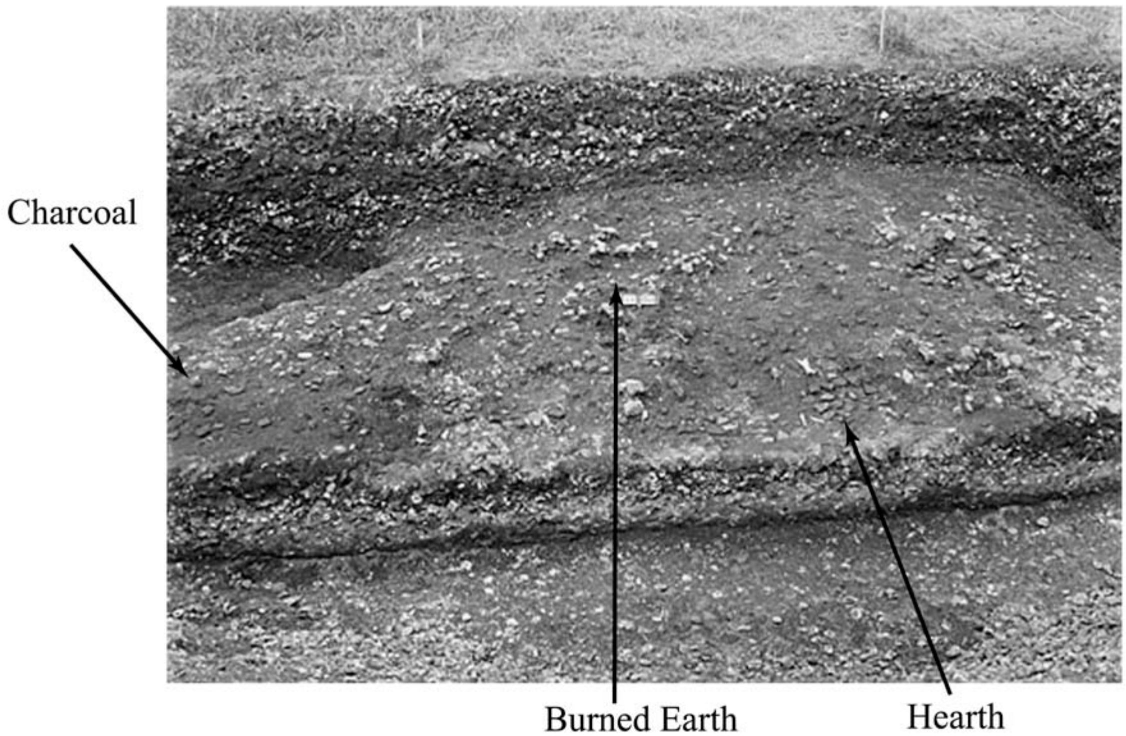


Figure 5-20. Chiggerville Feature No. 17 consisting of several Superimposed Zones. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature No. 17 was a little different from most of the fireplaces at Chiggerville. This feature was a large 200 ft^2 irregular area of FCR, charcoal, burned earth, and burned shells that may have been comprised of several superimposed features. Figure 5-19 depicts one portion of this feature consisting of a small burned area or hearth made up of a layer of intentionally arranged firecracked rocks lying in a shallow concave basin. A localized concentration of charcoal was found at one end of this feature and a patch of burned earth was found opposite the rock-lined hearth and charcoal zone (Figure 5-20).

Feature No. 52 (photograph 119Oh1 is labeled feature 53) consisted of a fireplace in a pit dug into the subsoil. This pit was lined with FCR and lay directly below Burial No. 119. Several large rocks were found at the base of this pit, suggesting it may have been a roasting pit (Figure 5-21). The feature data form does not indicate whether this pit exhibited evidence of *in situ* burning, however, so it is possible that Feature No. 52 was a refuse pit.

Figure 5-21. Chiggerville Feature No. 52, a possible Roasting Oven. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Table 5-4. Locations and Dimensions of Other Features at the Chiggerville Site.

Feature No.	East Grid (metric)	North Grid (metric)	Elevation (metric)	Length (ft)	Width (ft)
1	354.8	325.4	29.78	1	1
5	349.9	329.6	29.64	1.3	1.1
26	339.4	311.7	28.93	2	2
33	339.3	314.6	29.52	0.8	0.8
41	347.3	319.7	29.54	0.7	0.5
42	335.3	321.4	29.95	0.7	0.4
44	348.5	315.3	28.88	3.5	2.8
51	330.1	309.8	28.68	3.2	2.6

Features that could not be classified as 'fireplaces' are tabulated in Table 5-4. Feature No. 1 is a small hearth consisting of a layer of orange and red burned earth. This feature was once larger than the 1 x 1 ft dimensions recorded by the WPA but had been truncated by the plowzone. Feature No. 5 was a roughly circular layer of gastropod shells found within the shell midden.

Figure 5-22. Chiggerville Feature No. 44, a Rock Pile of Unknown Function. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature No. 26 was a unique feature consisting of a large pile of sandstone overlying a charcoal lens (Figure 8-5). This pile was contained within the shell midden and was placed between Burial Nos. 31 and 32, although its relation to these burials is unknown. Feature No. 44 was a smaller pile of rocks, some of which were FCR (Figure 5-22). Some burned shells were found in association with these rocks and several fragments of human bone were found in the midden around and above the rocks.

Whether the human remains and burned shells were related to the function of this feature is unknown.

Figure 5-23. Chiggerville Feature No. 33, a Cache of Debitage and Chipped Stone Objects. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature Nos. 33 and 42 were caches of chipped stone objects. Feature No. 33 (Figure 5-23) contained several large pieces of debitage that were assigned field specimen numbers (FS #s 773-791) but that were either discarded or not catalogued as from this feature by the WPA museum staff. Also included in this cache were two Ste. Genevieve chert bifaces (Cat. #s 608 and 1197). Feature No. 42 was recorded as containing five pieces of unmodified 'gray' chert. Four of these objects are listed in the WPA catalogue and consist of two amorphous cores (Cat. #s 1340 and 1343) and two flake tools (Cat. #s 1341 and 1342), all of Ste. Genevieve chert.

Figure 5-24. Chiggerville Feature No. 41, a Mortar and Pestle. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Feature No. 41 was either a mortar and pestle cache or an abandoned activity area consisting of these two objects. The mortar (Cat. # 1469) was missing at the time of this study and so could not be analyzed. The pestle (Cat. # 1830) is a conical limestone pestle that is pitted at the distal end. The mortar was found lying on edge with the pestle located adjacent to the mortar's concave working surface (Figure 5-24).

Feature No. 51 was a refuse pit dug into the subsoil beneath the shell midden. This feature contained sandstone, shell, and dark midden.

The 2009 Excavations at Chiggerville

The 2009 excavations at Chiggerville began on May 10 and continued through May 31. The field crew for this work consisted of the author, George Crothers, and Shawn Webb, an undergraduate student from the University of Kentucky. The first task upon arriving at the site was to re-establish the grid used by Crothers, Watson, and Stein to survey the site in 2002. Four datum points were established by Crothers in 1999, three of which were set with nails along the edge of the agricultural field containing the site. The fourth datum was a temporary point located at the top of the midden mound. All three permanent datum points were relocated visually and with the use of a metal detector and the original grid re-established. Datum A is located at grid coordinate N1000/E1000 (GPS – latitude 37^{o}14’18.6”N, longitude 86^{o}56’28.8”W).

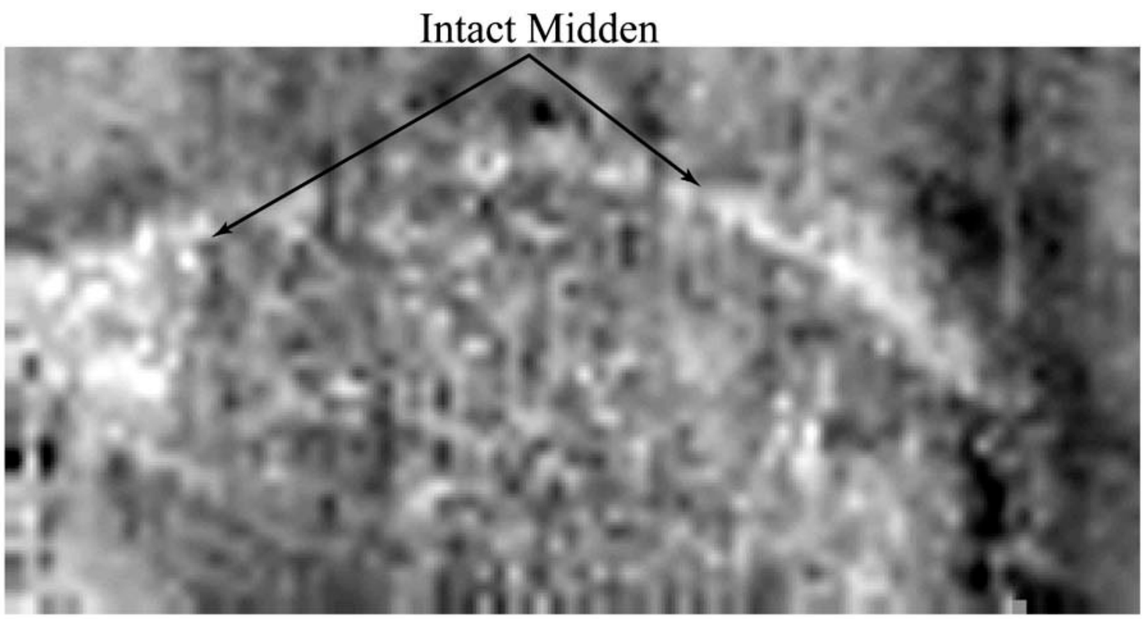


Figure 5-25. Conductivity Map depicting Areas of Intact Midden. Image provided by George Crothers.

Once the grid was re-established, it was possible to begin systematically coring areas for evidence of intact shell midden. This task was facilitated by the 2002 conductivity data, which Crothers was able to reprocess using Geoplot software in 2009. Although originally difficult to interpret due to differences in survey conditions from one grid to another, the newly processed data suggested the presence of intact midden at the western and northeastern edges of the site (Figure 5-25). Three coring transects were established to investigate these deposits. Transect 1 ran from N995/E975 to N999/E960 in the western portion of the site and Transects 2 and 3 ran from N995/E1025 to N1005/E1027.75 and N999/E1020 to N1010/E1022.75 in the northwestern portion, respectively (Figure 5-26).

1.

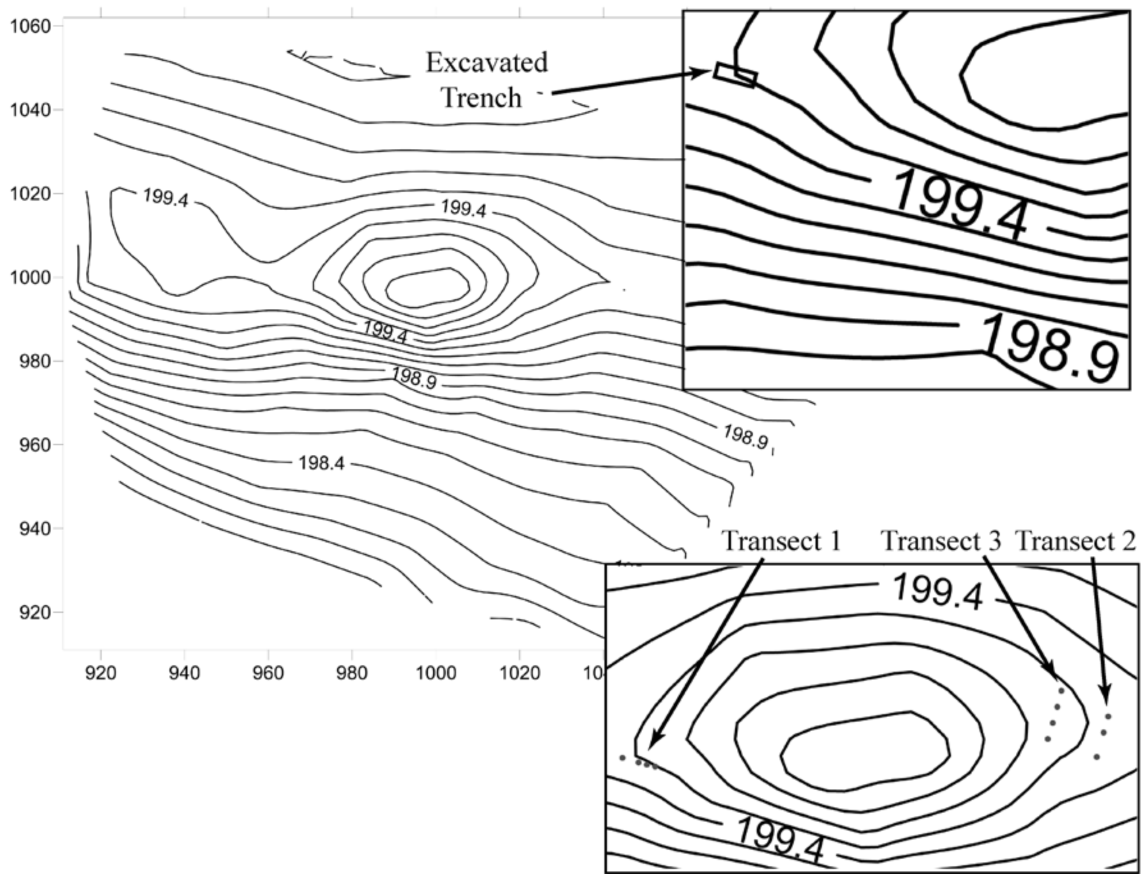


Figure 5-26. The 2009 Topographic Map of Chiggerville with Insets depicting Locations of Coring Transects and the 1 x 3 m Excavation Trench. Units are in meters.

Transect 2 was placed in the northwestern portion of the site. The first core consisted of a dark brown shell free plowzone to a depth of 25 cm, followed by disturbed dark brown midden to a depth of 45 cm. Below this was a 13 cm transition zone before reaching a yellow brown sterile subsoil. The second two probes exhibited evidence of a

20 to 30 cm thick plowzone overlying what appears to be undisturbed shell-free midden containing large quantities of sandstone. In the second core, this midden continued to a depth of 81 cm and in the third probe to a depth of 71 cm before encountering subsoil.

Transect 3 was also placed in the northwestern portion of the site and consisted of four cores. The first two were likely placed in the WPA units since they consisted of 20 to 30 cm of plowzone over a dark brown disturbed midden containing shell. This disturbed midden continued to a depth of 49 and 57 cm, respectively. The third core contained intact midden, however, consisting of 25 cm of plowzone over 31 cm of intact dark brown shell-free midden before encountering subsoil. The fourth core consisted of 29 cm of plowzone over 44 cm of undisturbed dark brown shell-free midden.

Transect 1 consisted of four cores. The first was placed two meters from the beginning of the transect line and was expected to encounter disturbed midden based upon the data from the conductivity survey. This core contained 61 cm of relatively soft, disturbed shell midden over a soft, yellow brown silt loam with no structure. Probes placed at four and six meters along the transect encountered 23 and 26 cm of dark brown plowzone midden with no shell. Below these depths in both cores was a dark brown shell midden to a depth of 86 and 80 cm, respectively. The upper 25 cm of the yellow brown subsoil in the six meter probe was slightly darker than the lower subsoil, but this distinction was not noted in the four meter probe. Both the four and six meter cores were thought to have encountered intact shell midden deposits. A fourth core was then placed one meter between the two and four meter probes (three meters along the transect). This probe consisted of 28 cm of dark brown plowzone over 35 cm of disturbed brown mottled shell midden.

Three adjacent units were then placed 10 cm north of this transect and parallel to it, with the southeast corner of the trench beginning 10 cm north of the three meter core (Figure 5-26). The datum for these units consisted of a wooden stake located 10 cm above the ground surface in the center of the north side of the trench. The units were numbered Units 1, 2, and 3, with Unit 1 being the westernmost unit and Unit 3 thought to be entirely contained within the old WPA excavations. The goals of this placement were to 1) obtain a sample of intact shell midden from at least one and possibly two units and 2) to be able to locate and identify the edge of the WPA excavations in profile.

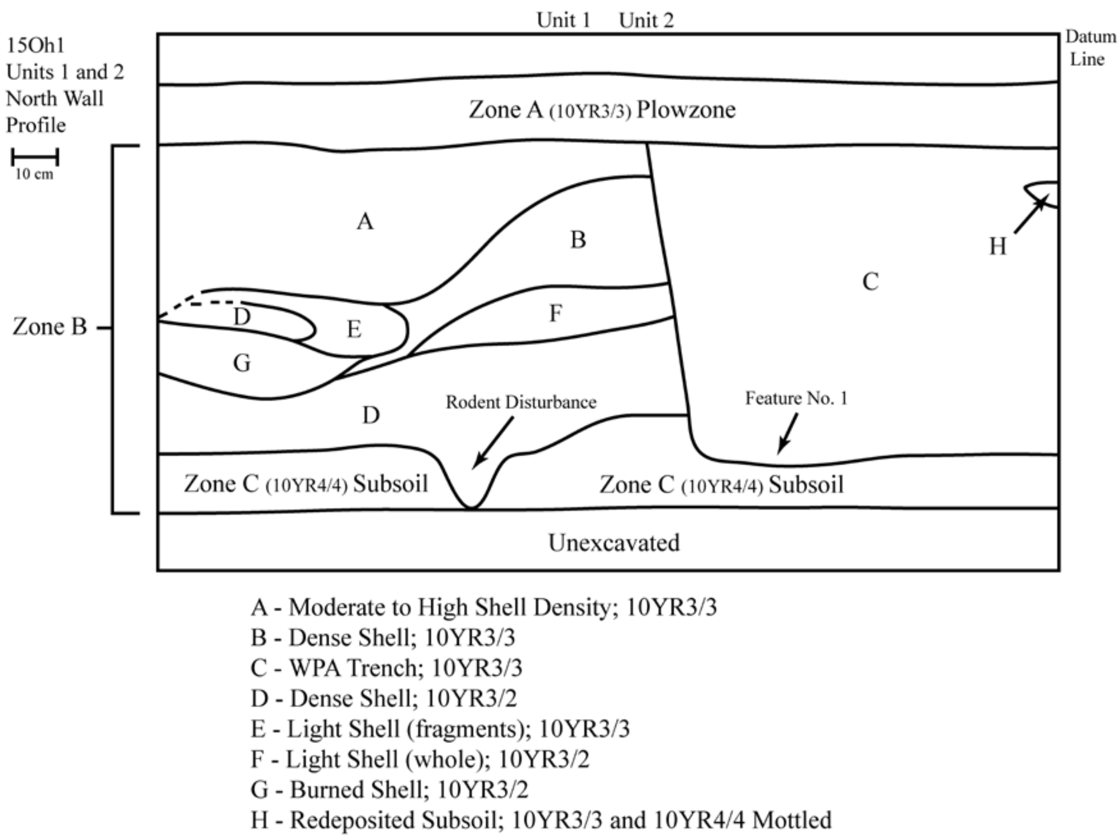


Figure 5-27. Units 1 and 2 North Wall Profiles.

Figure 5-28. Photograph of the North Profile of the 1 x 3 m Excavation Trench.

Excavation of the three meter long trench began by stripping off most of the plowzone (Zone A). This consisted of removing approximately the upper 15 cm of all three units as a single zone. This material was dry screened on site through ¼” mesh. Shell density was low in the upper 15 cm but increased discernibly below this. Below Zone A, shell midden (Zone B) in all three units was excavated separately and in six 10 cm levels. Below the shell midden was a dark yellowish brown silty clay loam (Zone C). Upon completing the excavation of the trench, it became apparent that the edge of the WPA trench extended across Unit 3 and most of Unit 2 and that both of these units were largely disturbed (Figures 5-27 and 5-28). As a result, detailed discussion of the stratigraphy at the site will focus on the undisturbed Unit 1.

Material from the disturbed Unit 3 was dry screened on site through ¼” mesh, while all material from Zones B and C of Units 1 and 2 was bagged in garbage bag-lined feed sacks and processed by wet screening. Since the midden from Unit 2 was primarily disturbed, wet screening consisted of separating ½” and ¼” fractions. Material from Unit 1 was screened through ½”, ¼”, and ⅛” mesh in order to maximize recovery; however, the ⅛” mesh fraction has not been sorted and is not included in the tabulations or discussion below. Charred nutshell submitted for radiocarbon dating of Levels B2 and C1 were both selected from the 1/8” mesh fraction from Unit 1. A 25 x 25 x 10 cm flotation sample was processed from the southwest corners of Units 1 and 2. These samples were collected beginning with Zone B Level 1 in Unit 1 and Zone B Level 2 in Unit 2. The flotation sample for Unit 1 Zone C Level 2 was collected as a bulk sample from the waterscreen bags.

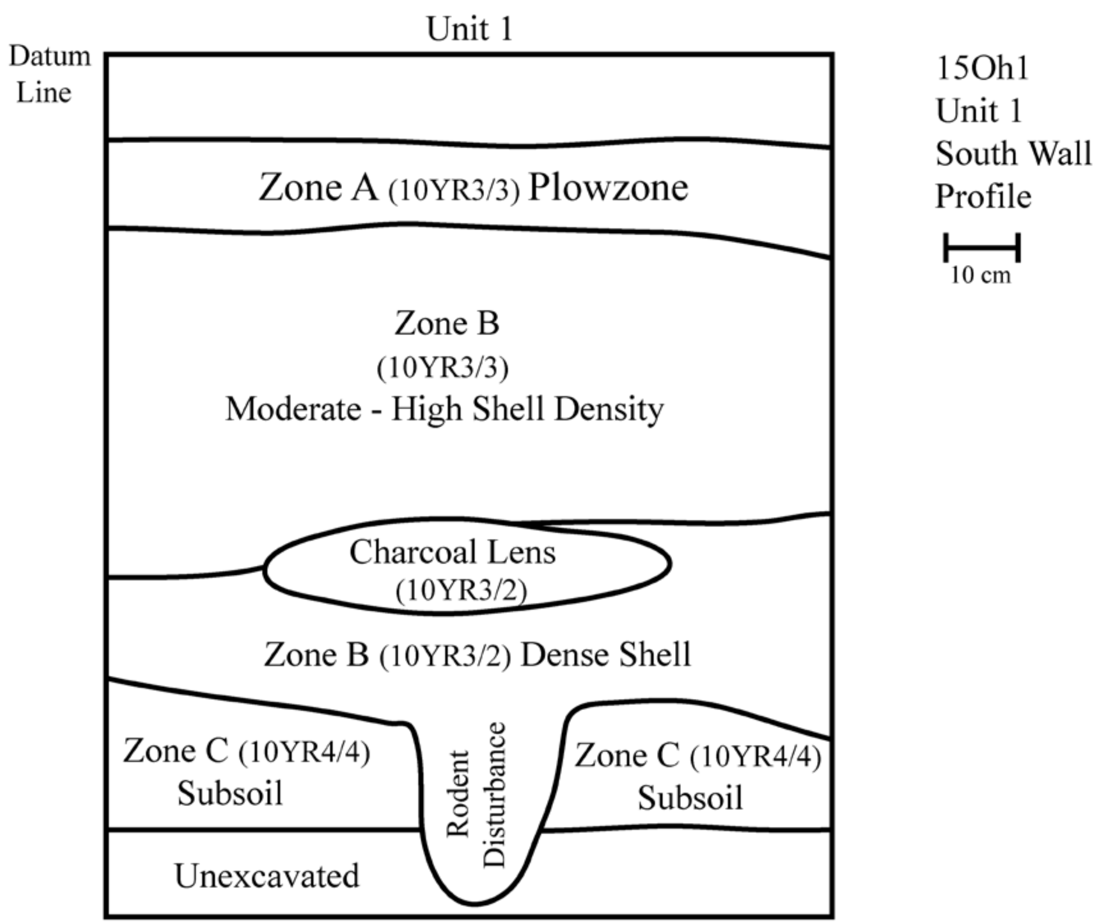


Figure 5-29. Profile of Unit 1 South Wall.

Figure 5-30. Photograph of the South Profile of Unit 1 depicting the Charcoal Lens and Rodent Disturbance.

Figure 5-31. Photograph of the East Profile of Unit 3 depicting Lens of Redeposited Subsoil.

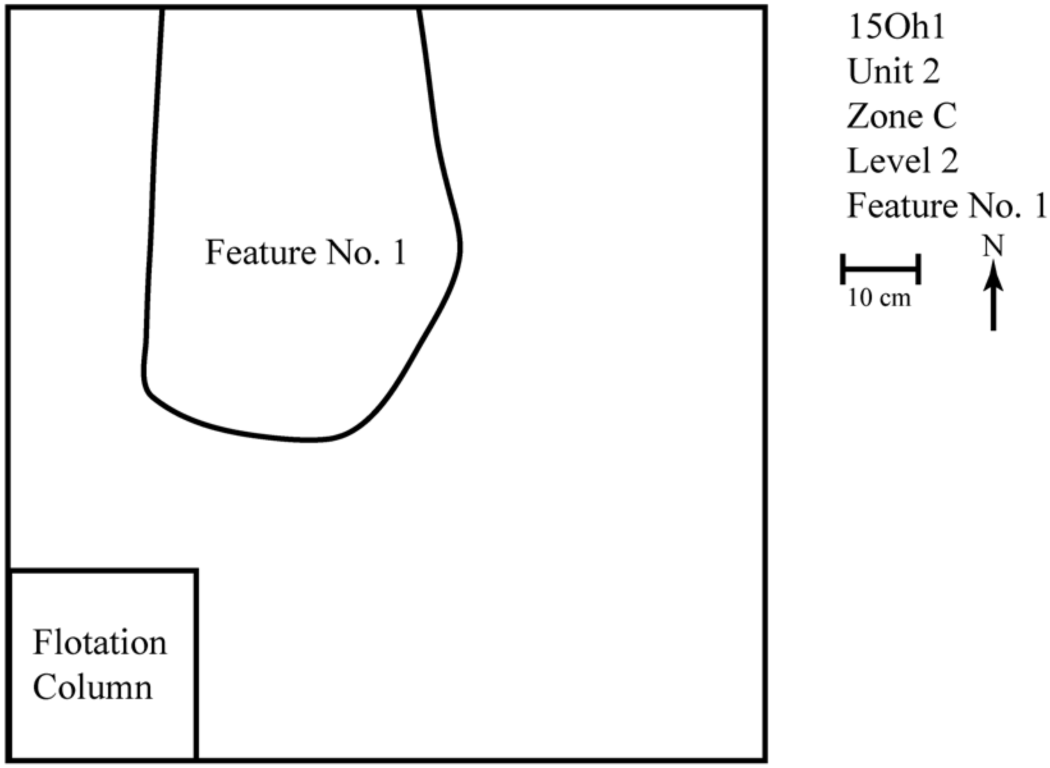


Figure 5-32. Plan View of Feature No. 1.

While excavating it was difficult to discern the boundary of the disturbed and undisturbed shell midden in the three units. Zone B consisted of shell of varying degrees of density encased by a 10YR3/2 very dark grayish brown silt loam midden sediment. That Unit 1 was undisturbed was indicated by the presence of concentrations of fragile burned shell in some levels (Figures 5-29 and 5-30), and the fact that Unit 3 was disturbed was confirmed by the presence of a thick layer of 10YR4/4 dark yellowish brown and 10YR3/3 dark brown mottled redeposited subsoil that pinched out to the west in the unit (Figure 5-31). Portions of Unit 2 were felt to be undisturbed throughout the excavation, and a shallow rectangular band of 10YR3/2 very dark grayish brown silt loam containing shell found at the base of Zone B in Unit 2 was initially interpreted to be a historic feature (Figure 5-32). However, upon completion of the trench, it became apparent that this feature was actually a dip in the edge of the WPA trench (Figure 5-27). Artifacts recovered from Units 2 and 3 are listed in Appendix 1.

The undisturbed stratigraphy in Unit 1 was slightly more complicated. In general, Zone B consisted of 10YR3/2 very dark grayish brown silt loam. As can be seen in Figures 5-27 through 5-30, the upper portion of Zone B consisted of shell midden with a moderate to high density of shell. Beginning in Zone B Level 3, concentrations of charcoal began appearing in the shell, particularly in the southwestern corner of Unit 1. A bulk flotation sample of this charcoal concentration was collected from this level.

The densest concentration of charcoal was in the form of a charcoal lens in Zone B Level 5 (Figures 5-29 and 5-30). Adjacent to this charcoal lens was a zone of intact burned shell, indicating that the charcoal was associated with a thermal feature that had been placed atop the layer of dense shell in Zone B Levels 5 and 6 (Figure 5-27 and 5-28). It is likely that this thermal feature represents a hearth and activity area built atop the dense shell zone. This dense shell zone continues under much of the site (see discussion of the WPA excavations above) and may indicate two distinct periods of site utilization and midden accumulation throughout the Late Archaic period. The silt loam matrix in these lower, dense levels of Zone B is also slightly more intense in color, shifting from 10YR3/2 very dark grayish brown to 10YR3/3 dark brown.

A rodent disturbance was indentified at the base of Zone B in Unit 1. This non-cultural feature consisted of a rounded zone of mottled subsoil and shell that penetrated below Zone C Level 2. This rodent disturbance is barely discernible in the shell midden profile and indicates the level of unobservable bioturbation affecting the midden matrix.

It is likely that this and other similar disturbances account for the presence of small pottery sherds throughout all levels of the 'undisturbed' shell midden (Appendix 1).

Below the dense shell midden of Zone B Levels 5 and 6 was the subsoil (Zone C). Zone C Level 1 consisted of a transition of mottled 10YR4/4 dark yellowish brown silty clay loam and 10YR3/3 dark brown silt loam. This zone represents the original land surface upon which the Chiggerville midden accumulated. Zone C Level 2 consisted of non-cultural 10YR4/4 dark yellowish brown silty clay loam. The majority of the objects recovered from this level are small sediment concretions cemented with calcium carbonate leached from the overlying shell midden. The small numbers of artifacts from this level are attributed to downward migration resulting from post-depositional site formation processes like bioturbation. Artifacts from Unit 1 are summarized by level in Appendix 1.

As can be seen from the tables in Appendix 1, all diagnostic chipped stone artifacts recovered during the 2009 excavations at Chiggerville were Late Archaic in age. The presence of a Late Prehistoric component at the site is confirmed by the large numbers of very small fragments of shell tempered pottery found in the plowzone and distributed throughout the midden matrix. The small size of these sherds supports the hypothesis that the plowzone consists at least partially of a Late Prehistoric component, artifacts from which were redistributed throughout the midden through a combination of cultural and non-cultural processes. Unlike some sections of the site identified by the WPA, the shell midden in Unit 1 appears undisturbed by Late Prehistoric activities, indicating that the sherds found throughout the midden in this unit are the result of the downward migration of small artifacts due to bioturbation.

Diagnostic Late Archaic artifacts from the site consist of seven Saratoga cluster hafted bifaces and a single unidentifiable Late Archaic projectile point fragment (Appendix 1). Unfortunately, all but two of these diagnostics came from disturbed surface, plowzone, or WPA contexts. The two Saratoga Cluster points found in Unit 1 were both contained in the dense shell midden of Zone B Level 6, however, indicating that the earliest intensive use of the site was during the Late Archaic period. This is confirmed by two radiocarbon dates obtained from nutshell from the ⅛” mesh waterscreen fraction from Zone B Level 2 and Zone C Level 1. These dates are 4610 +/-70 (ISGS #6582; $\delta^{13}C = -25.4\%_o$) and 4530 +/-70 (ISGS #6583; $\delta^{13}C = -25.2\%_o$) uncalibrated radiocarbon years before present, respectively. These dates place the age of the Chiggerville shell midden in the Late Archaic period and indicate that Chiggerville is between 1000 and 2000 years younger than the Baker site.

Although these most recent excavations at Chiggerville have provided much needed information pertaining to the age of the site and the composition of the shell midden, much additional work needs to be done to better understand prehistoric site use and to better contextualize the WPA excavations. Additional study of data obtained during the 2009 excavations should include analysis of the faunal and floral remains recovered from the site, a more detailed study of the artifacts and ecofacts recovered from both the screened and floated fractions, analysis of the ⅛” mesh fractions, and geoarchaeological analysis of soil samples recovered from the site in order to better characterize the composition and structure of the midden matrix. Additionally, more excavation is required in order to test the integrity of the dirt/rock midden identified in the northwestern portion of the site, and trenches should be placed along the north, south, and east sides of the midden to locate the edges of the WPA excavations so that these older blocks and trenches can be related to the more limited but more detailed recent excavations.

Chapter Six

Analysis of Organic Implements and Ornaments from Baker and Chiggerville

It is unfortunate that the majority of Archaic period archaeological sites in eastern North America preserve only those artifacts that were manufactured from stone. The presence of decomposing shell at shell midden sites like Baker and Chiggerville, however, provides unique soil conditions that are amenable to the preservation of bone and antler tools. The degree to which this lack of preservation at most Archaic sites biases our interpretations of prehistoric lifeways is highlighted if one considers that of the 56,487 catalogued artifacts from the five largest WPA excavated sites in the Green River region, 23,614 (41.8 percent) are modified bone, antler, and tooth objects. The proportion of bone tools increases to 52.4 percent when the large numbers of shell beads are excluded from this total. Remembering that no fiber, leather, or other perishable materials are preserved at any of these sites further enhances the importance of the bone and antler assemblages.

Bone, antler, ivory, and horn have long been important media for the manufacture of tools and ornaments of various kinds. The widespread use of these materials is likely owed to the fact that they 1) were a common byproduct of hunting and butchery, 2) exhibit high elasticity and are highly resistive when subjected to various compressive and bending forces (Albrecht 1977), and 3) can be easily shaped into a variety of forms with minimal effort. Like stone, bone and antler are reductive media, but, like ceramics, they are a plastic technology that can be manipulated to express a wide variety of messages. In this chapter, I provide a brief discussion of the use of bone and antler as media, describe the bone and antler tools at the Baker and Chiggerville sites, then evaluate the relative complexity of these two sites by analyzing the degree to which bone and antler tools at the two sites were curated and and/or used as media for the dissemination of social messages. Additionally, I evaluate the degree to which Baker and Chiggerville are historically related by comparing the technological styles recorded in the manufacturing process used to produce bone and antler tools at these two sites.

The Use of Bone and Antler as Raw Materials

Bone, antler, ivory, and horn have been utilized by hominins as raw materials for the manufacture of tools since the Lower Paleolithic (2.5 million to 300,000 B.P.). Clark (1977) provides an excellent summary of bone tool use by these early human ancestors, observing that the majority of early hominin organic technologies are found on northern sites, likely owing to the lack of available hardwoods used in the manufacture of similar objects in tropical zones. The influence of differential preservation on these distribution patterns is unknown, but not likely a factor in Clark's (1977) study since unmodified bones were present at many southern sites. Lower Paleolithic bone tools from Olduvai and contemporaneous sites were largely manufactured via direct percussion or consist of expediently utilized bones and splinters (Clark 1977). Recently, D'Errico and Backwell (2009) have employed detailed 2D and 3D microtopographic scans of pointed and spatulate bone implements from Sterkfontein, Swartkrans, and Drimolen in southern Africa to confirm the use of these objects as digging implements by *Paranthropus robustus*. Updated studies to test Clark's (1977) distributional patterns are currently unavailable.

Shaped bone implements are uncommon during the Middle Paleolithic but have been recovered from Acheulean sites like Choukoutien, Cagny, Terra Amata, Grotte du

Lazaret, and Grotte des Ours (Clark 1977). This initial use of bone, antler, ivory, and horn as raw materials climaxes during the Upper Paleolithic, however, as indicated by their use as representational art (e.g., McCoid and McDermott 1996) and the large assemblages of well-studied organic implements from sites like Ksar Akil in Lebanon (Newcomer 1974). Among the most thoroughly documented uses of bone and antler by Upper Paleolithic groups is Heidi Knecht's (1991, 1993) study of organic projectile technologies at Aurignacian and Gravettian sites in France, Germany, and Belgium. The use of bone and antler continued through the Mesolithic in Europe and the Near East (e.g., Campana 1989, David 2003) and continues to the present day.

Bone, antler, and ivory implements also are periodically recovered from the earliest Paleoindian sites in North America. The most common Paleoindian organic implements are uni- or bi-beveled rods that are variously interpreted as projectile points or foreshafts (Frison and Zeimens 1980, Guthrie 1983, Tankersley 1994) and that have been recovered from a number of sites such as Blackwater Draw, Sheriden Cave, Agate Basin, Anzick, Richey-Roberts, Lindenmeier, Marmes Rockshelter, the Grenfel site in Saskatchewan, and from various locations in Florida, California, and Alaska (Moore and Schmidt 2009:59). Moore and Schmidt (2009) summarize those Paleoindian organic implements that have been reported in the literature. This list of tool types is likely to markedly expand once assemblages from underwater sites in Florida are more thoroughly reported (e.g., Webb and Hemmings 2001). One important conclusion of Moore and Schmidt's (2009) comparative study is the fact that currently reported Paleoindian organic implements are quite distinct from Early Archaic bone and antler tools found at sites like Windover (Penders 1997, 2002) and Dust Cave (Goldman-Finn and Walker

1994), which are much more reminiscent of the later Archaic implements from Baker and Chiggerville reported herein.

Methods

Unfortunately, bone and antler tools as an analytical class have been under-theorized in eastern North American archaeology. One possible reason for this is that, due to preservational issues, these tools are rarely recovered in quantities comparable to stone tools. As a result, bone and antler tools "are often described and classified in a cursory fashion before being relegated to permanent storage" (LeMoine 1994:316). This is unfortunate given that bone and antler are well suited to stylistic messaging, and bone and antler tool forms might be hypothesized to have changed rapidly relative to more constraining stone media. The potential for bone tools to yield data pertaining to social group territories and interactions during the Archaic period in eastern North America is currently being examined by a small cadre of archaeologists (e.g., Jefferies 2004, Moore 2008a).

More refined theoretical approaches to the interpretation of bone tool forms and stylistic messaging requires firm empirical grounding. Unfortunately, the traditional classificatory approach to bone and antler studies in eastern North America has grouped artifacts into functional classes on the basis of shared forms (e.g., Webb 1974, Winters 1969). In some cases this approach was valid in that it was grounded in ethnohistoric analogy and use of the direct historical approach (e.g., Kidder 1932). However, use-wear analyses by Bader (1992) and others have demonstrated that the extension of typologies developed in the Southwest to eastern sites is problematic in that bone tools of similar forms were sometimes utilized for very different functional purposes. It is for this reason that more recent bone tool analysts (e.g., Campana 1989) have restricted initial morphological bone tool typologies to descriptive classes, basing functional interpretations on middle range microtrace studies and replicative experiments. The typology utilized in this study reflects these methodological advances.

Analysis of the Baker and Chiggerville bone and antler tool assemblages was divided into three parts. The first stage of the analysis consisted of dividing all objects from these assemblages into basic morphological types, varieties, and sub-varieties using a typology initially developed by Campana (1989), Bader (1992), and White (1990, 2005) and expanded for this study. For purposes of convenience, antler and bone objects are described and discussed separately below with artifacts from each site compared immediately following the description of each artifact class. This facilitates direct comparison of the specific artifacts from each assemblage. Comparisons of the antler and bone assemblages as wholes are made at the end of each of these larger sections.

The second stage of this study involved a low power (10 to 30x) microtrace analysis of a small sample of each artifact class from both sites. No burial goods were examined for microtrace evidence due to special curation procedures that restrict extended access to these tools. All non-burial artifact sub-varieties containing fewer than ten specimens were examined microscopically at a variety of angles using incident light. A 30 percent sample of all artifact sub-varieties containing ten or more specimens was selected for microscopic analysis using random number generating software (www.random.org). Specific well-preserved or unique specimens were sometimes selected in addition to those chosen via random number selection. These items include sub-categories defined during use-wear analysis, objects with special characteristics, and objects of special interest. In any case, a minimum of 30 percent of all sub-varieties was analyzed.

During sampling, if 30 percent of the total number of artifacts in a particular sub-variety resulted in a fraction, the number of items selected was rounded up. For example, If 48 objects belonged to a particular sub-variety, 30 percent of these objects would require a sample of 14.4 tools. In this case, 15 objects were randomly selected for study. To determine which particular objects were included in the sample, all catalogue numbers from each sub-variety were ordered from lowest to highest and then assigned a number (1 through ‘x’ with ‘x’ being the total number of classified objects of that sub-variety). These numbers were then used to randomly generate the sample.

It quickly became apparent that low power microscopy was insufficient for observing most use-wear trace. As a result, this portion of the study concentrates on the more readily observable manufacture microtrace data recorded during this analysis, with available use-wear microtrace included in descriptions where applicable. Inter-site comparisons are based upon differences in manufacturing strategies rather than artifact use.

Microscopic Use-Wear Analysis

Microscopic use-wear analyses gained popularity after Semenov’s (1964) classic study was first published in English. As is the case with lithic use-wear analysis, bone tool use-wear studies, in conjunction with replicative experiments, can only rarely induce the specific functions of implements. Nevertheless, analyses of use-wear polish and striations (in addition to breakage patterns and other indicators) can identify the direction in which a given implement was utilized and a range of possible activities. Both

Campana (1989) and Olsen (1984) suggest pre-treating artifacts with acetone or alcohol prior to conducting microtrace analyses to remove any oily residues, but Bader (1992:202) did not notice any "appreciable difference in visibility" when pre-treating artifacts from KYANG so this processing step was not conducted in this study. For additional discussion of the theoretical and methodological underpinnings of bone tool use-wear analyses see Bader (1992), Campana (1989), and Olsen (1984).

When observed, four different kinds of use-wear were recorded as part of this study: polish, striations, chipping and fractures, and breakage patterns. Use-wear polish is a special kind of abrasion where "a reflective surface is created by abrasion on a very small level" (LeMoine 1994:320). Polish develops when an abrader removes small particles, sometimes the size of individual molecules, from the surface of an object and can develop on bone tools either through intentional smoothing of the bone during manufacture or through subsequent use of tools against softer media (e.g., leather and skins). Use-wear polish can typically be distinguished from intentional polish through microtrace analysis in that use-wear striae tend to overlay intentional polish (White 1990:33). According to Campana (1989:8), surface polish is "largely the result of friction of the implement's surface with a suitable polishing agent, which may be a worked material such as hide or the skin of the hand of the user. In many cases such polishing is probably aided by surface chemical reactions although these have not yet been studied. Whatever the agency, the polish is usually not uniformly distributed over the tools [sic] surface but is deeper in areas of heavy friction and shading to nonexistence in other areas." The degree of polish can indicate the intensity and location of greatest use. This polish was coded, following Bader (1992:218-219), on a numerical scale of 1 to 5, with 5 representing a high sheen and well developed polish. However, Bader's (1992) coding system was found to be heavily biased by differential preservation, the surface contour of the bone, and the size of the polished area. As a result, these data are of limited analytical value and are not discussed further.

Use-wear striations consist of scratches, scores, and gouges of varying sizes and are typically utilized to indicate the direction of movement of an implement during use. As Campana (1989:9) points out, nearly all bone tools exhibit randomly oriented scratches as a result of abrasion or post-depositional processes. Microtrace analyses, therefore, tend to focus on distinct patterns of striae, particularly those associated with use-wear polish. The specific association of striations with particular locations on artifact forms must be considered on an individual basis within a given assemblage, but, in general, rotational and longitudinal striations radiating from tips are associated with piercing and perforating activities while transverse and oblique striae located on tool shafts are associated with basketry, weaving, and matting activities (Bader 1992, Campana 1989). Use-wear striations were rarely recorded during this study, likely due to the use of low power microscopy and lack of pretreatment of specimens. As a result, use-wear striations are described when applicable but not systematically analyzed.

Chipping and fracturing of sharp tips and edges are typically associated with high impact activities such as use as projectiles, chisels, and axes (Campana 1989). Additionally, other kinds of breaks are expected to regularly recur when the result of consistent patterns of use (Bader 1992). Both chipping and fracturing and breakage patterns were recorded and are evaluated herein.

Microscopic Analysis of Manufacture Trace

Two primary bone tool manufacturing techniques can be discerned through microtrace analysis—lithic shaving and abrasion (other techniques such as drilling and incising are readily discernible macroscopically and are discussed, where applicable, in the descriptive sections that follow). According to Campana (1989), antler and bone are most easily worked when softened by soaking (boiling) in water, but fresh bone is also easy to work without pretreatment. Dry bone tends to become brittle and is therefore difficult to work. It is important to distinguish between initial sharpening and resharpening microtrace since different manufacturing techniques may be used for each.

Bone artifacts produced by shaving or whittling with lithic tools tend to be rather irregular in shape and have an undulating profile. Oftentimes, these tools exhibit transverse chattermarks and series of parallel striations (Campana 1989, Newcomer 1974). According to Campana (1989:31), "If the worked piece is cylindrical or conical in shape several of these striations can be seen running down its length. These will be cut across by other sets of striations left by subsequent strokes. The striations are rarely straight, but rather tend to undulate back-and-forth due to lateral tool movements. Shallow, rapid strokes with light pressure produce fine striations which are nearly straight, while deeper, slower movements produce more pronounced undulations." In cross section, these grooves tend to have flat or shallow curving bottoms and a glossy appearance (Campana 1989). According to Newcomer (1974:149), these striations are "made by irregularities in the stone tool's edge, which may be present before the tool is used (through irregular retouch), or may develop as the tool is used and its edge becomes chipped."

Replicative experiments with abrasive techniques (using sandstones of varying coarseness) were found to be much more efficient in producing sharp tips and more parallel-sided bone implements. Both cross grinding and axial grinding can be utilized to quickly reduce bone. Cross grinding tends to leave "clear-cut flats or facets, often with a distinctly angled corner between them" and "clear, parallel striations running across the facetted areas," whereas axial grinding produces "smooth, regular curves" with criss-crossing groups of parallel striations (Campana 1989:33-34). Striations on abraded bone tend to be finer and more regular than those found on bone implements manufactured with flint tools (Campana 1989).

The third stage of analysis consisted of collection of detailed metric and non-metric data from every artifact. Basic metric data included lengths, widths, thicknesses, and weights, but other variables were recorded as applicable. All measurements are in millimeters and grams unless otherwise stated. Each of these variables is described below. Basic taxonomic and taphonomic data were also collected, but since the author is not a zooarchaeologist, the former are of little analytical value. The latter are discussed when taphonomic factors are felt to influence interpretations. Overall, both assemblages were comparable in that they yielded a high percentage of bone and antler tools in good to excellent condition.

The only systematic bias stemming from taphonomic factors observed in these assemblages is the lack of recovery of very small or highly fragmented objects by the WPA excavators. Since recovery methods at neither site included screening, it is likely that this bias is highly influential on the total number of artifacts recovered and, potentially, resulted in the systematic under-representation of certain small tool forms.

What follows is a test of this hypothesis using a Terminal Archaic bone tool assemblage recovered from the Firehouse site (Site 12D563) in Dearborn County, Indiana.

The Firehouse Site is an upland dirt/rock midden of the Ohio River valley Riverton Culture. No radiocarbon dates have been submitted for this site, but based on comparisons with sites elsewhere in the region, it is likely that the site is slightly younger than Chiggerville. Like Baker and Chiggerville, bone tool preservation at Firehouse was good to excellent and a total of 320 bone, antler, and modified tooth objects were recovered. Table 6-1 provides a comparison of descriptive statistics for weights of objects from Firehouse, Baker, and Chiggerville. Weight was chosen as the basis for comparison of these assemblages since lengths, widths, and thicknesses were not recorded for broken objects.

Table 6-1. Descriptive Statistics for Weights of Objects from Firehouse, Baker, and Chiggerville.

		Weights (in grams)					Quartiles		
Site	**Count**	**Min**	**Max**	**Mean**	**Median**	**Mode**	**25**	**50**	**75**
Firehouse	320	<0.1	274	5	1	0	0	1	3
Baker	533	0.5	443	16	8	3	3	8	19
Chiggerville	1144	0.4	108	9	5	2.9, 3.5	3	5	11

As can be seen from this table, the objects recovered from the Firehouse site are, on average, lighter (and presumably smaller) than those recovered from either Baker or Chiggerville. This suggests a systematic bias in recovery methods, with the Baker and Chiggerville assemblages biased against objects lighter than about 0.5 grams. Table 6-2 provides counts of objects from Firehouse weighing less than 0.5 grams. As can be seen, the majority of the smaller artifacts from Firehouse are antler and bone implement fragments and broken pointed implements. The only objects weighing less than 0.5

grams that were large enough to yield any metric data were 8 broken pointed implements tips. Overall, then, the comparative sample from Firehouse lends support for the hypothesis that very few artifact classes are under-represented at Baker and Chiggerville due to the lack of screening and that the absence of those under-represented objects has a minimum impact on the metric component of this analysis. Given their small numbers, fishhooks, bone tubes, and modified teeth are considered the most likely categories to be significantly biased due to the sampling procedures employed by the WPA.

Table 6-2. Counts of Objects from Firehouse Weighing less than 0.5 grams.

Object	**Count**
Antler Implement fragment	7
Bone Implement fragment	39
Fishhook Debitage	3
Fishhooks	2
Bone Tube fragments	6
Cut Bone (Butchery)	6
Bone and Antler Tool Production Debitage	4
Modified Teeth	2
Pointed Implement	21
Spatulates	2
Total	92

Weights were collected to the nearest tenth of a gram using an O'Haus digital scale. All metric data were collected to the nearest millimeter using Mitutoyo digital calipers. Maximum lengths, widths, and thicknesses and widths and thicknesses at object mid-sections were recorded for all objects (Figure 6-1). Maximum lengths were recorded with the object held in a vertical plane regardless of anatomical orientation or the presence of divergent tines. Maximum widths and thicknesses were taken at the widest point perpendicular to the maximum length in the X and Z axes, respectively. So as to best reflect the capacity of objects to pass through a material, thicknesses reflect the cross-section of the bone or antler tool regardless of the presence of curvatures or irregularly shaped cross-sections. These measurements are most useful in analyzing bone pointed implements that are relatively straight and uniform in their orientation. The measurements that were recorded for antler objects are likely to be difficult to replicate due to the degree of subjectivity involved in determining what appropriately reflects a 'vertical plane'. Furthermore, the shape of these objects is such as to suggest that the relationship between size and function is more complicated than simple length, width, or thickness measurements can reflect. As such, additional measurements that are felt to better characterize the overall form and utility of the objects were sometimes obtained. These additional measurements are described along with each artifact class below.

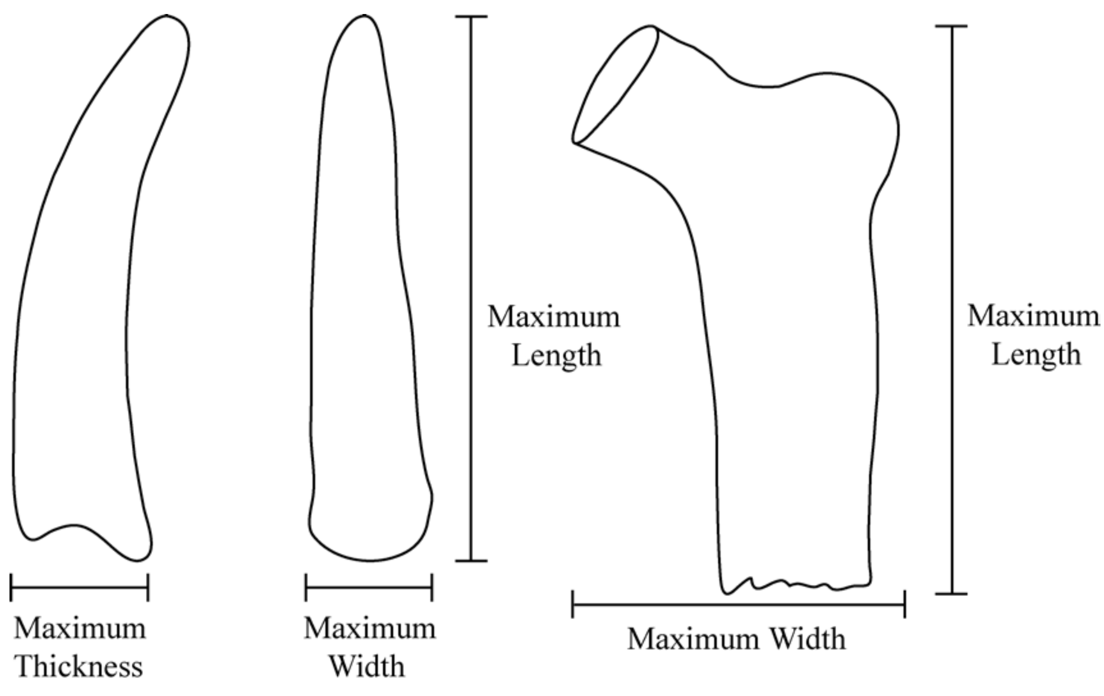


Figure 6-1. Illustration of the Method for Obtaining Maximum Lengths, Widths, and Thicknesses of Irregularly Shaped Objects.

Antler Tool Production at Baker and Chiggerville

A total of 52 bone, antler, and modified tooth catalogued objects from Chiggerville and 21 from Baker were missing at the time of this study and are not included in the analysis reported herein. Remaining in the WPA collection are 435 antler objects from the Chiggerville site and another 180 artifacts from Baker. Included among the objects from Chiggerville are 156 pointed implements, 4 hooked implements, 6 hollow/reamed implements, 11 blunted implements, 182 pieces of debitage, 33 unidentifiable antler implement fragments, 4 pieces of cut antler, and 39 unmodified antlers or antler fragments. The Baker antler assemblage consists of 27 pointed implements, 22 blunted implements, 84 pieces of debitage, 46 unidentifiable antler implement fragments, and 1 unmodified antler fragment. The unmodified antlers were classified as tools by the WPA but were not found to exhibit any microscopic or macroscopic evidence of use or modification during this study. All other artifact categories are discussed and varieties and sub-varieties identified and described individually below.

Pointed Implements

Antler pointed implements include all artifacts with a single converging functional end (including those traditionally classified as awls, projectile points, and daggers). This definition can be problematic, however, since antler tines converge to a point naturally and can be "broken from the antler and put directly into service" (Kidder 1932:278). Unlike bone pointed implements, then, antler tines require microtrace for identification due to the degree to which polish and striations can develop naturally on antler tines as a result of animals scraping earth and vegetation. In her analysis of unmodified and archaeological antlers, Olsen (1989) noted that unmodified antlers tend to lack fine parallel striae and grooves found on antler tools. Furthermore, Olsen (1989:130) warned that the "presence of antler in an archaeological context does not alone constitute sufficient evidence that it was used as a tool because more antler may have been collected as raw material than was actually utilized, or because it was simply brought in with a deer carcass." Given this caveat, all weathered antler tines and broken tine fragments with no microscopic evidence of use or manufacture have been classified as 'unmodified' even though these objects may be tools whose use-wear traces have been obliterated or broken away.

Table 6-3. Antler Pointed Implements from Baker.

		Subvariety				
		UID	N/A	Proximally Grooved	Finished, Transverse Base	Total
Variety	UID	3	0	0	0	3
	Reamed, Pointed	3	0	1	3	7
	Longitudinally Asymmetrical, Blunted	0	15	0	0	15
	Longitudinally Asymmetrical, Pointed	2	0	0	0	2
	Total	8	15	1	3	27

Tables 6-3 and 6-4 provide a cross-tabulation of antler pointed implements by type and variety from Baker and Chiggerville, respectively. As can be seen, reamed pointed implements and longitudinally asymmetrical, blunted objects make up the two largest categories of antler pointed implements at both sites, followed by smaller numbers of longitudinally asymmetrical, pointed implements. Chiggerville also yielded small numbers of beveled tipped and longitudinally symmetrical, blunted objects. While 39

Table 6-4. Antler Pointed Implements from Chiggerville.

		Subvariety									
		UID	N/A	Proximally Grooved	Flanged	Finished, Transverse Base	Unfinished Base	Proximally Incised	Round Tip	Irregular Tip	Total
Variety	UID	36	1	0	0	0	0	0	0	0	37
	Reamed, Pointed	13	0	4	1	30	2	1	0	0	51
	Longitudinally Asymmetrical, Blunted	0	57	0	0	0	0	0	0	0	57
	Longitudinally Asymmetrical, Beveled Tip	0	3	0	0	0	0	0	0	0	3
	Longitudinally Asymmetrical, Pointed	0	0	0	0	0	0	0	6	1	7
	Longitudinally Symmetrical, Blunted	0	1	0	0	0	0	0	0	0	1
	Total	48	63	4	1	30	2	1	6	1	156

percent of the Chiggerville antler assemblage consists of pointed implements, they make up only 15 percent of the antler tools from Baker. This difference is largely owing to the higher frequency of reamed pointed implements at Chiggerville.

Reamed, pointed implements make up 26 percent of the Baker pointed implement assemblage and 33 percent of the total number of Chiggerville antler pointed implements (Figures 6-2, 6-46a-e). These objects are sharp to slightly blunted, conical tools that are typically classified as antler projectile points due to their reamed base (for insertion of the shaft) and straightened form. Antler projectile points of various forms (e.g., split-based and beveled) have been recovered in early Upper Paleolithic Aurignacian (ca. 36,000 to 26,000 B.P.) contexts in Europe, indicating that the use of antler as the raw material for projectiles has great antiquity (Knecht 1991, 1993). In eastern North America, including at the Baker and Chiggerville sites, these tools are typically manufactured from antler tines removed via the groove and snap technique.

Reamed, pointed implements from Baker and Chiggerville have been further sub-divided based upon the kind and degree of basal shaping. Most of these objects exhibit transverse bases that have been further modified into a variety of base forms (Figure 6-2f-k). Others exhibit grooves running circumferentially just above their bases (Figure 6-2c-e), and one object from Chiggerville exhibits several tangential cut marks (incising) just above the base on one side (Figure 6-2b). Finally, two points from Chiggerville have rough, unformed bases, and one point has a flange (Figure 6-2a). This object is described in more detail below as a possible Late Prehistoric projectile point.

Antler reamed, pointed implements from Baker and Chiggerville are manufactured from the tips and mid-sections of antler tines. Although it is difficult to say with any certainty, it is likely that all of these antlers are from white-tailed deer given their size. Table 6-5 provides summary statistics of the basic metric data from Chiggerville. All of the reamed, pointed implements from Baker were broken. Object B151 from Baker was complete enough to obtain a maximum length of 45 mm and a mid-section width of 11 mm. This object was of the proximally grooved sub-variety.

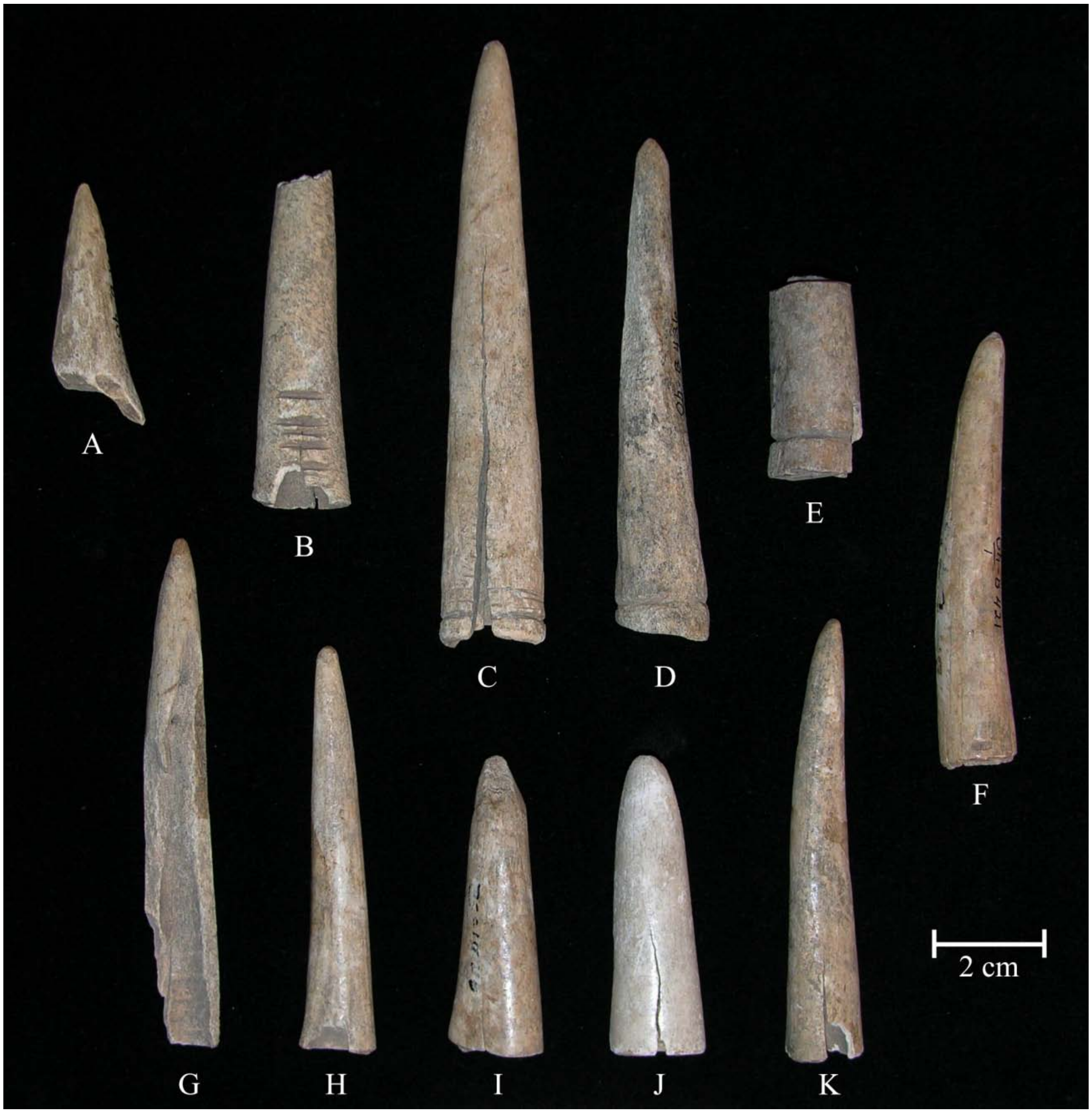


Figure 6-2. Antler Reamed, Pointed Implements from Chiggerville.

In addition to basic metric data, a series of measurements was obtained along the distal ends of all pointed implements (antler and bone) from the two sites (Table 6-6).

Following Bader (1992), these measurements were obtained at 5, 10, and 30 mm from the tip of tools with intact distal ends and are aimed at numerically characterizing the shape of the working ends of pointed artifacts of all kinds. They also provide a means of making detailed comparisons of bone and antler tool assemblages. Additionally, non-metric morphological data were collected. These categories are modified from Bader (1992) and are summarized in Table 6-6.

Table 6-5. Summary Statistics of Reamed, Pointed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness 1/2
Valid	17	25	18	14	15
Missing	33	25	32	36	35
Mean	75	18	15	12.5	11
Median	76	18	15	13	11
Mode	55	18	15	13	10, 11
Std. Deviation	18.588	4.455	2.770	1.888	1.595
Minimum	36	12	12	9	9
Maximum	110	36	24	16	15

The metric data presented in Table 6-6 consist of widths and thicknesses obtained at 5, 10, and 30 mm from the tip of tools with complete distal ends (the tip, foreshaft, and shaft, respectively) and at the base of the objects. Once obtained, these measurements are then divided to provide a rough numerical characterization of cross-sections at each of these locations, with a ratio of 1 indicating a roughly rounded cross-section. Additionally, Bader's (1992) outline (TO) and robustness (RB) indices were calculated by dividing the tip width by the shaft width and by multiplying the shaft width by the shaft thickness.

Table 6-6. Additional Metric Data for Reamed, Pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	Base W	Base T	W/T	OT W5/W30	RB W30 x T30
Valid	26	25	25	25	25	24	22	23	21	25	18	14	22	21
Missing	24	25	25	25	25	26	28	27	29	25	32	36	28	29
Mean	6	6	1.0	7	7	1.0	11	10	1.1	18	15	1.2	0.5	117
Median	6	5	1.0	7	7	1.0	10.5	10	1.1	18	15	1.1	0.5	110
Mode	5	5	1.0	7	7	1.0	10	9	1.0, 1.1	18	15	1.1	0.5	90
Std. Deviation	1.070	0.952	0.093	1.323	1.234	0.096	1.849	1.376	0.098	4.312	2.590	0.164	0.078	35.907
Minimum	4	4	0.8	6	6	0.9	9	9	0.9	12	12	1.0	0.4	81.0
Maximum	8	8	1.2	11	10	1.3	16	14	1.2	35	23	1.5	0.7	210.0

As can be seen from Table 6-6, only about half of the reamed, pointed objects from Chiggerville were complete enough to record these measurements. Nevertheless, between 15 and 27 measurements were recorded for each category. Even with these numbers, standard deviations remained small. The uniformity in these measurements is likely due to a single technological constraint – the small range of variation in the size of the antler tines from which these objects were manufactured.

Only two reamed, pointed objects from Baker retained tips or bases. Object B151 has a tip width and thickness of 6 mm (W5/T5 = 1.0) and a foreshaft width and thicknesses of 8 mm (W10/T10 = 1.0). Other measurements cannot be obtained. Object B480 has tip widths and thicknesses of 5 mm (W5/T5 = 1.0), foreshaft widths and thicknesses of 6 mm (W10/T10 = 1.0), a shaft width of 10 mm, and a shaft thickness of 9 mm (Sh W30/Sh T30 = 1.1). The outline index for this object is 0.5, and the robusticity index is 90. Object B255 has a base width of 18 mm and a base thickness of 16 mm (Base W/T = 1.1).

Non-metric variables recorded for bone and antler pointed implements include tip cross-section, tip plan, tip side, shaft outline, shaft side, base form, and symmetry. These non-metric variables follow Bader (1992). Illustrations of the various forms can be found in Figure 6-3. Base forms for reamed, pointed implements are illustrated in Figure 6-4.

Tip cross-sections at both sites were constrained by the shape of the tines on which the reamed, pointed implements were manufactured. Of those with identifiable tip cross-sections, 8 from Chiggerville had oval cross-sections and another 19 objects from Chiggerville and 2 from Baker had round cross-sections. One reamed, pointed tool from Chiggerville had a square cross-section.

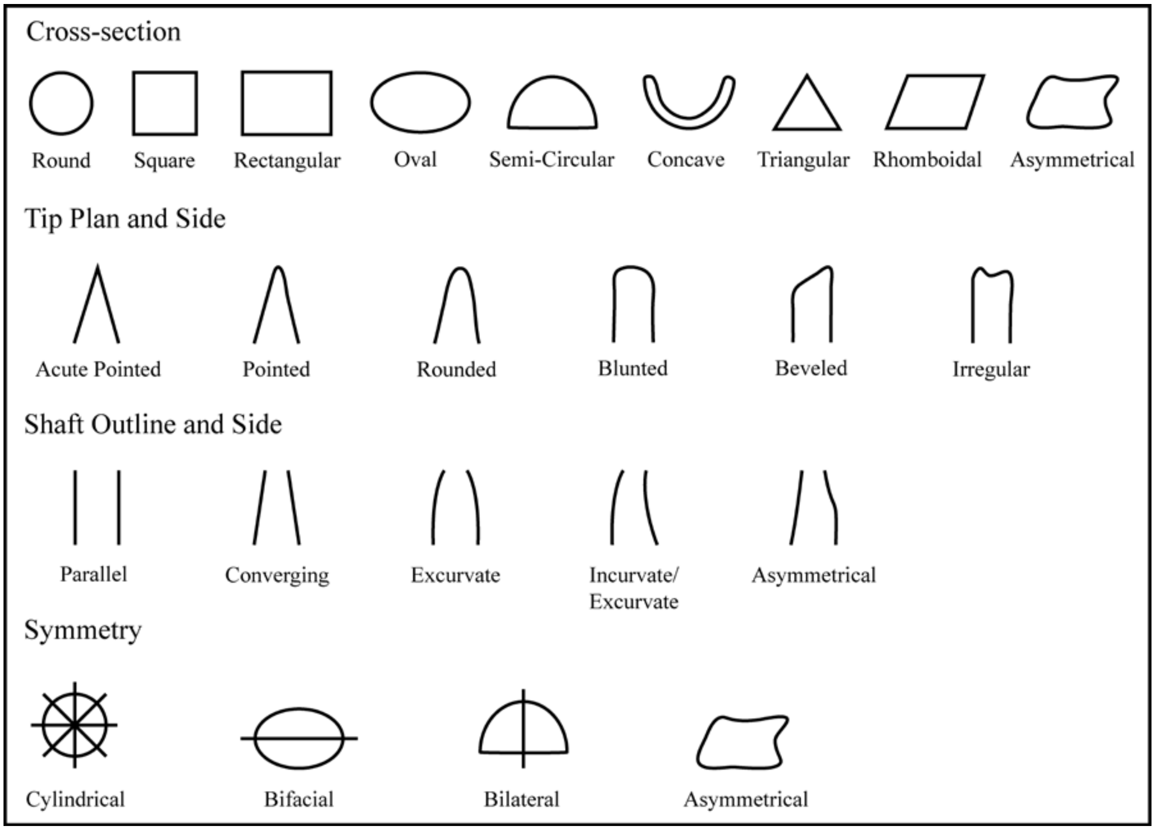


Figure 6-3. Non-metric Variables Recorded for Bone and Antler Pointed Implements. Adapted from Bader 1992:Figures 5.2-5.5.

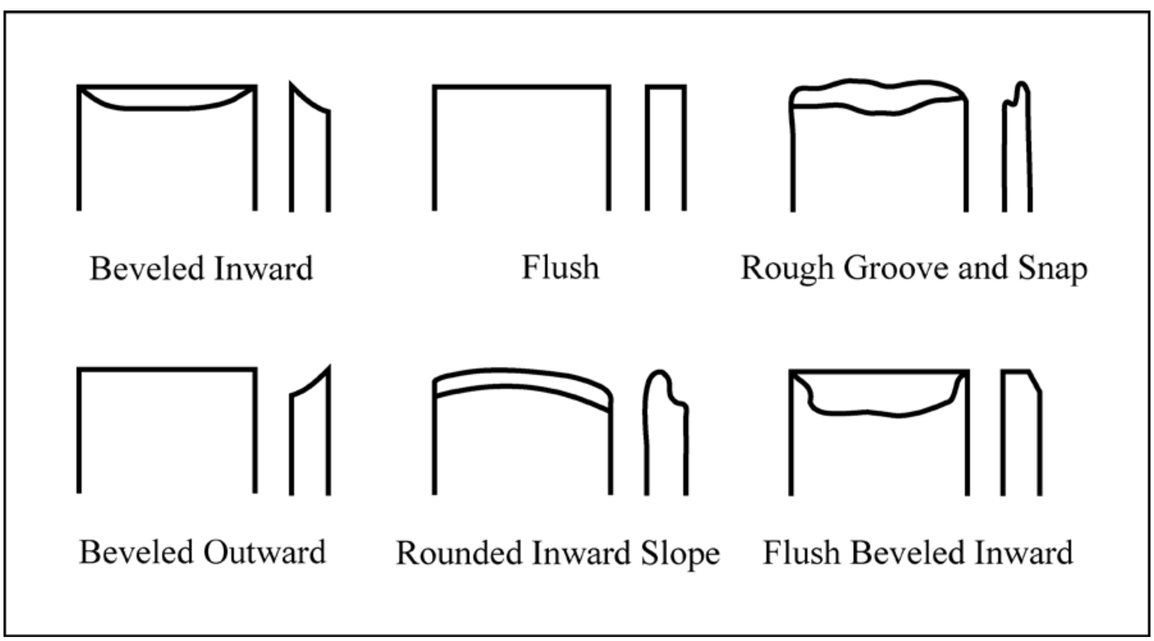


Figure 6-4. Base Forms for Antler Reamed, Pointed Implements.

Tip plans and tip sides and shaft outlines and shaft sides are largely interchangeable depending on how one holds the objects when recording the measurement. As a result, these objects have been analyzed as tip plans-sides and shaft outlines-sides. Combinations of tip plans-sides at Chiggerville include broken-beveled (n = 1), beveled-beveled (n = 1), beveled-rounded (n = 2), beveled-blunted (n = 1), blunted-blunted (n = 3), blunted-rounded (n = 4), pointed-pointed (n = 3), pointed-rounded (n = 4), and rounded-rounded (n = 8). At Baker, only one each blunted-blunted and rounded-rounded tip plans-sides are represented.

Combinations of shaft outlines-sides at Chiggerville consist of broken-excurvate (n = 1), asymmetrical-asymmetrical (n = 5), asymmetrical-converging (n = 2), converging-converging (n = 4), converging-incurvate/excurvate (n = 13), converging-excurvate (n = 1), converging-pentagonal (n = 1), excurvate-excurvate (n = 2), excurvate-incurvate/excurvate (n = 2), and pentagonal-pentagonal (n = 1) forms. At Baker, only asymmetrical-asymmetrical (n = 3), and converging-excurvate (n = 1) forms are represented.

Symmetry of reamed, pointed objects at Chiggerville include asymmetrical (n = 6), bilateral (n = 12), bilateral/bifacial (n = 3), and cylindrical (n = 4) forms. Only asymmetrical (n = 3), and cylindrical (n = 1) forms are represented at Baker. The fact that many antler reamed, pointed implements at the two sites are asymmetrical in at least one dimension illustrates the difficulty of truly straightening antler. However, these objects are closer to being exactly symmetrical than the blunted antler implements described below.

Base forms at Chiggerville include objects whose bases are beveled inward (n = 9), flush (n = 1), rough grooved and snapped (n = 18), and have a rounded inward slope (n = 1). Only beveled inward (n = 2), flush (n = 1), and rounded inward slope (n = 1) forms were found at Baker. The lack of certain base forms and symmetry types at Baker is attributed to differences in sample size.

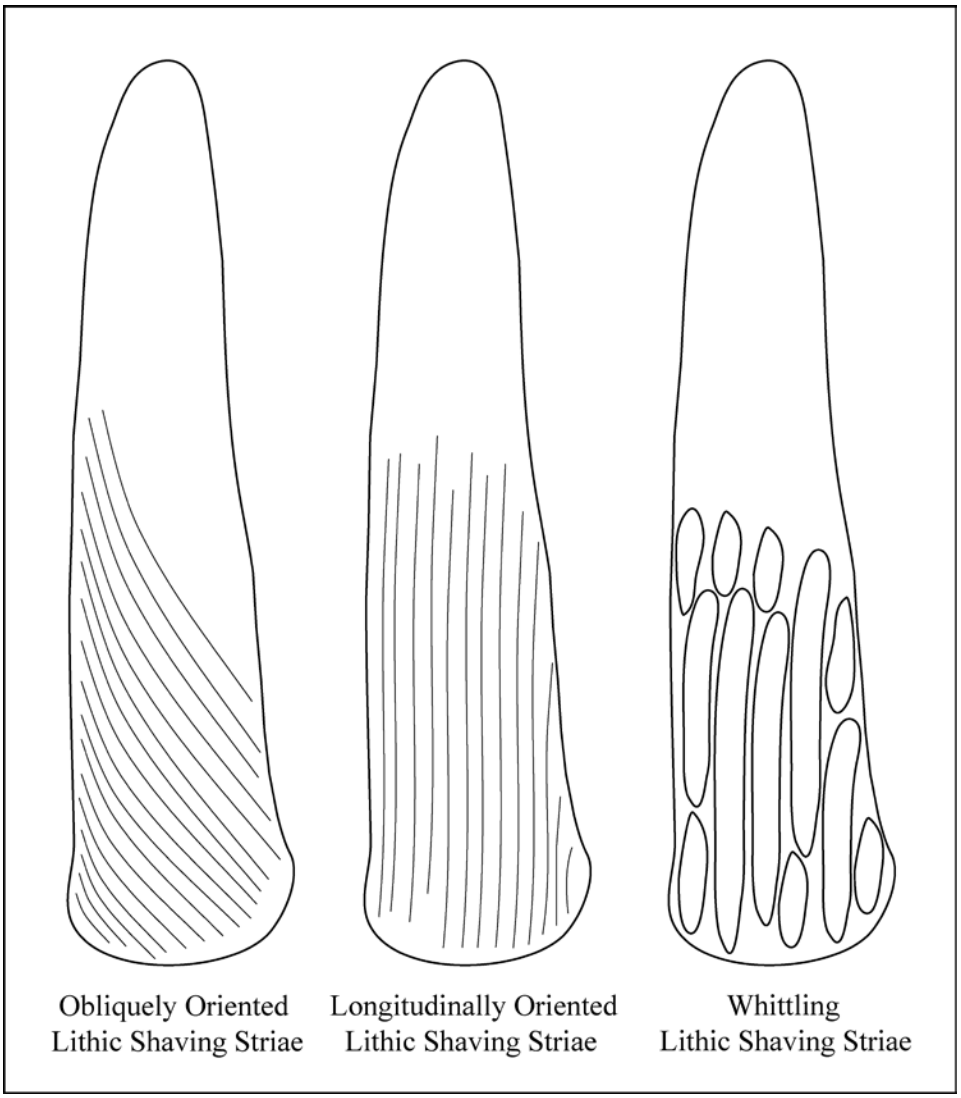


Figure 6-5. Model Illustrating the Three Primary Forms of Tine Shaping Microtrace.

Microscopic examination of manufacture microtrace on the reamed, pointed implements from Baker and Chiggerville indicate that both assemblages were manufactured using chipped stone tools, but employing different methods. At Baker, six of the seven reamed, pointed implements exhibit longitudinal striations along the length of at least portions of their margins, indicating use of a lithic shaving technique to shape the antler tines from which they were produced (Figure 6-5 center). Four of these points exhibit circumferential grooves in their hollow proximal ends, indicating rotational reaming. Three of these reamed sections exhibit a distinctly conical shape, indicating use of a lithic drill. One reamed, pointed implement exhibits an abrupt termination with shallow rotational grooves, suggesting use of a cane. One retains evidence of use of the circumferential groove and snap technique to remove the tine from the antler raw material. This technique is discussed in more detail below in the description of debitage from Baker and Chiggerville.

At Chiggerville, only four of the 24 reamed, pointed implements sampled for microtrace analysis exhibit longitudinal manufacture striations similar to those from Baker. Five of the remaining points exhibit obliquely oriented parallel striations that wrap around and up the length of the reamed pointed implements (Figure 6-5 left). These striations likely indicate use of a chipped stone tool, but replication studies are needed to confirm this. Another three objects exhibit narrow, deep channeling indicative of use of a whittling technique to shape them (Figure 6-5 right). Finally, three reamed, pointed implements exhibit both longitudinal striae and channels and five exhibit a combination of oblique longitudinal striae and channels. One of the combination channeled and oblique longitudinal striated implements has long longitudinal striations associated with the channels, and one of the combination channeled and longitudinally striated implements has channels and striations oriented in the same direction. Both of these suggest that lithic shaving (either longitudinally or oblique longitudinally) is the same technique as whittling, with whittling involving the artisan pressing harder into the antler medium, resulting in the removal of narrow channels.

If whittling is a distinct manufacturing technique, then 11 out of the 24 (46 percent) sampled objects exhibit this technique, and 10 out of 24 (42 percent) exhibit the obliquely oriented method of lithic shaving. Only seven out of 24 (29 percent) exhibit the longitudinally oriented lithic shaving found at Baker and three of those are associated with deeper whittling than found at that site. Furthermore, only one of the unsampled reamed, pointed implements exhibit macroscopic evidence of longitudinally oriented lithic shaving, while two exhibit macroscopic evidence of obliquely oriented lithic shaving, four evidence of whittling, and one evidence of a combination of longitudinally oriented lithic shaving and whittling. Two objects exhibit unusually deep obliquely oriented cutmarks that may be additional examples of the oblique lithic shaving technique or that may be a rougher hacking or slicing technique.

Manufacture of reamed, pointed bases at Chiggerville mirrors that seen at Baker. Of the 24 sampled reamed, pointed implements, 13 exhibit evidence of use of the circumferential groove and snap technique to remove the tine from the antler raw material. Circumferential reaming is indicated by rotational striae on 13 implements (Figure 6-6), three of which were conical, indicating use of a lithic drill. Two of the reamed bases exhibit abrupt terminations that may indicate use of a cane to drill these pointed implements. Among the unsampled reamed, pointed implements, five exhibit macroscopic evidence of use of the circumferential groove and snap technique, nine exhibit evidence of rotational reaming, and one is conically reamed.

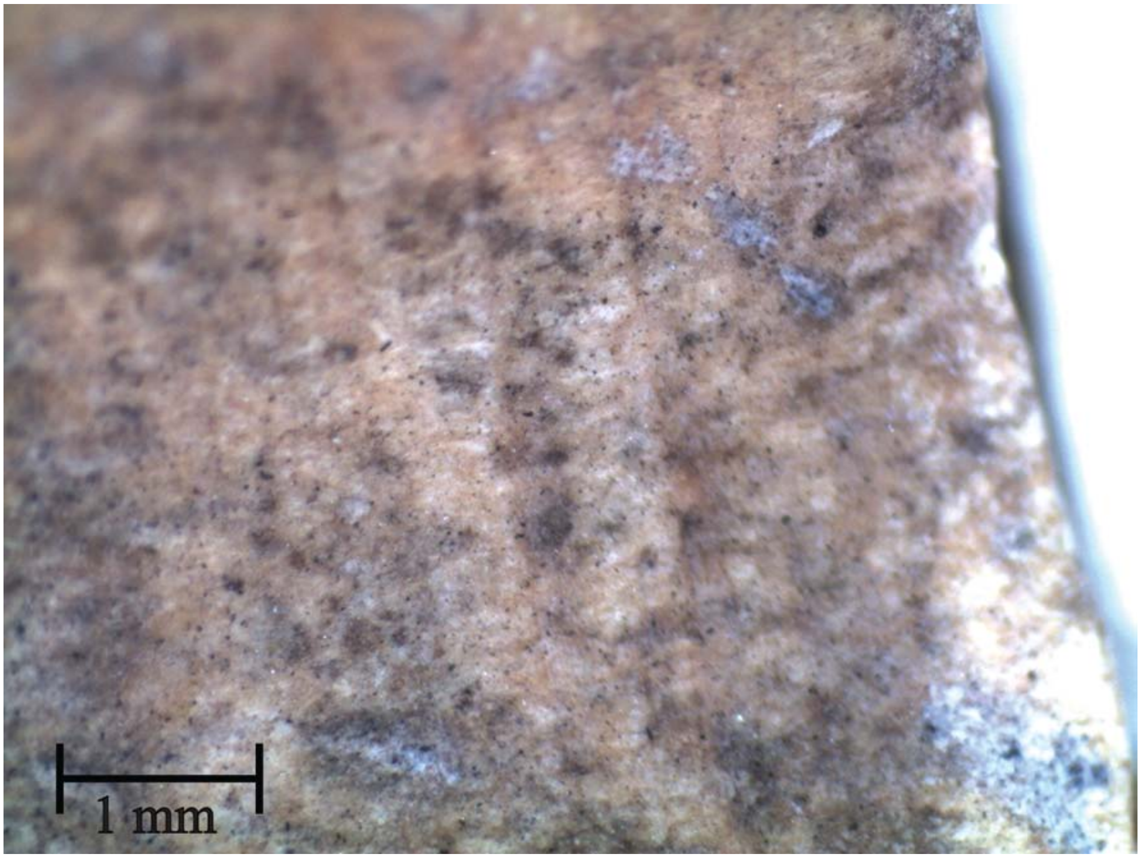


Figure 6-6. Micrograph Illustrating Reaming Striae Evident on Object B415 from Chiggerville. Base is to the right.

One additional manufacture technique was observed on object B404 from Chiggerville. This object has a uniformly black color suggesting that it was intentionally subjected to heat during manufacture. Fire hardening is recorded only in cases where burning resulted in a relatively uniform black or dark brown color, where fire damage is not discernible, and where the structure of the antler or bone was changed so as to become noticeably harder than unmodified bone or antler. Use of a heat treating technique was not observed on any of the reamed, pointed implements from Baker.

Several lines of evidence suggest that objects similar to the reamed, pointed objects from Baker and Chiggerville functioned primarily as projectile points. Objects similar to these have been recovered from deposits as early as the Early Archaic

Windover site (ca. 8100 to 7000 B.P.) in Florida. Points from Windover include both barbed and socketed forms, as well as others similar to those from the Kentucky middens. The Windover points are thought to have been reamed with a chert drill or shark tooth and exterior surfaces were both scraped and smoothed by grinding. According to Penders (2002:102), these points "were probably secured by giving the tine a twist. It is possible the twisting action was sufficient to affix them tightly enough for use, since none showed evidence of adhesive or cordage." No evidence of adhesive was noted on the Kentucky specimens, but the grooving and incising noted on some reamed, pointed bases may have been useful for securing binding. Further evidence that the Kentucky points were bound to a shaft or foreshaft comes from Webb (1974:310), who identified asphaltum adhering to specimens from Indian Knoll. The projectile function of these implements was confirmed by the fact that one was found embedded in the pelvis of Burial No. 102, an adult male (Penders 1997, 2002). A gouging, rather than reaming, technique was observed and experimentally replicated on reamed, pointed implements from the Middle to Late Woodland Schultz site in Michigan (Murray 1972a, b).

Additional evidence for the use of reamed, pointed implements as projectile points comes from Willoughby (1901), who described antler point tipped arrows from ethnographic collections obtained from Southeastern tribes that are curated at the Peabody Museum. Two of the antler points are double barbed and unpainted, one is two-pronged and painted, and a fourth is diamond-shaped in cross-section and painted. All four arrow shafts were also painted.

Evidence of a projectile function at Baker and Chiggerville involves distinct breakage and chipping patterns suggesting impact damage. One of the seven implements from Baker and nine of the 51 from Chiggerville exhibit breaks at the tip or along the side that were likely caused by impact, and another one from Baker and four from Chiggerville exhibit possible impact damage. Similar breakage patterns were observed by Webb (1974:310) on reamed, pointed implements from Indian Knoll.

Two objects from Baker and six from Chiggerville also exhibit pitting at the tip that may have been from use. It is possible these reamed, pointed implements were used secondarily as awl/perforators or as lithic flaking tools. One of the objects from Baker exhibits a v-shaped gouge at the tip that strongly suggests the latter. Four objects exhibit blunting at the tip and another two exhibit both chipping and blunting that may be from use. Based on these data, it is likely that reamed, pointed implements from Baker and Chiggerville functioned primarily as projectile points and secondarily as awl/perforators and/or flaking tools (see Breitburg 1982:920) for a similar interpretation of reamed, pointed implements from Black Earth.

Object B451 (Figure 6-2a) from Chiggerville is a reamed, pointed implement that is unique to the Chiggerville assemblage and distinct from the other pointed implements at the site in terms of its form and manufacturing trajectory. Based on comparison with reamed, pointed implements from Late Prehistoric sites curated at the Webb Museum, it is felt that this object is likely Late Prehistoric in age and associated with the shell-tempered pottery found in the plowzone at Chiggerville. This is supported by the fact that object B451 was recovered from the uppermost (1/2 foot) level of Unit 130L2.

Object B451 is a flanged reamed, pointed implement that is 46 mm long, 14 mm wide, and 10 mm thick. It has a mid-section width of 10 mm and a mid-section thickness of 9 mm. The length of the flange is 7 mm. This object is different from the Archaic reamed, pointed implements from the site in that a whittling technique was used to shape the entire artifact. Cuts around the exterior of B451 consist of relatively deep but short and narrow grooves, and the tip was also cut to a fine point via whittling. This rough whittling technique left distinct chattermarks within some of the cuts. Circumferential incisions within the reamed base and the conical shape of the reaming indicate drilling with a stone drill. No chipping or fracture damage was noted and no use-wear striations were observed with low power microscopy. The object exhibits moderate to heavy surficial weathering and damage from WPA era label removal. Tip form and metric description data are provided in Table 6-7.

Table 6-7. Metric and Non-metric Data pertaining to Object B451.

Max. Length	46	Tip W5	5	Base Width	13
Max. Width	14	Tip T5	5	Base Thickness	10
Max. Thickness	10	Foreshaft W10	7	X-section	Round
Width ½	10	Foreshaft T10	7	Tip Plan	Pointed
Thickness ½	9	Shaft W30	13	Tip Side	Pointed
Weight	3.5 g	Shaft T30	10	Shaft Outline	Converging
Flange Length	7	Outline W5/W30	0.4	Shaft Side	Excurvate
Base Form	Beveled Outward	Robustness W30 x T30	130	Symmetry	Bilateral

Thirty-seven percent (n = 57) of the pointed implements from Chiggerville and 56 percent from Baker are longitudinally asymmetrical, blunted forms (Figures 6-7, 6-11a-d). These objects, which are similar in form to unmodified antler tines, are common in archaeological assemblages and are oftentimes classified as ‘flakers’ or flintknapping tools. Unfortunately, the analysis of these objects is problematic given the prevalence of scratches and pitting on non-archaeological antler (Olsen 1989). According to Winters (1969:47), at the Riverton site, “All the antler tines seemed to have more wear than that resulting naturally from the rubbing of tines against trees. At the same time, we are not absolutely certain that all of these tines were flaking tools, even after careful inspection of their surfaces under a binocular microscope." This contrasts with Campana's (1989) systematic use-wear analysis of Levantine Natufian and Zagros Protoneolithic antler tines. In this study, Campana found use-wear indicative of artificial modification on only one of the numerous antler tines at a variety of sites in the region.

Figure 6-7. Antler Longitudinally Asymmetrical, Blunted Pointed Implements from Baker.

At KYANG, Bader (1992:317) identified 29 antler tines that had been modified. Of these, 12 had “a grooved and pitted tip end” and 11 exhibited “terminal impact fractures or chipping at the tip” (Bader 1992:322) suggesting use as flaking tools. In addition, the presence of transverse and longitudinal striae along the shafts of these objects suggested additional (possibly flintknapping related) uses (Bader 1992). Penders (1997, 2002) described similar forms from Windover with transversely oriented striations and embedded chert microflakes in their tips.

These use-wear indicators of flaking activities are consistent with Olsen’s (1989) experimental study, which found that tips of antler flaking tools tend to be blunted by heavy pitting and crushing and that flintknapping tools may exhibit faceting perpendicular to the long axis of the antler from extended use. Longitudinal striations and v-shaped nicks near flaker tips are not uncommon, and sometimes small flakes can be found embedded in the ends of these tools (Olsen 1980, 1989).

Tables 6-8 and 6-9 provide metric data for the longitudinally asymmetrical, blunted pointed implements from Baker and Chiggerville. While the larger sample size of these objects from Chiggerville results in a greater range of overall sizes, the tip cross-section measurements from the two sites are similar. As with the reamed, pointed implements, this is largely due to the constraining factor of the original size of the antler tines from which these objects are manufactured.

Not surprisingly, Chiggerville exhibits more variation in tip side and plan forms. Of the 54 objects from Chiggerville for which either of these variables could be recorded, 4 are broken-blunted, 2 are blunted-beveled, 14 are blunted-blunted, 1 is blunted-irregular, 16 are blunted-rounded, 1 is beveled-pointed, 1 is pointed-rounded, and 15 are rounded-rounded. This is compared with 10 blunted-blunted, 2 blunted-rounded, and 1 blunted-beveled objects from Baker with complete tips. This greater degree of variation in tip plan and side forms is attributed to the larger sample size present at Chiggerville and the degree of subjectivity involved in identifying a tip as rounded or blunted.

Cross-sections of longitudinally asymmetrical, blunted pointed implements from the two sites are also similar due to the constraining shape of the raw material. At Chiggerville, 36 objects exhibit round cross-sections, 14 are oval in shape, 1 is square in cross-section, 1 is asymmetrical, and 4 are broken. At Baker, 4 objects exhibit round cross-sections, 4 are oval, 6 are asymmetrical, and 1 is broken.

Table 6-8. Summary Statistics of Longitudinally Asymmetrical, Blunted Pointed Implements from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Baker	Valid	6	6	6	6	6
	Missing	9	9	9	9	9
	Mean	103	37	15	21	12
	Median	99	31.5	14.5	17	11.5
	Mode	N/A	19	13	15	11
	Std. Deviation	20.673	22.903	2.927	8.824	3.077
	Minimum	82	18	12	14	9
	Maximum	129	75	19	33	18
Chiggerville	Valid	34	36	36	33	33
	Missing	22	20	20	23	23
	Mean	86	21	15	14	12
	Median	72	18	13	13	10
	Mode	52, 57, 68	14	12	11	9, 10
	Std. Deviation	40.092	8.588	5.115	4.113	3.984
	Minimum	39	9	8	8	7
	Maximum	194	45	27	25	21

A total of 21 objects from Chiggerville and 7 from Baker were examined microscopically for evidence of manufacture and use-wear microtrace. Patterns of tine shaping are not as abundant on the longitudinally asymmetrical, blunted pointed implements as on the antler points, but the types of tine shaping techniques are the same. Of the 21 sampled objects from Chiggerville, 1 exhibits oblique striations, 2 longitudinal striations, and 3 both oblique and longitudinally oriented striations indicative of use of a lithic shaving technique. One additional object was whittled at its tip. At Baker, 3 objects were shaved longitudinally and 1 was whittled. The remainder of the sampled objects exhibits no evidence of tine shaping. Of those objects that were not examined microscopically, 5 from Chiggerville exhibit macroscopically visible obliquely oriented striations (1 was also whittled at the tip), 1 has both oblique and longitudinal striations, and 1 was whittled. At Baker 1 unsampled longitudinally asymmetrical, blunted pointed implement was shaved obliquely and another was shaved longitudinally.

In addition to tine shaping microtrace, macroscopic evidence of tine removal and processing is present on several objects from both sites. Definitions of the techniques used to process antler at both sites are provided in the section on antler tool production debitage below. Including both sampled and unsampled specimens, one object from Chiggerville was grooved around its entire circumference to remove the tine from the beam (circum g/s1), and another four were partially grooved to facilitate tine removal (circum g/s2) (Figure 6-18). Both of these techniques were used at Baker as well – two objects exhibit evidence of use of the circum g/s1 technique and 3 exhibit use of the circum g/s2 technique. An additional object was grooved, but the specific technique used cannot be discerned.

Table 6-9. Additional Metric Data for Longitudinally Asymmetrical, Blunted Pointed Implements from Baker and Chiggerville.

		Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Baker	Valid	13	13	13	13	13	13	10	9	9	10	9
	Missing	2	2	2	2	2	2	5	6	6	5	6
	Mean	6	6	1.1	8	7	1.1	13	10	1.3	0.5	122
	Median	6	6	1	8	7	1	12.5	10	1.2	0.5	120
	Mode	6	6	1.0	8	6, 7	1.0	12, 13	10	1.2	0.5	120
	Std. Deviation	0.816	0.630	0.150	0.877	0.801	0.153	1.080	1.093	0.221	0.067	16.912
	Minimum	5	5	0.8	6	6	1.0	11	8	1.1	0.4	99
	Maximum	7	7	1.4	9	8	1.5	14	12	1.8	0.6	156
Chiggerville	Valid	53	51	51	54	52	52	48	50	48	46	48
	Missing	3	5	5	2	4	4	8	6	8	10	8
	Mean	6	6	1.1	8	7	1.1	12	11	1.1	0.5	133
	Median	6	6	1	8	7	1	12	11	1.1	0.5	123.5
	Mode	5, 6	6	1.0	7	7	1.0	11	9	1.1	0.5	99
	Std. Deviation	1.262	1.005	0.163	1.439	1.004	0.163	2.078	1.966	0.153	0.096	44.496
	Minimum	5	4	1.0	6	5	0.9	9	8	0.8	0.4	72
	Maximum	10	8	1.7	13	9	1.6	17	15	1.6	0.9	255

Three of the sampled objects from Chiggerville exhibit a beveled and cut proximal end indicative of using a slicing technique to thin the base of the antler tine prior to removal from the beam. Another seven of the unsampled objects were also likely removed in this manner, but only one unsampled object from Baker suggests the use of this technique. One longitudinally asymmetrical, blunted pointed implement from Chiggerville exhibits microscopic divets at its proximal end, suggesting that a pecking technique may have been used to weaken the tine to facilitate removal from the beam.

Chiggerville and Baker also differ as to the direction in which tines were removed from antler beams. At Baker, 5 objects are broken in such a way as to indicate they were pulled from the beam in a direction transverse to the long axis of the beam (the transverse pull and snap technique). At Chiggerville, 8 objects exhibit this technique, but another 5 are broken in such a way as to indicate they were pulled in a direction parallel to the long axis of the beam (the longitudinal pull and snap technique). One additional object from Chiggerville is broken in such a way as to suggest use of a combination of these techniques to remove the antler. Interestingly, three of the longitudinally asymmetrical, blunted tools from Chiggerville were dark brown to black in color and exhibited other characteristics indicative of intentional heat treatment.

Use-wear present on several longitudinally asymmetrical, blunted objects suggests that a variety of functional types are present. Of the 57 objects from Chiggerville, 8 exhibit macroscopic chipping, pitting, and/or deep striations at their tips indicating use as lithic flaking tools. Microscopic use-wear on these tools includes transverse, oblique-transverse, and oblique striations or deep gashes localized at the tips.

A beveled tip on object B1046 from Chiggerville was created by heavy use that also left deep scoring around the circumference of the object and the tip.

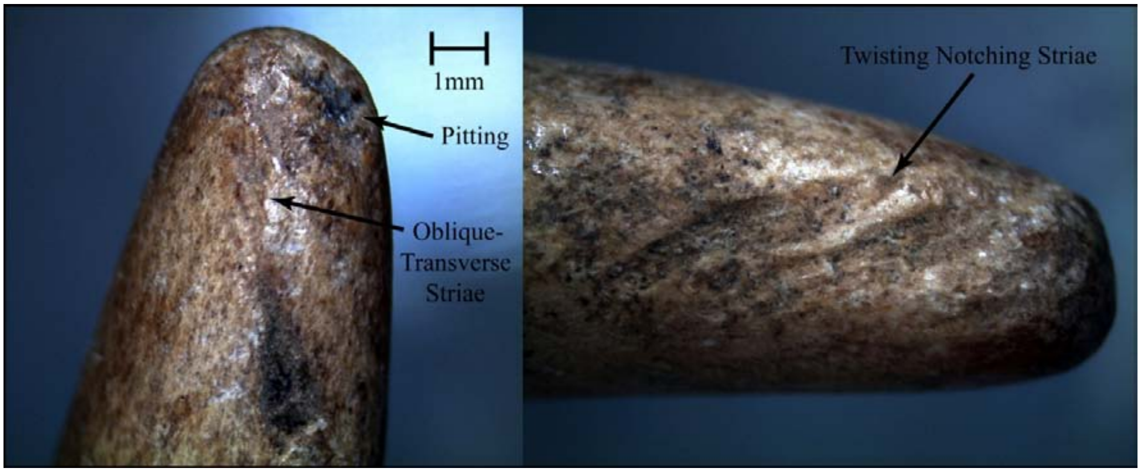


Figure 6-8. Lithic Reduction Microwear on Two Tines from Object B425 from Baker.

Beveling evident on the tip of object B173 from Baker was created by heavy use as a lithic flaking tool. Ten objects from Baker exhibit macroscopic pitting and one is chipped from use. This damage and microscopic transverse, oblique-transverse, and oblique striations indicate that 9 of the longitudinally asymmetrical, blunted pointed implements from Baker are lithic flaking tools, and another 4 are possibly lithic flaking tools (2 have unidentified functions). Some of these objects from Baker exhibit pitting and lithic flaking use-wear on multiple tines, including object B425, which exhibits deep longitudinal cuts that wrap around the object's tips (Figure 6-8). This pattern of use-wear is interpreted as evidence of use as a flaking and notching tool.

In addition to longitudinally asymmetrical, blunted pointed implements that functioned as flaking tools, four objects from Chiggerville (B1072, B1097, B1194, and B1240) exhibit light longitudinal and/or rotational striae or microchipping that suggest use as awls or perforating tools. Object B1190 exhibits deep transverse striations consistent with use as a lithic flaking tool (Figure 6-9), but also exhibits rotational striae that suggest a secondary function as an awl/perforator.

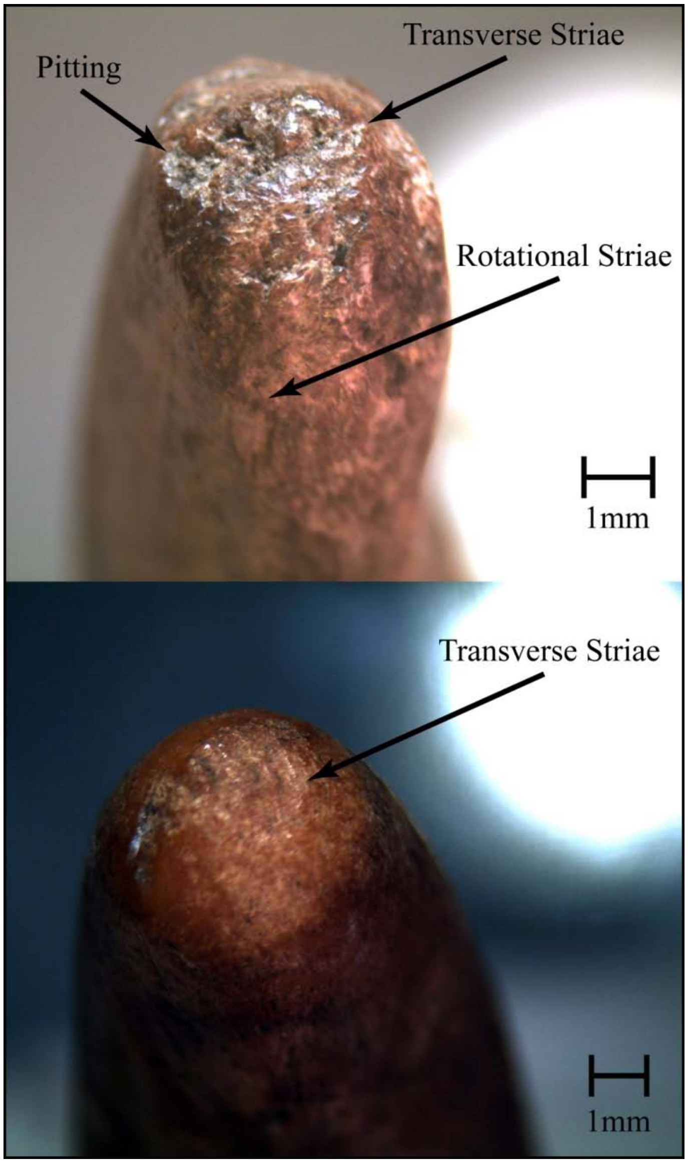


Figure 6-9. Lithic Reduction Microwear on Objects B1190 from Chiggerville (top) and B98 (bottom) from Baker.

Three longitudinally asymmetrical, blunted pointed implements from Chiggerville may be discards or debitage from the production of other tools. Object B1109 exhibits evidence of use of the circum g/s2 technique to remove the tine from the beam, but upon removal the break seems to have not followed the groove but travelled up the tine, resulting in discard. This object does exhibit some pitting at the tip that may be use-related, however.

Object B1178 is the object from Chiggerville with whittling at its tip. This object exhibits no evidence of use and may have been abandoned in production. Object B1246 is the object from Chiggerville with evidence of use of the circum g/s1 technique to remove the tine from the antler beam. This object was not examined microscopically but may be a tine removed from a beam as debitage.

Object B1230 is a broken fragment of an antler pointed implement. It is broken at both the base and tip in such a way as to suggest damage from impact. This longitudinally asymmetrical, blunted pointed implement, then, is likely a fragment of an antler projectile point and may be a broken reamed, pointed implement. Finally, one object (B955) exhibits a beveled and incised proximal end and is interpreted to have functioned as an atlatl hook. This object is not included in the metric tables provided above as it has a unique morphology and is described along with the other atlatl hooks (hooked implements) below.

Three (2 percent) of the pointed implements from Chiggerville are longitudinally asymmetrical with beveled tips (Figure 6-10a-b). These objects differ from longitudinally asymmetrical, blunted pointed implements with beveled tip sides or plans in that their bevels are well defined macroscopically and extend up the foreshaft of the objects.

Object B911 is broken but has a Tip W5 and T5 of 5 mm, a Foreshaft W10 of 7 mm, a Foreshaft T10 of 6 mm, a Shaft W30 of 11 mm, and an Outline Index (W5/W30) of 0.5. The object is semi-circular in cross-section with a blunted-beveled tip plan-side.

Interestingly, this object exhibits longitudinal and oblique abrasion striae at its tip and proximal end, differentiating it from the multitude of antler implements from Chiggerville manufactured using a lithic shaving technique of one form or another. The beveling on this object was formed by this abrasion and is interpreted as a resharpening event. Macroscopic chipping at the tip is interpreted as use damage. This object is interpreted to be a broken antler projectile point, but it is possible that some of the striations at the tip are from use rather than manufacture, indicating a lithic flaking tool function.

Figure 6-10. Beveled Bone and Antler Tools from Chiggerville.

Object B1223 (Figure 6-10a) is 124 mm long, 22 mm wide, 21 mm thick, has a mid-section width of 20 mm, and a mid-section thickness of 18 mm. This object is complete, with a Tip W5 of 8 mm, a Tip T5 of 6 mm, a Foreshaft W10 of 9 mm, a Foreshaft T10 of 8 mm, a Shaft W30 of 12 mm, a Shaft T30 of 13 mm, an Outline Index of 0.7, and a Robusticity Index (W30 x T30) of 156. This object is asymmetrical in cross-section and exhibits a blunted-beveled tip plan and side. Most of the manufacture microtrace on this implement was removed by subsequent polish, but remnant narrow channels indicate use of a whittling technique. Oblique cuts found toward the base of the implement are likely related to use of a slicing technique to remove the tine from its beam via a longitudinal pull and snap method. The large bevel on this object was created by the removal of a large chip from the tip of the implement during use. The presence of a row of equally spaced oblique-transverse striations along one edge and at the mid-section of this object, along with use polish over the entire object, suggests use as a basketry, matting, or weaving tool.

Object B1241 (Figure 6-10b) is 71 mm long, 16 mm wide, 16 mm thick, has a mid-section width of 13 mm, and a mid-section thickness of 14 mm. This object is complete, with a Tip W5 of 8 mm, a Tip T5 of 6 mm, a Foreshaft W5 of 9 mm, a Foreshaft T5 of 8 mm, a Shaft W30 of 12 mm, a Shaft T30 of 13 mm, an Outline Index of 0.7, and a Robusticity Index of 156. The object is oval in cross-section with a blunted-beveled tip plan-side. Macroscopic and microscopic obliquely oriented striations wrap around most of the object from the base toward the tip, indicating use of a lithic shaving technique to shape the antler tine, which was removed from the beam via a transverse pull and snap technique. Heavy pitting is visible at the object's tip and above the bevel.

Transverse use-wear striations are present on and on the side opposite from the bevel. This form of use-wear and damage is consistent with a lithic flaking tool function.

Seven (4 percent) of the antler pointed implements from Chiggerville and two (7 percent) from Baker were longitudinally asymmetrical, pointed implements. In retrospect, these objects could have been grouped in a single category with the longitudinally asymmetrical, blunted pointed implements, but they were initially sorted out due to their relatively acute tips. Tables 6-10 and 6-11 provide metric data for these objects, which, like the other antler pointed implements from these sites, retain a predictable uniformity in size and shape.

The small sample size of longitudinally asymmetrical, pointed implements from Baker leaves little room for comparison. Both objects from Baker have asymmetrical cross-sections and symmetries. Tip plans-sides for these objects are blunted-beveled and blunted-rounded. Shaft outlines-sides are incurvate/excurvate-incurvate/excurvate and incurvate/excurvate-asymmetrical. The beveling on object B406 is from use and this, coupled with pitting below the tip and oblique-transverse microscopic striations at the tip, indicate use of this object as a lithic flaking tool. This object was removed from the beam via the circum g/s2 technique, followed by a longitudinal pull and snap. Object B508 is too heavily weathered to identify any manufacture or use-wear microtrace, but heavy pitting and gouging preserved at the tip may also be from use as a flaking tool.

The seven longitudinally asymmetrical, pointed implements from Chiggerville are all in good condition. Of these, six have round cross-sections and one has an oval cross-section. Tip plans-sides consist of five rounded-rounded, one rounded-pointed, and one

Table 6-10. Basic Metric Data pertaining to Longitudinally Asymmetrical, Pointed Implements from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Weight (g)
Baker	B406	93	16	16	12	13	15.7
	B508	Broken	Broken	Broken	Broken	Broken	Broken
Chiggerville	B1044	57	15	13	11	10	6.1
	B1049	67	15	13	10	9	8.0
	B1053	152	28	16	21	15	36.3
	B1080	Broken	Broken	Broken	Broken	Broken	Broken
	B1141	Broken	Broken	Broken	Broken	Broken	Broken
	B1173	123	30	22	21	13	34.7
	B1179	64	11	10	10	9	5.1

Table 6-11. Additional Metric Data for Longitudinally Asymmetrical, Pointed Implements from Baker and Chiggerville.

		Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/W30	RB W30 x T30
Baker	B406	5	Br	Br	6	6	1.0	10	11	0.9	0.5	110
	B508	4	3	1.3	5	4	1.3	8	7	1.1	0.5	56
Chiggerville	B1044	5	4	1.3	6	5	1.2	11	11	1.0	0.5	121
	B1049	5	5	1.0	7	7	1.0	9	10	0.9	0.6	90
	B1053	6	5	1.2	8	7	1.1	12	12	1.0	0.5	144
	B1080	4	4	1.0	6	6	1.0	10	9	1.1	0.4	90
	B1141	4	4	1.0	6	5	1.2	9	8	1.1	0.4	72
	B1173	5	5	1.0	Br	Br	Br	12	10	1.2	0.4	120
	B1179	5	5	1.0	6	6	1.0	9	9	1.0	0.6	81

pointed-pointed. Shaft outlines-sides consist of two incurvate/excurvate-incurvate/ excurvate, two incurvate/excurvate-converging, one incurvate/excurvate-asymmetrical, and two asymmetrical-asymmetrical. Six are asymmetrical in overall form, but one (object B1044) exhibits bilateral symmetry. Manufacture striations include longitudinally oriented (n = 1), obliquely oriented (n = 1), and obliquely and longitudinally oriented (n = 1) lithic shaving striae, narrow channels indicative of whittling (n = 2), and no evidence of shaping (n = 1). One of the whittling episodes was localized at the tip. Three objects exhibit evidence of removal from the beam via a proximal slicing technique, and one has three deep gouges at the proximal end that may be from use of a hacking technique to remove the tine or may be present to facilitate hafting. Rounding of the surfaces of the gouges and polish near the base of this object suggest it may have been set into a foreshaft or socket and hafted.

Very few use-wear striations were evident using low power microscopy on the longitudinally asymmetrical, pointed implements from Chiggerville. Two objects exhibit pitting at the mid-section that may be from use, and three have pitting at the tip. Two objects exhibit facets at the tip that are likely from use. One of these objects also exhibits pitting and has been interpreted as a lithic flaking tool. One of the others with pitting at the tip also exhibits microscopic longitudinal striae at this location. This object, along with another with two deep, transverse striae below the tip, have been interpreted as awl/perforators, but a lithic flaking tool function cannot be ruled out. The object with the gouging at the base may be a projectile point that has warped so as to be incurvate/excurvate-incurvate/excurvate in outline and asymmetrical in form. The remaining objects are of unknown function but may be lightly used lithic flaking tools or awl/perforators. The latter function is preferred given the degree of use-wear noted on longitudinally asymmetrical, blunted flaking tools from the site and the limited wear on these tools.

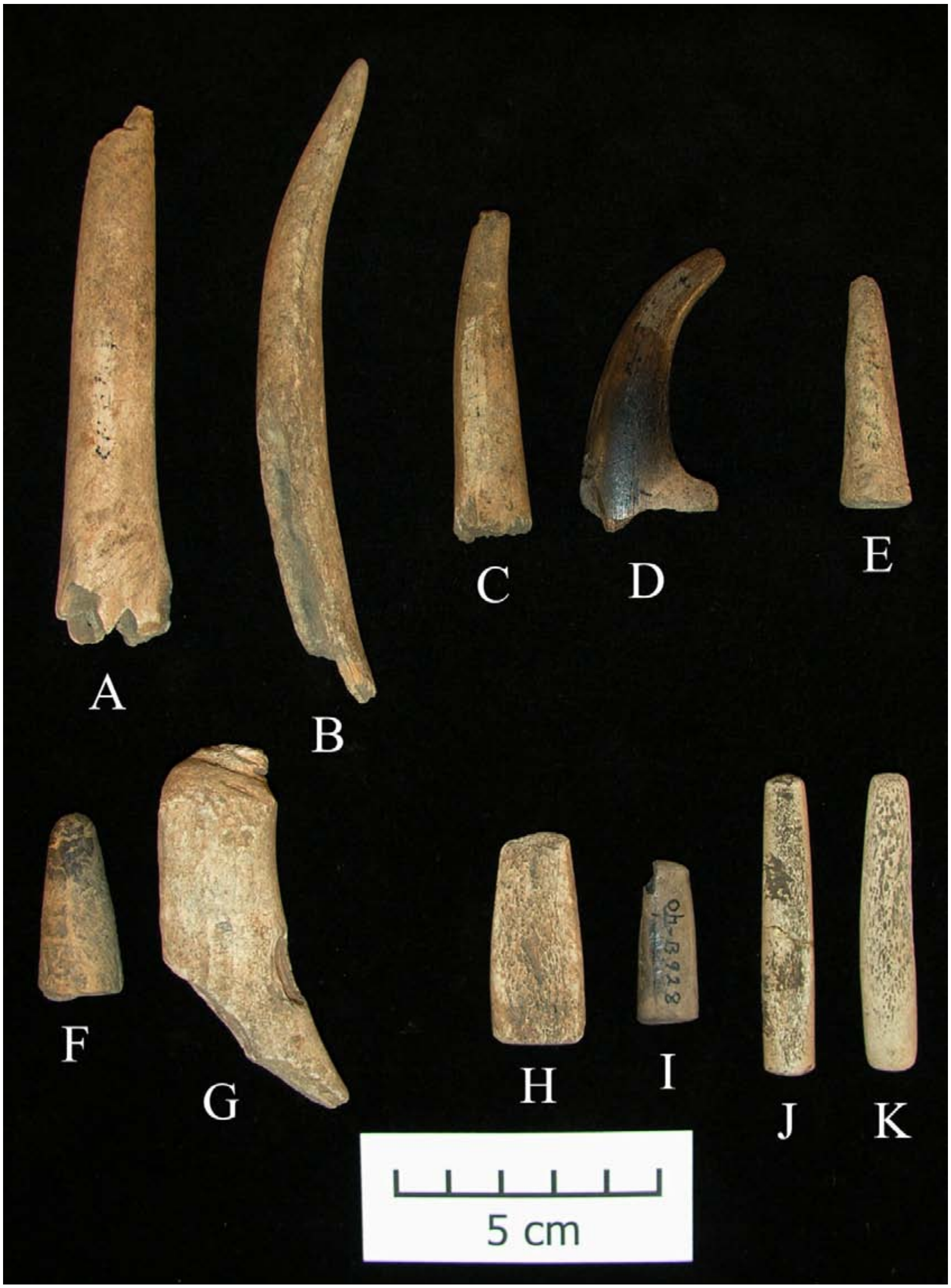


Figure 6-11. Various Blunted Tipped Implements from Chiggerville.

One object (1 percent) from Chiggerville is a longitudinally symmetrical, blunted pointed implement (Figure 6-11e). This object is 43 mm long, 14 mm wide, 10 mm thick, and has a mid-section width and thickness of 9 mm. It has a Tip W5 and T5 of 6 mm, a Foreshaft W10 and T10 of 7 mm, a Shaft W30 of 10 mm, a Shaft T30 of 9 mm, a Base Width of 14 mm, a Base Thickness of 10 mm, an Outline Index of 0.6, and a Robusticity Index of 90. The object is round in cross-section, has an expanding base form, a blunted-blunted tip plan-side, a converging-excurvate shaft outline-side, and is bilaterally symmetrical. Oblique-longitudinal and transverse cutmarks near the base are likely from removal of the object from an antler tine using an unidentified technique. Both ends have been rounded and smoothed. Pitting from use is evident at the tip, but no microscopic use-wear striations were noted at low power. This object is interpreted as a lithic flaking tool and may be an indirect percussion tool known as a drift (see the section on blunted implements below for further discussion of this tool type).

A total of 37 pointed implements (24 percent) from Chiggerville and 3 (11 percent) from Baker were broken and fragmented and placed in an 'unidentified' variety. Metric and non-metric data were recorded for these pointed implements, but these are not presented here due to the lack of morphological or functional uniformity in this class. Seven of the objects from Chiggerville exhibit breaks indicative of impact and are likely broken projectile points. Another five exhibit possible impact fractures or are straightened so as to suggest they are also projectile point fragments. Two exhibit faceting and/or oblique to oblique-transverse striations on their tips, suggesting use as lithic flaking tools, and two others may be awl/perforator fragments. One object is a small cut antler fragment that may be antler tool production debitage. Two of the likely projectile point fragments and both possible lithic flaking tools exhibit evidence of intentional heat treatment (fire hardening). One of the antler pointed implement fragments from Baker exhibits a possible impact fracture at its proximal end, suggesting a projectile function, and another exhibits pitting at the tip that suggests use as a lithic flaking tool.

Hooked Implements

These antler objects exhibit long, cylindrical and sometimes longitudinally grooved shafts and are typically reamed at the base. Distal modifications range from a slight curvature of the tine to a fully formed and stylized hook reminiscent of netting needles, a function originally assigned to these tools by Moore (2002). Hooked implements were eventually determined to be atlatl hooks by Webb (1957) utilizing a number of collections from the Green River region of Kentucky and the Pickwick Basin, where they were found in burials in association with atlatl weights and handles. Lutz (2000) has since divided atlatl hook forms into three temporally distinct types—Eva, Black Earth, and Indian Knoll. Terminal Archaic and Woodland atlatl hooks are also known, but in more limited numbers. According to Lutz (2000:44), "Often burials are found with two different hook styles suggesting they functioned in much the same fashion as bannerstones, each group or clan identified by their individualized atlatl hook style." Unfortunately, although the social functions of atlatl weights have been more fully explored by other researchers (e.g., Burdin 2004), similar studies of atlatl hooks have not been conducted.

Four fragmentary hooked implements were recovered from Chiggerville (Figure 6-12f-h). Based upon their form and similarities to objects found in situ at Indian Knoll and other Green River sites (Webb 1957), these objects are interpreted to be stylized atlatl hooks. One of these objects (B991) was found in situ along with an atlatl weight in association with Burial No. 44 (Figure 8-8), further supporting this interpretation. Very little information was derived from these objects due to their fragmentary condition. None exhibited microscopic evidence of use-wear, so it is unclear whether they were ever used to propel atlatl darts. It is possible they were originally deposited with burials and later disturbed by additional digging in the midden. No stylized atlatl hooks were recovered from Baker.

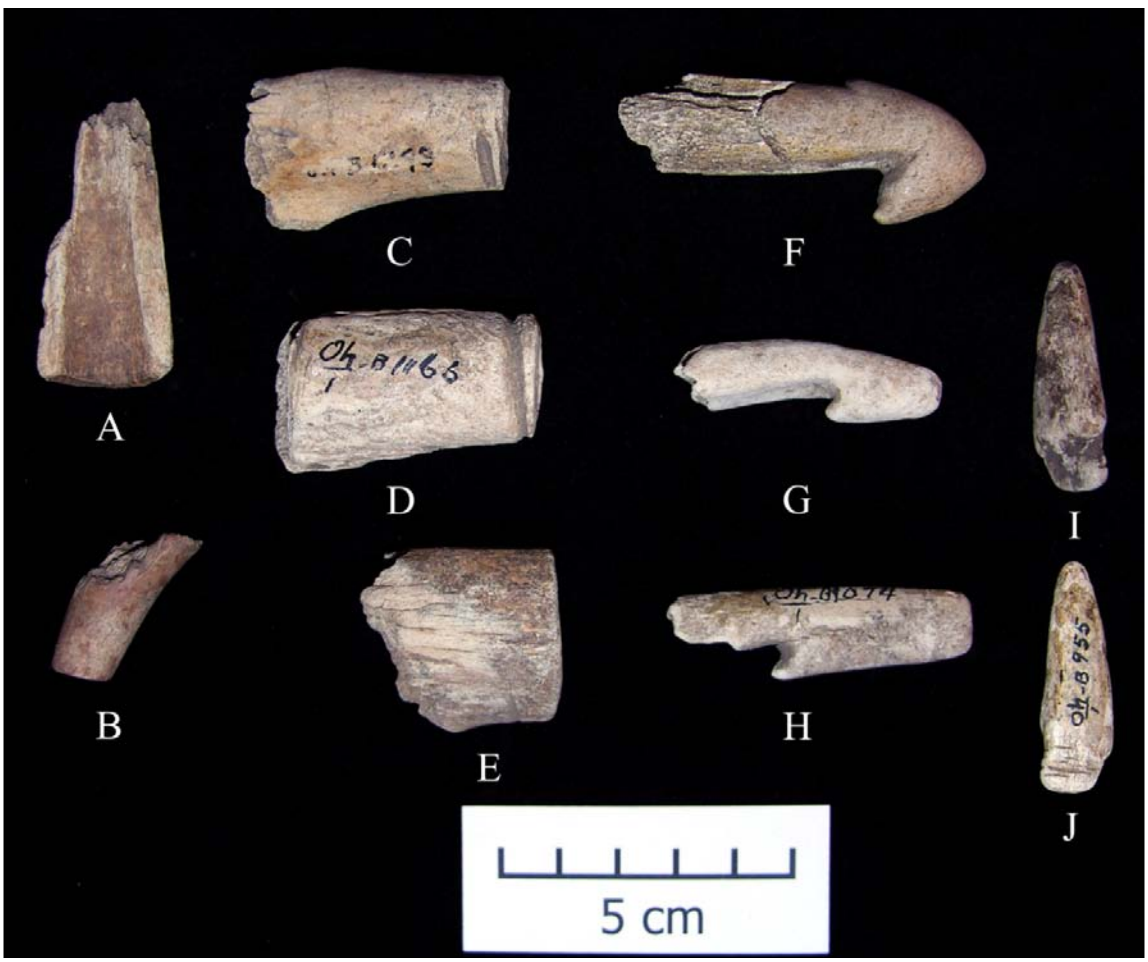


Figure 6-12. Atlatl Hooks and Hollow/Reamed Implements from Chiggerville.

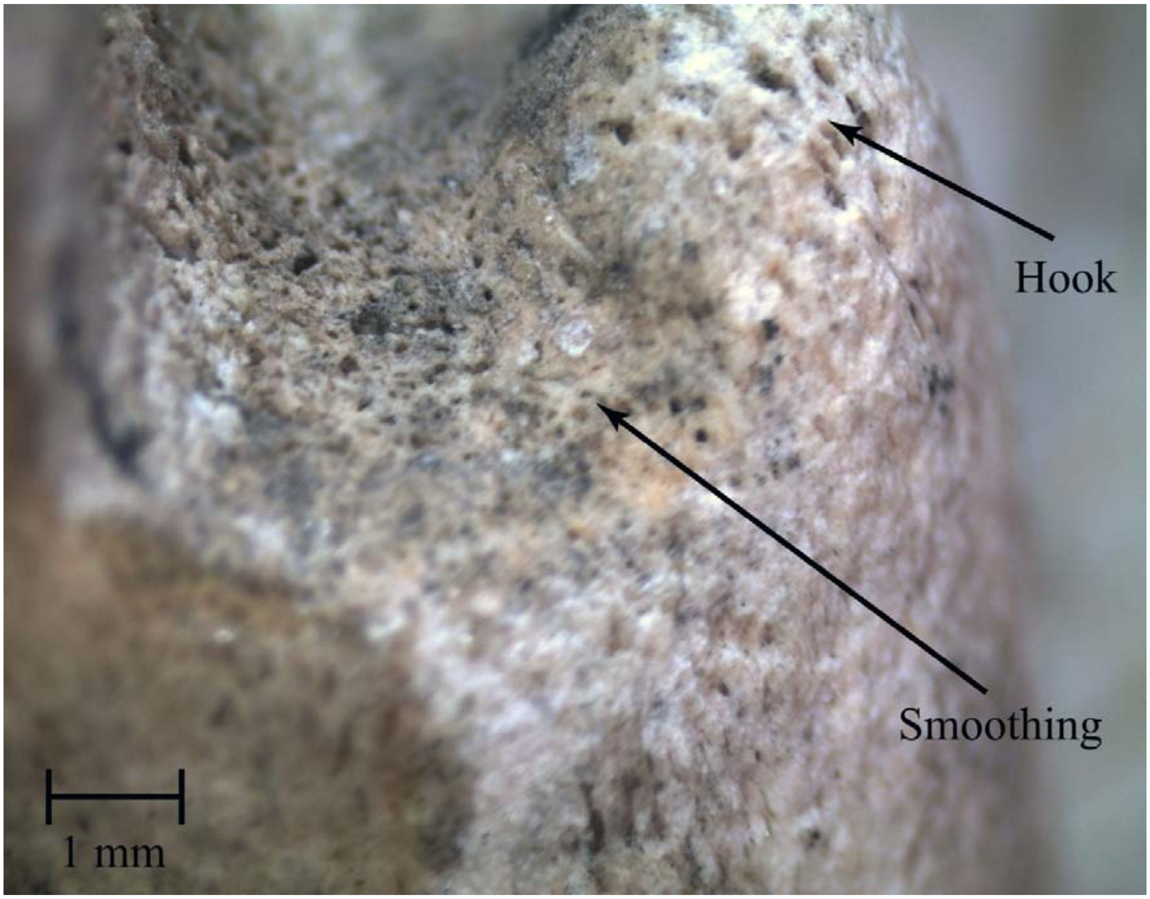


Figure 6-13. Micrograph of Object B920 from Chiggerville.

Object B920 (Figure 6-12g) has a relatively long, blunted distal tip and a narrow, v-shaped hook, but is not stylized beyond this. The object exhibits no manufacture microtrace, likely due to the high degree of weathering and breakage. The area beneath the hook or beak of this hooked implement is rounded and smoothed, possibly from use but more likely from the use of a leather thong to shape the beak (Figure 6-13). Some pitting is present at the distal end of this object, but it cannot be said for certain what this pitting represents.

Object B991 (Figure 8-8) was recovered along with a winged bannerstone from Burial No. 44. This atlatl hook is long with a very small hook that, given its small size, likely would not have functioned well if actually meant to be used to propel an atlatl dart.

This hook is the only one complete enough to classify and, following Lutz (2000:47) is of the Indian Knoll type. The atlatl hook is heavily weathered and was partially repaired using some kind of preservative. A break at the distal end precludes obtaining a maximum length, but the object is 20 mm wide and 18 mm thick. It is longitudinally reamed from the proximal end for attachment to an atlatl shaft. This object, along with the other burial goods from the site, was not included among the objects sampled for microscopic examination.

Object B1074 (Figure 6-12h) has a long, blunted tip and a small, narrow v-shaped hook. Transverse cuts are located along the hooked edge, likely for stylistic purposes. The hooked implement is broken but retains evidence of having been longitudinally reamed, although no grooving is present on the remaining reamed portion. Manufacture microtrace has been obliterated by polishing, weathering, and fragmentation. Like object B920, this implement is rounded and smoothed beneath the beak of the hook either from use or from manufacture using a leather thong.

Object B1193 (Figure 6-12f) is carved into a stylized form with a sharp pointed hook, rounded-pointed distal end, and a shallow elevated ledge on the edge opposite the hook. Carving of this hooked implement was finely executed, save for the beak, which is roughly carved using a whittling technique. This whittling resulted in many short, overlapping narrow channels at the hook and is likely a resharpening event. In addition to the whittling, manufacture striae consist of longitudinally oriented (and some obliquely oriented) striations indicative of use of a lithic shaving technique. These striations are most evident in places where the artisan cut into the antler to create relief as part of the design.

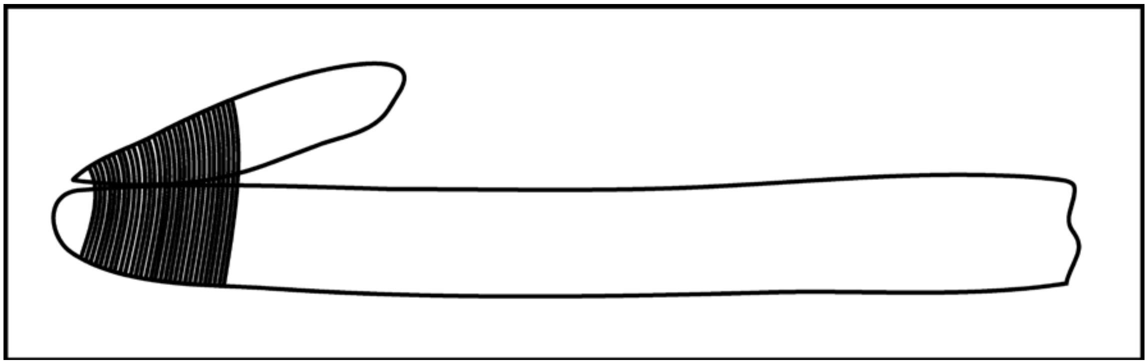


Figure 6-14. Reconstruction of Object B955, a Longitudinally Asymmetrical, Blunted Pointed Atlatl Hook from Chiggerville.

In addition to the hooked implements, one longitudinally asymmetrical, blunted implement (B955) and one antler implement fragment (B443) from Chiggerville are interpreted to have functioned as atlatl hooks. The pointed implement (Figure 6-12i-j) is 39 mm long, 12 mm wide, 11 mm thick, has a mid-section width and thickness of 10 mm, and weighs 2.8 g. The object's Tip W5 is 7 mm, Tip T5 is 6 mm, Foreshaft W10 and T10 are 8 mm, Shaft W30 is 12 mm, Shaft T30 is 10 mm, base width is 9 mm, base thickness is 5 mm, Outline Index is 0.6, and Robusticity Index is 120. The object is asymmetrical in cross-section and symmetry, has a blunted-beveled tip plan-side, and an asymmetrical-asymmetrical shaft outline-side. Obliquely oriented microscopic striations indicate shaping via a lithic shaving technique, although most of the microtrace has been obliterated by heavy weathering. The base of this object is roughly flanged and five transverse cuts have been made into the edge opposite the bevel, as if to facilitate hafting (Figure 6-12j, 6-14). The bevel at the tip is considered intentional and may have functioned to facilitate purchase of an atlatl dart against the hook.

Object B443 is an antler implement fragment with a rounded cross-section, blunted-blunted tip plan-side, and a converging-incurvate/excurvate shaft outline-side. The object is broken at the proximal end at what was likely a beak, suggesting it is a fragment of a hooked implement. Heavy obliquely oriented microscopic striations indicate manufacture via a lithic shaving technique. From the location and pattern of breakage, this object was likely abandoned due to a longitudinal split originating from the shaft/hook juncture, possibly as a result of use.

Hollow/Reamed Implements

Hollow/Reamed implements consist of sections of antler that have been reamed or hollowed along their longitudinal axes. Oftentimes these tools are polished (either intentionally or from use), and may be rounded at one or both ends. Sometimes protuberances and small junctures are removed through cutting or abrasion, while at other times these features are retained. Hollow/reamed implements are further subdivided into four varieties, only one (and possibly two) of which are represented at Chiggerville: 1) longitudinally reamed, formed and polished; 2) longitudinally reamed, unpolished; 3) longitudinally reamed, flanged; and 4) transversely (or latitudinally) reamed. No hollow/reamed implements were recovered from Baker.

Longitudinally reamed, formed and polished implements from Archaic sites are typically interpreted to have functioned as atlatl handles due to the association of these implements with atlatl weights and/or hooks from burials at sites like Indian Knoll (Webb 1974). When these objects exhibit protuberances or tine remnants they are typically well rounded and polished and may have been intentionally retained for stylistic purposes. Longitudinally reamed, unpolished hollow/reamed implements, on the other hand, may have functioned as handles for more mundane and less socially charged tool forms like knives, scrapers, or awls. White (1990:48) identified two such partially hollowed grooved and snapped objects that may have functioned as handles at Carlston Annis, and

Murray (1972a:226-229) identified both large and small handles at the Schultz site, one of which contained a cylindrical piece of copper interpreted as an awl fragment. Longitudinally reamed, flanged objects were recovered from the Firehouse site (12D563) and have been interpreted as atlatl hooks (Moore 2007). Transversely reamed hollow/reamed implements are typically interpreted as shaft strengtheners (e.g., Campana 1989:109, Olsen 1979:349) or atlatl weights (e.g., Penders 1997, 2002; Slaughter and Hoover 1965).

A total of six objects from the Chiggerville site are longitudinally reamed, unpolished hollow/reamed implements (Figure 6-12c-e). The generic form of these implements is similar to that of circumferentially grooved and snapped antler tool production debitage. It seems likely, based on their form and size, that these objects were manufactured from debitage produced by removing a distal tine from an antler tine blank. Additional shaping apparent on these objects suggests recycling into handles of some kind, but the lack of use-wear evidence at low power leaves the function of these implements in question. They were differentiated from other similar forms included among antler tool production debitage on the basis of the presence of one or more of the following morphological traits: 1) a wide and deep groove proximal to the groove and snap (n = 2), possibly for securing binding (Figure 6-12c-d); 2) a hollow rounded or conical interior (n = 6) suggesting reaming, although weathering apparently removed any evidence of reaming manufacture trace on all but one (object B569) of these objects; and/or 3) a bevel oriented toward the interior of one face (n = 2), possibly to facilitate use as a handle.

Most of these six objects were relatively complete, and basic metric data are provided in Table 6-12. Three of the hollow/reamed implements from Chiggerville exhibit evidence of manufacture via a combination of the circum g/s1 technique at the distal end, where a hafted object would have been inserted in the handles, and a slicing technique at the proximal end. Another exhibits a combination of a circum g/s2 and a slicing technique, and a fifth is broken. The sixth object (B1166) exhibits the best evidence of use as a handle (Figure 6-12d). This object was manufacture by a combination of a circum g/s1 technique at the distal end and circum g/s2 technique at the proximal end. The cross-section of the interior hollow of object B1166 is rounded through the entire length of the implement. This indicates reaming of the antler, although no reaming microtrace remains. At the object's distal end is a deep, 4 mm wide groove that runs the entire circumference. This groove is too prominent to have been a false start to an original tine sectioning groove and snap and is likely either for securing binding or for decoration.

Table 6-12. Basic Metric Data for Hollow/Reamed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Weight
B458	56	22	21	21	20	17.0
B558	44	28	19	23	18	12.7
B569	Broken	Broken	Broken	Broken	Broken	Broken
B576	Broken	33	22	Broken	Broken	Broken
B640	76	26	19	24	18	18.1
B1166	46	26	22	24	21	16.6

Additional manufacture striae evident on hollow/reamed implements include one with narrow longitudinally and obliquely oriented channels, indicating use of a whittling technique. Two others exhibited evidence of use of a combination longitudinally oriented lithic shaving and whittling technique and a combination obliquely oriented lithic shaving and whittling technique, respectively. Three of the tines used to manufacture these handles were removed from the beam via a transverse pull and snap technique, one via a longitudinal pull and snap technique, and a third through a combination transverse and longitudinal (or twisting) technique. Object B576 exhibits divets on one side, possibly indicating that the antler was weakened by pecking prior to removal.

Finally, two antler implement fragments exhibit characteristics suggesting they are broken sections of hollow/reamed implements. Object B616 (Figure 6-12a) is a large fragment of one side of a reamed implement. Circumferential grooves in the object's interior and a narrowing of the reamed channel confirms use of a lithic drill. Narrow channels at the wide end of the object indicate shaping via a whittling technique. It is possible that this object is a fragment of an antler projectile point or atlatl hook, but its large size suggests it may be an atlatl handle fragment.

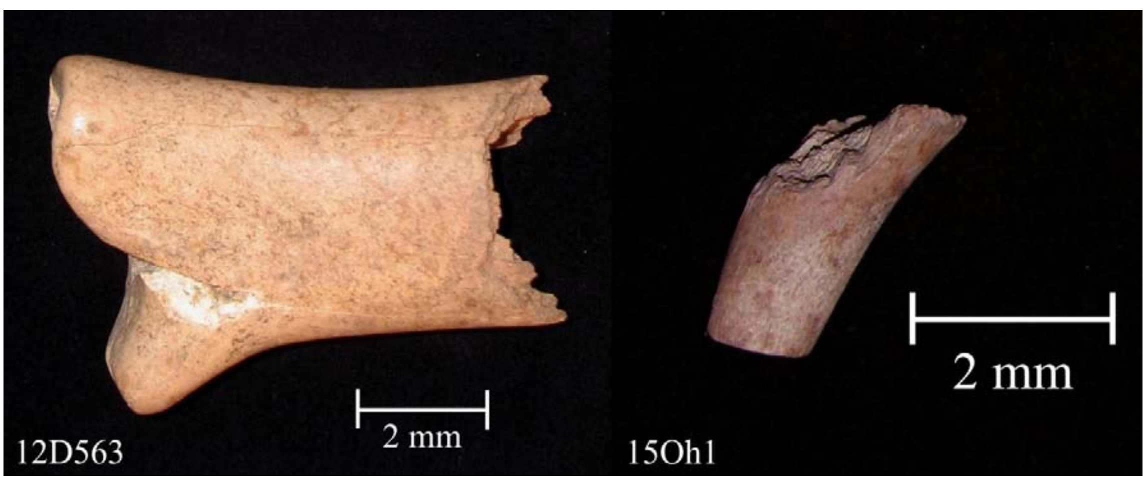


Figure 6-15. Atlatl Handles from Firehouse and Chiggerville.

Object B1115 (Figure 6-12b) is a small intentionally blunted tine portion of a heavily shaped and polished implement. The object's uniform brown color indicates intentional heat treatment prior to final polishing. Based on a comparison between this object and object 1197 from the Firehouse site, object B1115 is interpreted as an atlatl handle fragment (Figure 6-15). If this is a fragment of a hollow/reamed implement, then it is the only hollow/reamed implement that is of the longitudinally reamed, formed and polished variety.

Blunted Implements

Blunted implements consist of antler tools with at least one flat or wide, rounded working end. Latitudinally asymmetrical blunted implements (Figure 6-11f-g) consist of both antler tines with distal ends that were so reduced by use or manufacture that they could not be classified as pointed implements with blunted ends and sections of utilized antler beams. Both artifact types are typically considered to have functioned as lithic reduction tools, with the former classified as flakers and the latter as billets. Antler beam billets at Grasshopper Pueblo, analyzed by Olsen (1979:346-348), ranged in size from 9 to 23 cm and exhibited heavy pitting and v-shaped nicks "apparently caused by a spray of chips as the hammer strikes the stone" (Olsen 1979:348). Use of these objects as billets was confirmed through use-wear analysis of replicated specimens (Olsen 1979).

A total of 22 latitudinally asymmetrical blunted implements were recovered from Baker and another 6 were recovered from Chiggerville, suggesting that lithic reduction using these tools was more common at Baker than at Chiggerville. One explanation of this difference, given the larger number of antler tools at Chiggerville overall, is that these blunted implements were used for an earlier stage of lithic reduction than longitudinally asymmetrical, blunted pointed implements. This is supported by the presence of three objects classifiable as possible billets at Baker and none of these soft hammer percussion tools at Chiggerville, as well as by the debitage analysis presented in chapter 7. Additionally, two of the latitudinally asymmetrical blunted implements from Chiggerville have been classified as antler tool production debitage and are discussed with the other debitage below.

Summary statistics for the 22 latitudinally asymmetrical blunted implements from Baker are provided in Table 6-13. Much of the use-wear from lithic reduction was visible macroscopically, but nine were examined microscopically. Of the nine examined, five are classified as lithic flaking tools, one as a possible billet, one as a possible lithic flaking tool, and two as having unidentified functions. Two additional latitudinally asymmetrical blunted implements are classified as lithic flaking tools on the basis of macroscopic use-wear, two as possible billets and six as possible lithic flaking tools on the basis of similarities in form with the tools that were examined microscopically, and three as having unidentified functions. Microscopic and macroscopic use-wear includes seven implements with transverse striations on their blunted ends, seven with oblique-transverse striations, and four with longitudinal striations, all consistent with lithic reduction wear. Four of these tools exhibit lithic reduction-related pitting or chipping on their blunted ends.

Manufacture of the latitudinally asymmetrical blunted implements from Baker is consistent with other antler implements from the site. Of those examined microscopically, five exhibit evidence of reduction via the circum g/s2 technique, and another two exhibit evidence of use of the circum g/s1 technique. One was reduced by a slicing technique, and another via an unidentified groove and snap technique. Four exhibit longitudinally oriented striae indicative of use of a lithic shaving technique and another one exhibits obliquely oriented striae. An additional two unsampled objects exhibit macroscopic evidence of use of a slicing technique, one was reduced via the circum g/s2 technique and one via an unidentified groove and snap technique. One unsampled object exhibits longitudinally oriented lithic shaving striae from shaping of the tool.

Table 6-13. Summary Statistics of Latitudinally Asymmetrical, Blunted Implements from Baker.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	6	10	10	6	6
Missing	16	12	12	16	16
Mean	107	32	21	25	14
Median	94	31.5	20	24	13.5
Mode	N/A	31, 36	20	24	13
Std. Deviation	34.586	6.132	6.684	5.514	2.714
Minimum	73	23	12	18	11
Maximum	159	43	33	32	19

Three of the four latitudinally asymmetrical blunted implements from Chiggerville that are not antler tool production debitage exhibit no use-wear or use damage allowing for a functional classification. Object B950 is 35 mm long, 16 mm wide, 12 mm thick, has a mid-section width of 13 mm, and a mid-section thickness of 10 mm. This object was reduced via a circum g/s1 technique and exhibits evidence of both an obliquely oriented lithic shaving technique and a whittling technique to shape the object. The tip has been intentionally rounded and blunted for an unidentified purpose.

Object B1025 is 52 mm wide and 33 mm thick. It exhibits both longitudinally and obliquely oriented striations below the blunt that may be from either use or manufacture, and the blunted end exhibits use polish. The function of this tool is unknown. Object B1066 exhibits some widely spaced obliquely oriented striae toward the proximal end from shaping via lithic shaving. The functions of both of these objects are unknown.

Object B1017 is asymmetrical in form, but it exhibits rounding on the unbroken portions of its proximal end. This, along with heavy pitting and chipping present at the distal end, suggests this object functioned as a drift and might better be classified with the five latitudinally symmetrical blunted objects from Chiggerville (Figure 6-11h-k). These latter objects are typically cylindrical in form and exhibit two blunted (and oftentimes battered) ends. According to Winters (1969:48), tips of drifts may be slightly convex with battering on the bases. Larger forms may have been used as hammers or billets. None of these objects were recovered from Baker.

Table 6-14 provides metric data for the five latitudinally symmetrical blunted implements from Chiggerville. These objects are fairly short and narrow in shape and all five exhibit obliquely oriented lithic shaving striae. Four of the five are polished on three sides and have exposed cancellous tissue on the fourth side. Object B928 (Figure 6-11i) is burned under heavy polish, indicating intentional heat treatment or fire hardening. All five of these objects exhibit pitting or chipping on at least one end, and four exhibit evidence of compression of the antler on at least one end. Both of these use-damage patterns are consistent with use of these objects as drifts (indirect percussion tools) (Figure 6-16).

Table 6-14. Basic Metric Data for Drifts from Chiggerville.

	Max Length	Max Width	Max Thickness	Width 1/2	Thickness 1/2	Weight
B550	39	17	10	17	9	5.6
B928	31	11	6	11	6	Broken
B956	56	10	9	9	7	4.5
B984	Broken	Broken	Broken	Broken	Broken	Broken
B1061	56	10	8	10	8	4.7

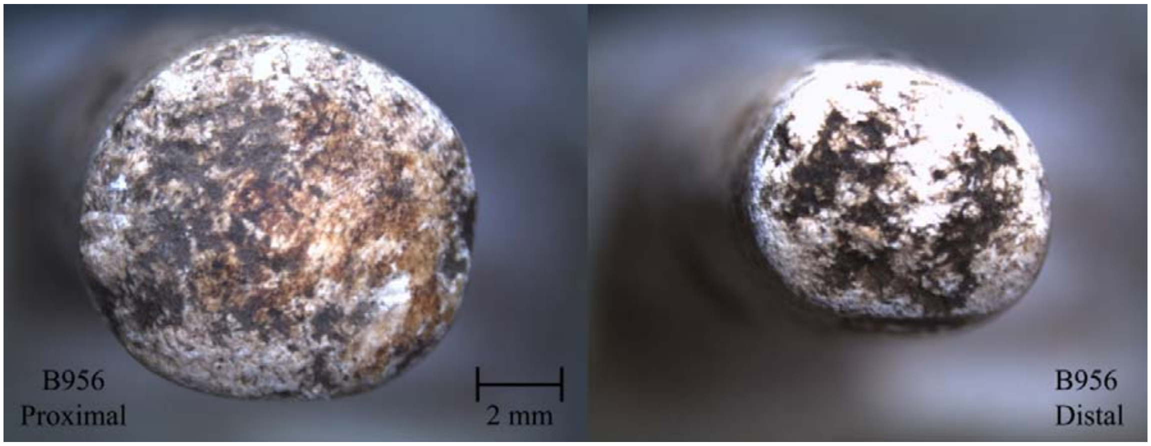


Figure 6-16. Micrographs of Proximal and Distal Ends of an Antler Drift from Chiggerville.

Antler Implement Fragments

In addition to the three antler implement fragments from Chiggerville described above, 30 objects from Chiggerville and 46 from Baker are fragments of unidentifiable antler artifacts. Of these, five from Chiggerville and three from Baker exhibit evidence of proximal reaming, indicating that they are likely fragments of either projectile points or atlatl hooks. Of the five from Chiggerville, two have flush bases, two have roughly grooved and snapped bases, and one has a beveled inward base. Of the two with bases from Baker, one is beveled inward and the other beveled outward. Two of the fragments from Chiggerville are broken in such a way as to suggest they are projectiles that shattered on impact. Antler implement fragments were not examined microscopically due to their fragmentary nature.

Of the remaining antler implement fragments from Chiggerville, two (objects B652 and B1103) may be antler tool production debitage, two may be objects abandoned during production (objects B524 and B626), and two exhibit discoloration suggesting intentional heat treatment (objects B1033 and B1183). Of the remaining antler implement fragments from Baker, objects B178 and B179 are two pieces of the same unidentified object, reducing the total number of antler implement fragments from Baker by one. Additionally, eleven objects are broken antler tine fragments with breaks at the distal end indicating a heavy downward force was applied to the distal tines of these objects. This breakage pattern suggests these eleven implements were longitudinally asymmetrical, blunted pointed implements that functioned as lithic flaking tools. These tools subsequently broke during use and were discarded at the site.

Cut Antler

Four pieces of antler from Chiggerville exhibit one or more cutmarks that are not related to use or manufacture. These are interpreted as cutmarks from butchery or processing of the deer carcass, although the possibility that these are unpatterned cutmarks related to segmenting antlers for manufacture into artifacts cannot be ruled out. No cut antler was retained in the Baker collection.

Antler Tool Production Debitage

According to Andrefsky (1998:xxii), debitage consists of "detached pieces that are discarded during the reduction process." Antler, like stone, is a reductive medium. Antler tool manufacture, therefore, results in abundant debitage, much of which is so small as to rarely be recovered by standard archaeological recovery practices (such as that removed through lithic shaving and sandstone abrasion). Commonly recovered debitage forms consist of grooved and snapped and cut fragments resulting from the removal of antler tines. Large pieces of antler production debitage such as this are common at Green River shell midden sites.

Figure 6-17 illustrates the main parts of antlers discussed in this section. For descriptive purposes, these antler sections have been further subdivided to allow for a more accurate discussion of what parts of the antler were transported to Baker and Chiggerville and how these sections were reduced. The pedicle is that section of the antler that attaches to the skull of the deer or elk. Pedicle A specimens have been cut at the skull and retain portions of the skull attached to Pedicle B, which consists of the base of the pedicle. Pedicle C is that portion of the pedicle located above the wider attachment and is typically characterized by a roughened surface and numerous small antler nubbins.

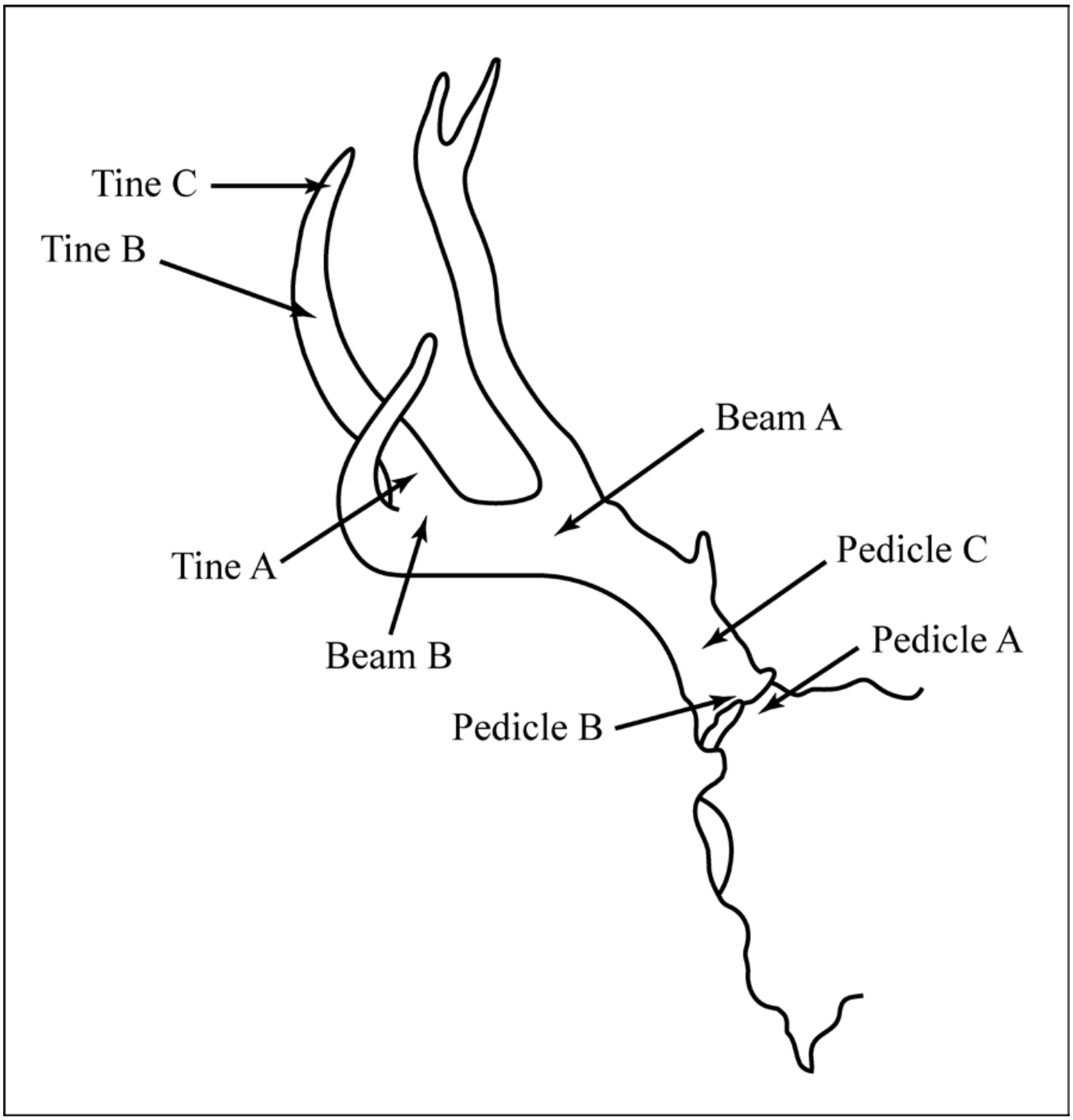


Figure 6-17. Sections of Deer Antlers.

Figure 6-18. Grooved and Snapped Bone (a) and Antler (b-i) from Chiggerville.

The antler beam is the wide, thick body of the antler located above the pedicle. Beam A is the main portion of the beam running the long axis of the antler, while Beam B consists of that small portion of the beam located at the beam/tine juncture. Tines are the pointed sections of the antler that split off from the beam both along its length and at its distal end. Tines have been furthered subdivided into proximal (Tine A), medial (Tine B), and distal (Tine C) portions.

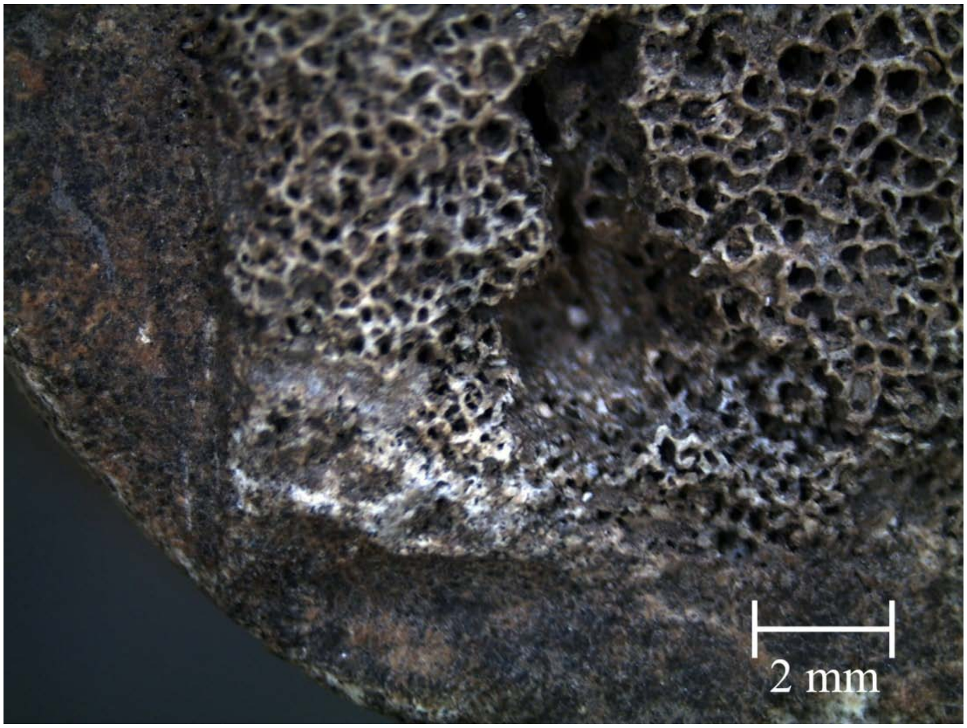


Figure 6-19. Micrograph of a Linear Turn and Cut Facet on Object B540 from Chiggerville.

Three major methods of reducing antlers have been identified at Baker and Chiggerville. The first and most common is the groove and snap technique, a cutting technique where wide grooves are cut into an antler beam or tine to weaken the antler and allow it to be broken along the groove (Figure 6-18). Although longitudinal grooving and snapping is present in the bone tool assemblage, the most common method of bone and antler reduction at these sites is circumferential grooving and snapping, where a circular groove is cut around the circumference of the antler or bone. If the groove is cut around the entire circumference, resulting in a clean break along the groove, then the 'circum g/s1' technique has been employed. If the groove is cut around only a portion of the circumference so that the break does not follow a groove around the entire antler section, then a 'circum g/s2' technique has been employed. In the latter case, an antler flange typically peels off the tine and into the beam. In cases where circumferential grooving was accomplished by cutting a series of intersecting facets (Figure 6-19), then the 'linear turn and cut' method was used to cut the groove. If the cut was accomplished by rotating the cutting tool around the circumference of the object, leaving a smooth, rounded groove, then a 'circumferential incising' method was used (Figure 6-20).

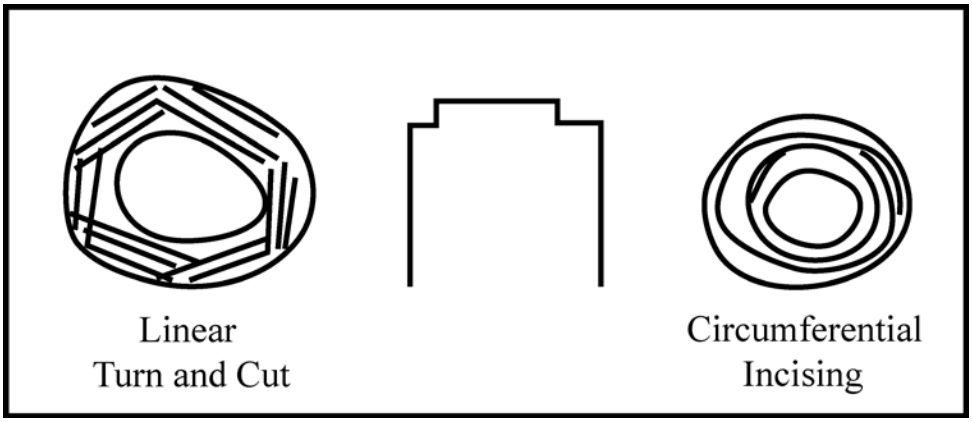


Figure 6-20. Illustrations of the Linear Turn and Cut and Circumferential Incising Techniques.

Object B604 from Chiggerville illustrates how the linear turn and cut and circumferential incising techniques are sometimes found on the same artifact. In this case, the proximal end of the object is circumferentially incised, while the distal end has facets indicative of the linear turn and cut method. It is possible that the circumferential incising technique was used while the antler was still attached to the rack (wherein it would be easier to rotate the cutting tool rather than the antler tine while cutting) and the linear turn and cut technique was used to section antlers that had been removed from the animal (presumably because it is easier to rotate the tine blank rather than the cutting tool when cutting a smooth, rounded surface). Such a distinction would support a staged antler reduction sequence, but replicative work is required to test the assumptions of the hypothesis.

The groove and snap technique of antler reduction is a common technique employed by cultures around the world. Clark and Thompson (1953) were the first to explicitly identify the technique in Upper Paleolithic through middle Neolithic assemblages in Europe. Significant quantities of red deer antler from Star Carr were reduced by longitudinally cutting grooves into antler beams with burins or blades and then removing the v-shaped projectile blanks by levering or cutting with a strip of thread. Numerous analysts have identified the use of this technique at sites in the Midwest and Southeast, and it was the most common antler reduction technique employed at both the Archaic Black Earth site in Illinois (Breitburg 1982) and the Woodland Schultz site in Michigan (Murray 1972b). Kidder (1932), working in the Southwest, and Morrison (1986), working in the Northwest Territory of Canada, both identified a tendency for groups to abandon the groove and snap antler reduction technique and replace it with a transverse sawing technique once metal tools were adopted.

Figure 6-21. Antler (a-d) and Bone (e-g) Tool Production Debitage from Baker.

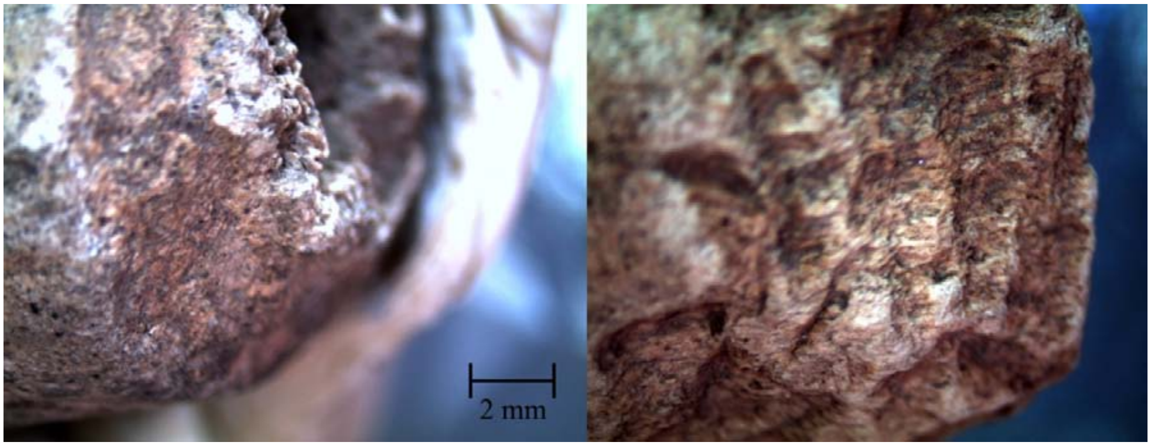


Figure 6-22. Slicing Microtrace on Object B618 from Chiggerville (left) and B129 from Baker (right).

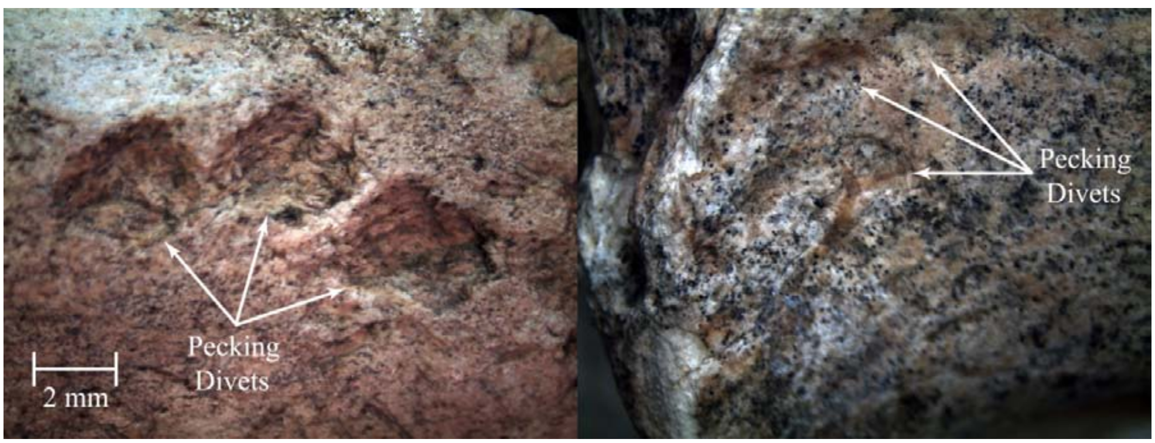


Figure 6-23. Pecking Divets on Objects B129 from Baker (left) and B470 from Chiggerville (right).

Some objects were reduced by a circumferential slicing technique, where the antler is cut around its circumference by pressing a lithic tool into and downward against the side of the tine or beam, removing a small sliver of antler with each cut (Figure 6-21). This serves to thin the antler in the same manner as grooving, but removes more of the antler surface in the process. Slicing results in a cut with a rough and jagged appearance. Sliced antler may retain short, parallel v-shaped cuts with antler flaps from cutting left adhering to the debitage (Figure 6-22). Localized polish on some sliced and grooved and snapped objects may be from contact of the cutting tool with the antler or from use of a lithic wedging device to facilitate antler removal. Microscopic divets at the beam/tine juncture on some pieces of debitage suggest use of a pecking technique to weaken the antler at this location prior to removal (Figure 6-23). Limited experiments with removing antler tines from beams by the author indicated that wedging with a flake or retouched tool was difficult to perform due to slippage of the wedge against the antler, although a hafted wedge may have more success. An experiment with pecking suggested that this technique did have a weakening effect since the antler tine broke where the pecking had been conducted, but additional experimentation is required to more fully explore the influence of pecking on the break. Both grooved and snapped and pecked and sliced objects replicated by the author required use of a vice to remove the weakened and thinned antlers from their beams. It is possible that some of the polish identified on these specimens and attributed to wedging is vice polish from use of a prying implement to separate the tool blank from the antler.

Reference to slicing, wedging, and pecking in the literature is rare. Saunders et al. (1990) describe an ivory mammoth tusk semifabricate from the Clovis culture Blackwater Draw Locality No. 1 in New Mexico that was detached by pecking a guide line on the tusk, expanding this guide line into a circumferential groove through longitudinal cutting/scraping/chopping, and then prying the tusk tip from the shaft with a pair of hammerstone/wedges. Kidder (1932) states that some of the antler from the Pecos region was reduced by hitting with a stone or prying the antler apart in a rock crevice. This may have involved use of a slicing or pecking technique that was not identified by Kidder (1932), although it is also possible that unaided reduction by percussion or prying/wedging was practiced at Baker and Chiggerville but not identified during this study. Both Breitburg (1982) and Murray (1972) identified use of a prying and breaking technique at Black Earth and Schultz, respectively. Morrison (1986) mentions use of a chop and snap technique at the Kugaluk site in Canada. This may refer to the slicing technique as described herein but is more likely a hacking technique, although slicing and light hacking may be difficult to distinguish. Replication is needed to further differentiate between these two techniques.

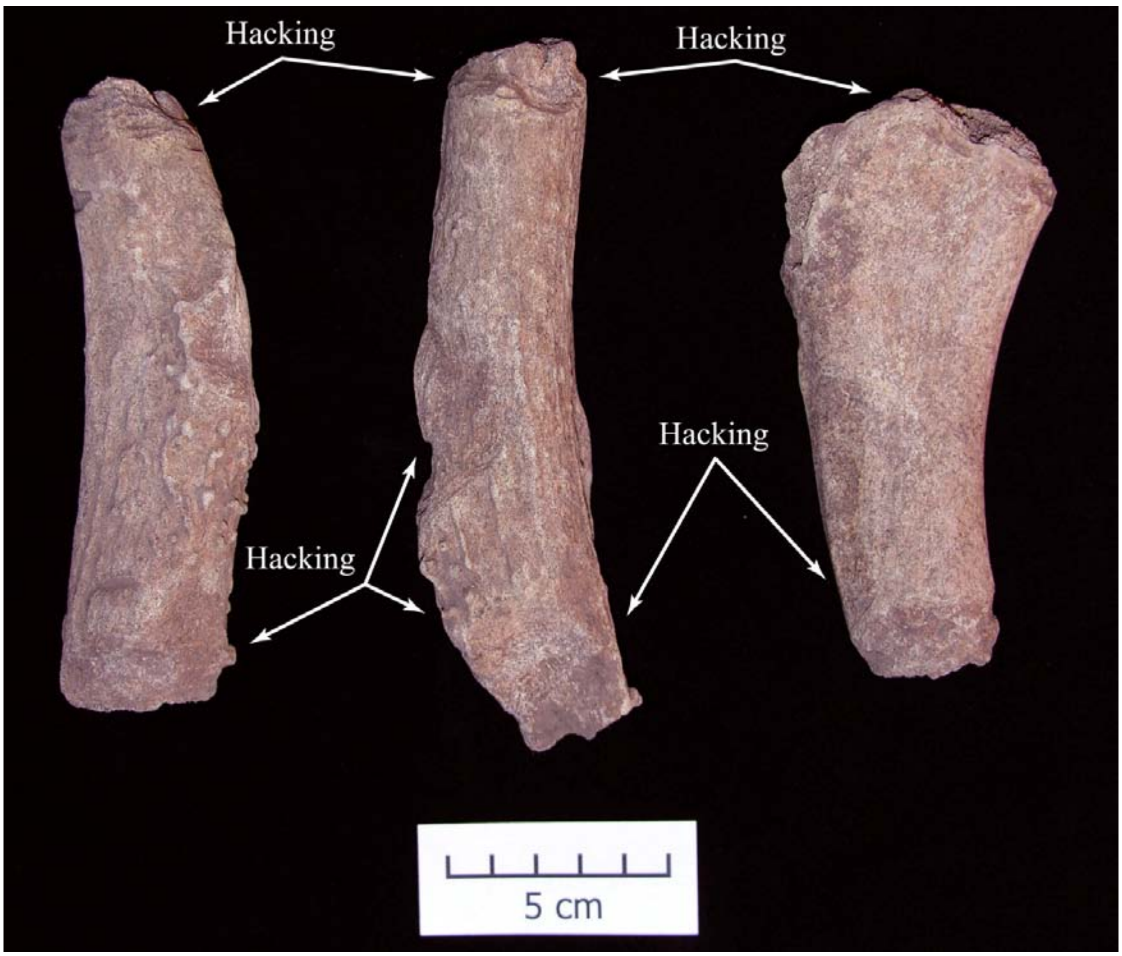


Figure 6-24. Hacked Antler Pedicles and Beams from Chiggerville.

Hacking, as defined at the Baker and Chiggerville sites, consists of separation of antler beam or tine sections using a heavy stone axe or adze (Figure 6-24). Hacking results in deep gashes and v-shaped short cuts over the hacked area, some of which retain small flaps of antler similar to those created by the slicing technique. The two techniques are differentiated by wider grooves created by use of a heavier stone implement during hacking (Figure 6-25). Both Kidder (1932) and Olsen (1979, 1980) record use of the hacking technique at sites in the Southwest. According to Olsen (1979), hacking yields v-shaped cuts and an irregular breakage pattern. According to Kidder (1932:272):

> Hacking, a method much less neat than sawing, was nevertheless often used for severing tines. A stone axe or heavy spall was employed to chop a rough groove, sometimes sufficiently deep to reach the soft core, more often only far enough in to weaken the shaft and enable it to be snapped in two… An examination of the hack marks shows them to have been made in all cases with a rather blunt-edged instrument, evidently a stone axe of so little cutting ability that dozens of blows were often necessary to produce the necessary groove, even on a small tine.

Hacking, or "cleaving the portion [of antler] with an ax," was reported as rarely used at Black Earth (Breitburg 1982:918).

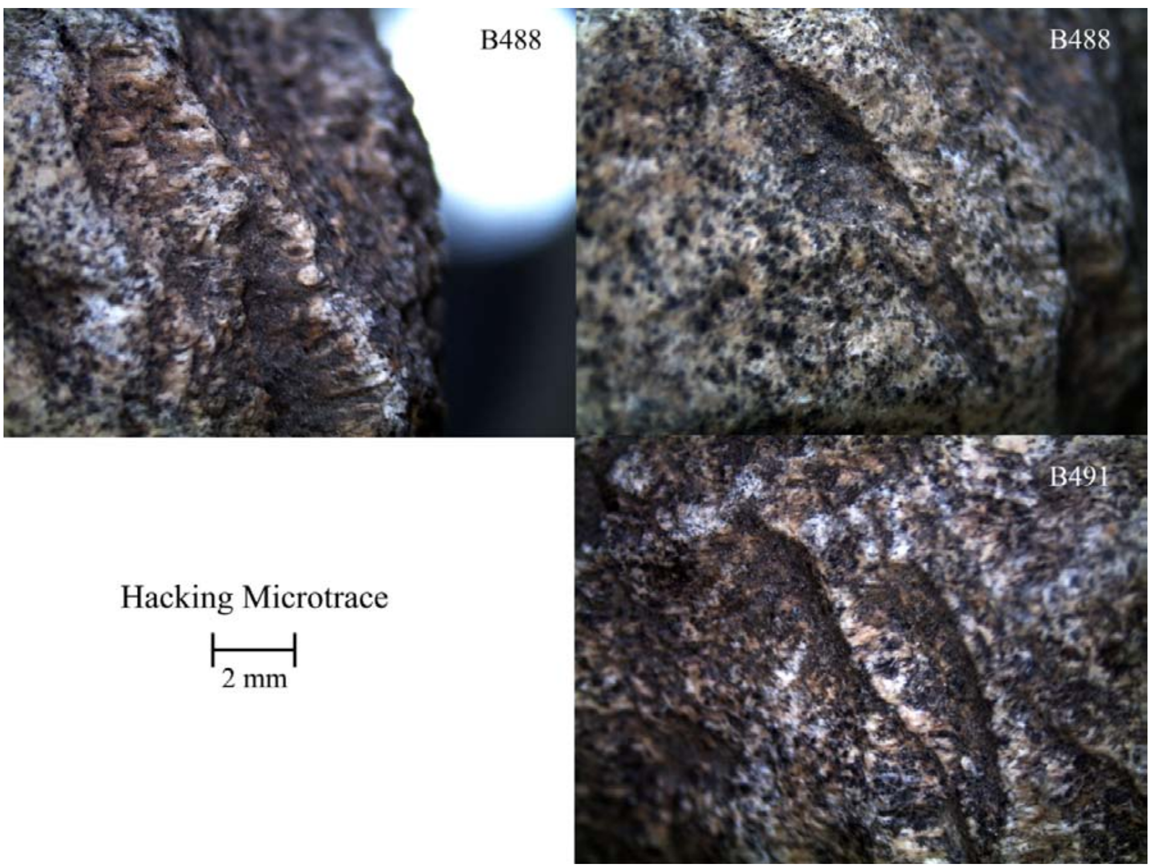


Figure 6-25. Micrographs of Hacking on Antler Tool Production Debitage from Chiggerville.

Experimental removal of antler tines conducted by the author indicated that the direction of removal of an antler tine from a beam could be determined by examining the orientation of roughened grooves remaining in the cancellous tissue on broken specimens. Breaks tend to be directed perpendicular to these grooves (Figure 6-26). Tines removed perpendicular to the long axis of the antler are removed via the 'transverse pull and snap' technique, while tines removed by applying downward pressure in alignment with the long axis of the beams are removed via a 'longitudinal pull and snap' technique. Some tines were removed by applying force in a twisting or back-and-forth-side-to-side motion, resulting in a combination of the two techniques. Many objects removed via the transverse pull and snap or combination techniques retain a section of the flat portion of the antler beam at their proximal ends (Figure 6-18:c, e), while those removed via the longitudinal pull and snap technique retain a portion of the rounded edge of the antler beam. These beam sections are referred to herein as the flange.

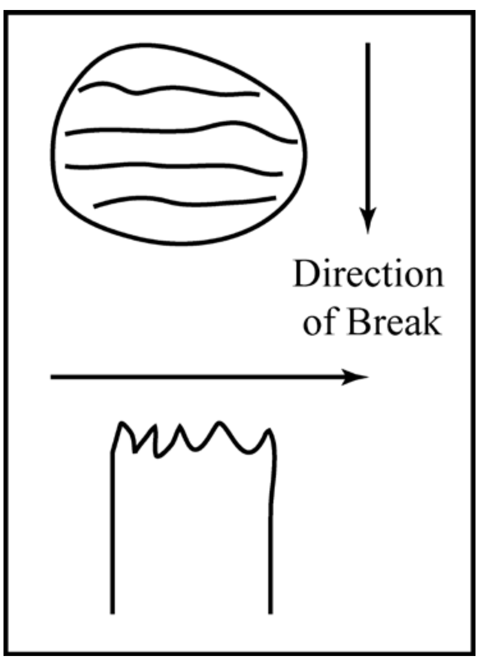


Figure 6-26. Relationship between Roughened Grooves on Broken Antler and the Direction of Tine Removal.

A total of 84 artifacts from Baker and 182 from Chiggerville were classified as antler tool production debitage. Of these, most (83 from Baker and 174 from Chiggerville) exhibit some evidence of use of a groove and snap technique. Only one object from Baker and four from Chiggerville exhibit only evidence of a hacking technique, while two from Chiggerville exhibit only evidence of slicing and two only evidence of pecking. Additionally, two latitudinally asymmetrical blunted implements from Chiggerville have been classified as debitage. Table 6-15 provides summary statistics for circumferentially grooved and snapped antler tool production debitage from the two sites.

Table 6-15. Summary Statistics for Circumferentially Grooved and Snapped Antler Tool Production Debitage from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width 1/2	Thickness 1/2
Baker	Valid	54	60	58	53	53
	Missing	29	23	25	30	30
	Mean	80	28	20	23	19
	Median	69.5	25.5	19	21	18
	Mode	45	22	18	21	19
	Std. Deviation	44.760	9.087	4.521	6.650	2.962
	Minimum	29	18	12	14	12
	Maximum	293	63	42	56	28
Chiggerville	Valid	131	126	130	119	121
	Missing	43	48	44	55	53
	Mean	64	30	19	23	18
	Median	61	29	19	23	18
	Mode	56	30	18	22	18
	Std. Deviation	21.470	6.705	2.855	4.569	2.943
	Minimum	25	17	12	12	11
	Maximum	137	54	32	35	31

A total of eight pieces of antler tool production debitage from Chiggerville and ten from Baker include portions of antler pedicle. The objects from Chiggerville consist of two objects that are Pedicle B fragments, one that is Pedicle B and C, two that are Pedicle B/C and Beam A, one that is Pedicle C, one that is Pedicle C and Beam A/B, and one that is Pedicle C and Tine A. Five of these objects exhibit circumferential grooving and snapping. The use of this technique and the small size of some pedicle fragments suggest that these are worked pieces of smaller antlers that were treated in a manner similar to tines.

Three sections of pedicle from large antlers exhibit only evidence of hacking (n = 2) or slicing (n = 1). The two hacked specimens (Figure 6-24 left and center) exhibit deep gashes and v-shaped cuts indicating use of a heavy stone tool such as an axe or an adze. Both specimens also are hacked at their mid-sections, where ancillary tines were removed from the pedicle by hacking circumferentially around the base of the tine, leaving a small knob on each pedicle. Both antlers were removed from the skull by chopping two bevels into the base of the antler in a manner similar to that employed when chopping down a tree with an axe. One specimen (B491) exhibits a single gouge in the side opposite the bevels, and the other has hack marks randomly placed across the pedicle, including misplaced hack marks.

The ten pedicles from Baker all exhibit evidence of use of the groove and snap technique. Of these, seven are nearly complete antlers consisting of portions of the pedicle, beam, and tines. These antlers each have between one and three tines removed via a groove and snap technique. One (object B264) exhibits three perpendicular cuts on its distal beam section that may represent preparations to section the distal antler. Three other pedicles are fragments of smaller antlers that were treated in a manner similar to tines.

It seems, then, that pedicle reduction differs at the two sites. At Chiggerville, when larger antlers were brought to the site they were further reduced by heavy cutting or chopping via a circumferential hacking or slicing technique. This sectioned the antlers and removed their tines, which could be further worked into artifacts. At Baker, complete or nearly complete antlers were more likely to be brought to the site whole. Rather than sectioning these antlers, however, distal tines were removed as needed via a circumferential groove and snap technique. Unfortunately, the antler sections used to produce the one piece of hacked antler tool production debitage (object B168) from Baker was not recorded as part of this analysis. Judging from the size of this object (maximum width = 21 mm, maximum thickness = 18 mm), however, it is likely that it is a section of antler tine and not a pedicle or beam.

Six pieces of antler tool production debitage from Chiggerville are portions of antler beams retaining Beam A and Beam B sections. Two of these are palmate in form and one retains a Tine A/B. These beam sections indicate that whole antlers returned to Chiggerville were sectioned prior to tine removal. Two (and possibly a third) of the antler Beam A/B sections were sectioned at the beam via a circum g/s1 technique. Of these, one exhibits tine removal via a slicing technique, one via a circum g/s2 technique, and one via an unidentifiable groove and snap technique. The Beam A/B section that retains a Tine A/B was removed from the pedicle by hacking with an axe or adze, as were the two palmate Beam A/B sections. The tine on the Beam A/B and Tine A/B antler section was removed via a circum g/s1 technique, while those on the palmate beams were removed by hacking (Figure 6-24 right). The sectioning of complete antlers returned to Chiggerville is further illustrated by the fact that one of the palmate Beam A/B sections (object B488) does not refit with but seems to match one of the hacked pedicle sections (object B491), suggesting they are two portions of the same antler.

At Baker, nine pieces of antler tool production debitage retain sections of Beam A and B. Six of these retain between one and three Tine A sections and one a Tine A/B section. All Beam A/B objects from Baker exhibit evidence of use of the circumferential groove and snap technique both to section the beams (in four cases) and to remove tines (eleven tines total removed with both the circum g/s1 and g/s2 techniques). Beams from both sites, then, confirm that removal of antler tines was the primary goal of antler reduction, although some beam and pedicle sectioning for an unknown purpose was practiced at both sites. The use of circumferential grooving for all steps at Baker differs from Chiggerville in that a heavy hacking reduction technique was practiced to a limited degree at Chiggerville. It is possible that initial antler reduction at Chiggerville was practiced at the kill site, where sections of antler were rapidly reduced for transport by chopping with an axe or adze, while antlers were sometimes returned nearly complete to Baker and reduced entirely via a more carefully executed groove and snap technique.

Of the remaining 168 pieces of antler tool production debitage from Chiggerville, 165 are grooved and snapped sections of antler tine. Of these, 94 are sections of cut antler retaining the Beam B and Tine A portions, 1 is a Beam B with two Tine A portions present, 9 are Beam B portions with Tine A/B portions present, 48 are Tine A sections, 10 are Tine A/B sections, and 2 are Tine B sections. Finally, one piece of antler tool production debitage is a Tine A/B/C with the beginning of a groove for removal of the tine present but not completed.

All of the remaining 64 pieces of antler tool production debitage from Baker are grooved and snapped. Of these, 1 is a Beam B section, 22 are Beam B and Tine A sections, 13 are Beam B sections with Tine A/B portions present, 21 are Tine A sections, and 7 are Tine A/B sections. This large amount of antler tine debitage at both sites indicates that the major focus of antler reduction was the production of antler tine pointed implements like antler projectile points. Murray (1972:305) has suggested that the presence of so many proximal cut antler tine fragments at Schultz indicates "that a number of tines were removed and collected at one time and saved as reserve stock. As an implement was needed, the tine could then be cut to the desired length." The same is likely true of the Baker and Chiggerville sites.

These antler sections at both sites indicate removal of the antler tine from the beam via either a circum g/s2 or proximal slicing technique. This was followed by removal of the distal Tine B/C via a circum g/s1 technique. At Chiggerville, and in two cases at Baker, removal of the proximal beam section from the main beam was apparently sometimes facilitated by striking the antler tine around its base in a pecking technique. Use of a wedging device of some sort is also suggested at Chiggerville, although polish attributed to a wedging tool may also be from proximal slicing. In rare cases, a circum g/s1 technique was used to cut the antler tine at both ends. Additionally, four objects from Chiggerville exhibit one or more hack marks, suggesting use of this technique to reduce tines or misplaced hack marks from initial sectioning of the antler beam.

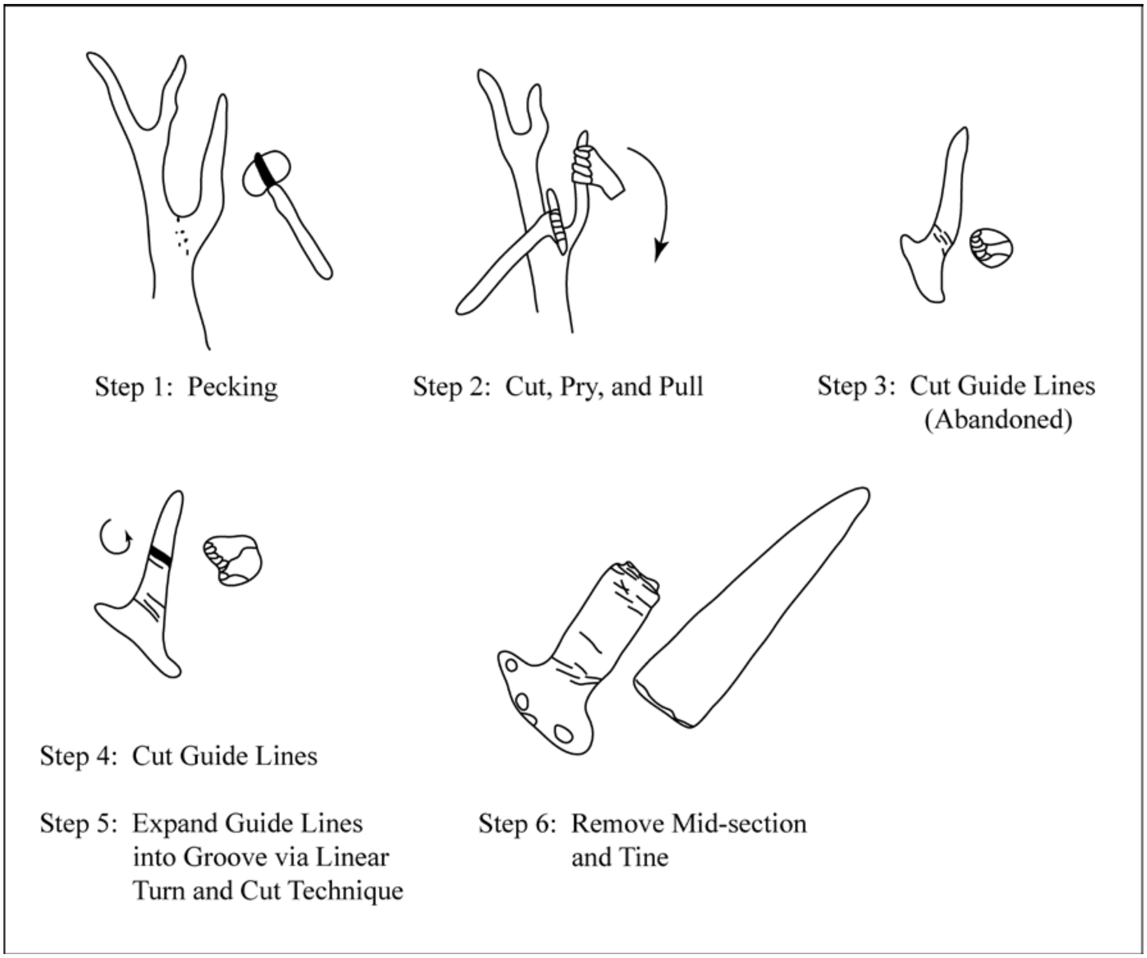


Figure 6-27. Outline of Manufacture Techniques represented by Object B522 from Chiggerville.

Object B522 from Chiggerville illustrates the dominant method of antler reduction at that site (Figure 6-27). This antler Beam B and Tine A section was apparently removed from the beam by pecking around Beam B, then slicing into the side of the base of the tine and using this lithic tool as a wedge and prying tool while pulling the tine along the longitudinal axis of the beam. Once the beam section and complete tine was removed from the antler, a light circumferential groove (or guide line) was incised around the base of the tine just above Beam B. These cuts are both perpendicular and oblique to the long axis of the tine. This shallow groove was then abandoned and a second groove was started farther up the antler. After starting a circumferential guide line, a groove was cut deep into the antler via the linear turn and cut technique. The antler tine and mid-section was snapped off of object B522 once the groove had been cut deeply enough to penetrate the entire cortex of the antler.

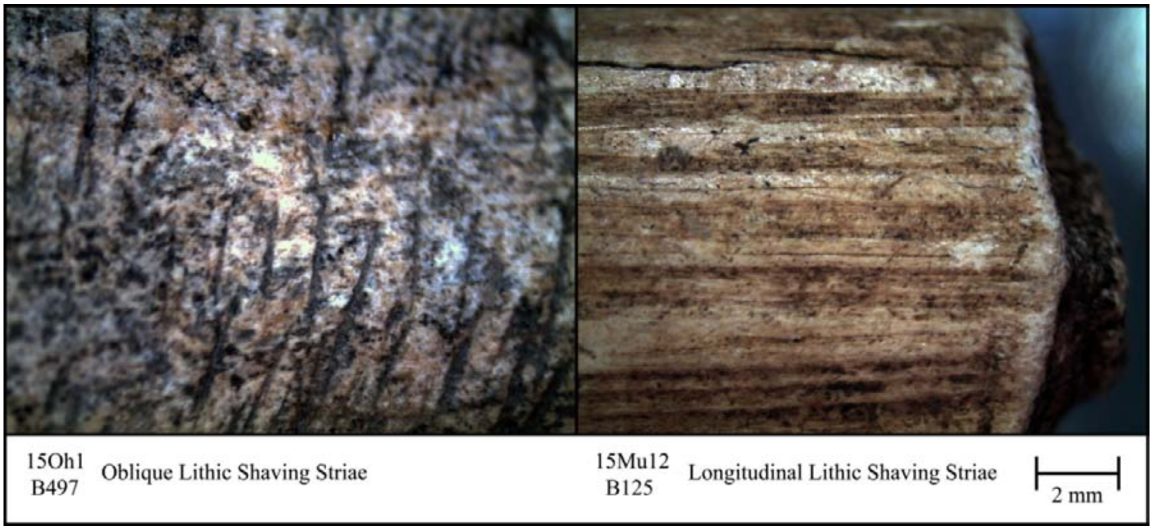


Figure 6-28. Pre-Removal Tine Shaping Manufacture Microtrace.

In some cases, grooved and snapped pieces of antler tool production debitage exhibit evidence of pre-removal tine shaping manufacture microtrace (Figure 6-28). At Chiggerville, 70 of the 165 grooved and snapped beam and tine sections exhibit macroscopic evidence of shaping of the distal tine prior to cutting the groove that removed the tine from the debitage. Of these, 48 were shaped via an obliquely oriented lithic shaving technique, 2 via a longitudinally oriented lithic shaving technique, 5 via a combination of obliquely and longitudinally oriented lithic shaving, 2 via a combination of obliquely oriented lithic shaving and whittling, and 13 via a whittling technique alone. The pre-removal tine shaping of object B456 stands out as unique. This object was apparently whittled, but the cutmarks exhibited are not the short, narrow channels evident on most whittled artifacts. Instead, this object exhibits fine, parallel longitudinal cuts that in one place cut into the antler deeply. It is possible this object might better be classified as shaped via a longitudinally oriented lithic shaving technique.

At Baker, 38 of the 64 grooved and snapped beam and tine sections exhibit macroscopic evidence of shaping of the distal tine prior to cutting the groove that removed the tine from the debitage. Of these, 34 were shaped via a longitudinally oriented lithic shaving technique, 1 via an obliquely oriented lithic shaving technique, and 3 via a combination of obliquely and longitudinally oriented lithic shaving. The lack of whittling at Baker and the predominance of longitudinally oriented lithic shaving over the obliquely oriented striae found at Chiggerville further supports the distinction between the two assemblages (discussed below).

One piece of antler Tine A debitage from Chiggerville (object B485) was removed via a slicing technique, with no evidence of grooving and snapping present, and two other objects (B484 and B605) exhibit pecking divets but no other evidence of modification. All three of these objects are heavily weathered or damaged, suggesting that other manufacture techniques may have been used to reduce these antler fragments. In fact, object B605 exhibits some deep parallel grooves that may be hack marks, and object B484 may exhibit a weathered section of a groove.

Two additional pieces of antler tool production debitage from Chiggerville require special mention. Objects B459 and B620 are latitudinally asymmetrical, blunted implements that have been classified as debitage. Object B459 is grooved and snapped at one end and blunted at another. This blunted end is a Tine A section that exhibits no use-wear and is likely a naturally broken and rounded antler tine that was removed from a beam (possibly being shaped for use) and discarded. Object B620 is an antler Tine A that is deeply incised transverse to the distal end, narrowing the final circum g/s1 (Figure 6-11g). This piece of debitage was likely cut in this manner in preparation of removal of a tine specially thinned for manufacture into a latitudinally symmetrical, blunted implement (or drift). These objects illustrate that the morphological classification employed in the majority of bone tool analyses is not sufficient for distinguishing artifacts from debitage.

Figure 6-29. Antler Sectioning at Chiggerville.

Analysis of the antler tools and tool production debitage at Baker and Chiggerville indicates that all sections of the antler are represented but in varying quantities (Figure 6-29). To assess the total use of antler at the site, the total number of antler sections by type were calculated (Table 6-16). The data presented in Table 6-16 treats each antler section as a unique entity so that an antler artifact consisting of Beam B and Tine A sections is counted twice in the table. As can be seen, there is little apparent variation between the two sites in terms of the kinds of antler sections represented, however, these differences are statistically significant ($\chi 2 = 82.371$; *df* = 7; $p < .001$). Antler base (Tine A) sections are the most common fragments, stemming from the recovery of large numbers of circumferentially grooved and snapped debitage at each site. Table 6-16 further supports the hypothesis that the groups inhabiting both sites were curating antler tines for further reduction into antler pointed implements.

The greatest difference between the two sites lies in the significantly higher than expected frequency of distal antler tines (Tine C) at Chiggerville and significantly lower than expected frequency of these sections at Baker (Table 6-16). This reflects the greater number of antler pointed implements recovered at Chiggerville and likely indicates that Baker's inhabitants were manufacturing implements at Baker and then removing them from the site prior to discard. Chiggerville's inhabitants, on the other hand, were apparently making and using their antler pointed implements on site. This may indicate that a greater degree of curation and recycling was practiced by Baker's inhabitants or that Baker was a gearing up station for activities conducted elsewhere, while Chiggerville was occupied for a longer period of time.

This gearing up hypothesis may be supported by the higher frequency of early stage antler reduction activities evident at Baker. While Baker yielded only 29.3 percent of the total number of antler artifacts from the two sites, it yielded 38.2 percent of the total number of antler sections, suggesting that antler is less reduced at Baker than at Chiggerville. This is further supported by the significantly higher than expected frequency of Beam A and Pedicle C sections at Baker and significantly lower than

Table 6-16. Total Number of Antler Sections by Type at Baker and Chiggerville.

		Antler Section								
		Tine A	Tine B	Tine C	Beam A	Beam B	Pedicle A	Pedicle B	Pedicle C	Total
Baker	Count	154	95	27	30	86	1	5	25	423
	Expected Count	140.4	87.2	72.3	16.8	87.2	.8	5.0	13.4	423.0
	Std. Residual	1.2	.8	-5.3	3.2	-.1	.3	.0	3.2	
Chiggerville	Count	213	133	162	14	142	1	8	10	683
	Expected Count	226.6	140.8	116.7	27.2	140.8	1.2	8.0	21.6	683.0
	Std. Residual	-.9	-.7	4.2	-2.5	.1	-.2	.0	-2.5	
Total	Count	367	228	189	44	228	2	13	35	1106
	Expected Count	367.0	228.0	189.0	44.0	228.0	2.0	13.0	35.0	1106.0

expected frequencies of both at Chiggerville (Table 6-16). As mentioned before, it appears that whole antlers were more likely to be brought to Baker for reduction, while late stage debitage (antler Beam B and Tine A sections) and finished tools are more prevalent at Chiggerville.

Tables 6-17 through 6-22 further explore manufacturing strategies at Baker and Chiggerville by calculating the frequencies and proportions of various production techniques employed at the two sites. These tables compile data on production for all artifacts and antler tool production debitage sampled for microscopic analysis. A total of 189 (43.4 percent) antler objects from Chiggerville and 66 (36.7 percent) from Baker are included in this sample. These tables do not account for multiple uses of each technique on a single artifact.

Table 6-17. Frequencies of Antler Reduction Strategies Employed at Baker and Chiggerville.

		Antler Reduction Strategies					
		UID G/S	Circum G/S1	Circum G/S2	Slicing	Hacking	Total
Baker	Count	8	32	27	7	1	75
	Expected Count	5.5	37.4	12.7	16.5	2.9	75.0
	Std. Residual	1.1	-.9	4.0	-2.3	-1.1	
Chiggerville	Count	11	97	17	50	9	184
	Expected Count	13.5	91.6	31.3	40.5	7.1	184.0
	Std. Residual	-.7	.6	-2.6	1.5	.7	
Total	Count	19	129	44	57	10	259
	Expected Count	19.0	129.0	44.0	57.0	10.0	259.0

Table 6-18. Frequencies and Proportions of Groove and Snap Methods Employed at Baker and Chiggerville.

		Linear Turn and Cut	Circumferential Incising	Combination
Baker	Frequency	32	1	0
	Percent	48.5	1.5	0.0
Chiggerville	Frequency	76	7	2
	Percent	40.2	3.7	1.5

Table 6-19. Frequencies of Pull and Snap Techniques Employed at Baker and Chiggerville.

		Pull and Snap Techniques			
		Transverse	Longitudinal	Combination/ Twisting	Total
Baker	Count	18	10	1	29
	Expected Count	18.7	7.7	2.6	29.0
	Std. Residual	-.2	.8	-1.0	
Chiggerville	Count	55	20	9	84
	Expected Count	54.3	22.3	7.4	84.0
	Std. Residual	.1	-.5	.6	
Total	Count	73	30	10	113
	Expected Count	73.0	30.0	10.0	113.0

Table 6-20. Frequencies and Proportions of Pecking and Possible Wedging Employed at Baker and Chiggerville.

		Pecking	Wedging	Both
Baker	Frequency	2	1	0
	Percent	3.0	1.5	0.0
Chiggerville	Frequency	14	6	13
	Percent	7.4	3.2	6.9

Table 6-21. Frequencies and Proportions of Manufacture Striae Reflecting Various Tine Shaping Techniques Employed at Baker and Chiggerville.

		Oblique	Longitudinal	Whittling	Long/ Obl	Long/ Whit	Obl/ Whit	Obl/ Long/ Whit	Abrasion	Abras/ Long
Baker	Freq	2	33	1	2	0	0	0	0	0
	%	3.0	50.0	1.5	3.0	0.0	0.0	0.0	0.0	0.0
Chiggerville	Freq	46	10	25	10	5	10	1	1	1
	%	24.3	5.3	13.2	5.3	2.6	5.3	0.5	0.5	0.5

Table 6-22. Frequencies and Proportions of Antler Heat Treatment Observed on Baker and Chiggerville Artifacts.

		Absent	Suggested	Present
Baker	Frequency	65	0	1
	Percent	98.5	0.0	1.5
Chiggerville	Frequency	181	1	7
	Percent	95.8	0.5	3.7

As can be seen from these tables, the Baker and Chiggerville assemblages differ little with regard to the method used to groove and snap and pull and snap (χ^2 = 2.250; *df* = 2; p = .325) antler and in the general absence of use of any method of heat treatment. Chi-square tests of groove and snap and heat treatment techniques are not permissible because 50 percent of the cells in both tables have expected frequencies of less than 5. However, the two assemblages are distinct in terms of the antler reduction strategies and tine shaping techniques employed. While inhabitants of both sites frequently employed the circum g/s1 technique to section antler, particularly to remove distal tines from proximal tine and beam sections, the inhabitants of the Baker site were more likely to use the more carefully executed circum g/s2 technique to remove antler tines from beams and section antler (χ^2 = 34.591; *df* = 4; p <.001). Chiggerville's inhabitants, on the other hand, rarely used this technique and, instead, employed a slicing or hacking technique, possibly in conjunction with pecking and wedging (Tables 6-17 and 6-20). The frequency of slicing at Baker is significantly lower than expected, but standard residuals of hacking at both sites and slicing at Chiggerville do not indicate frequencies that vary significantly from observed values, and a Chi-square test was not possible for Table 6-20 since 50 percent of the cells have expected frequencies less than 5. While both assemblages indicate use of a lithic shaving technique to shape and form antler artifacts, a longitudinally oriented lithic shaving technique was more often used at Baker and an obliquely oriented lithic shaving or whittling technique was used at Chiggerville. Together, these differences indicate that very different antler production strategies were being practiced at the two sites. Unfortunately, too many cells (55.6 percent) in Table 6-21 have expected frequencies less than 5 for a Chi-square test to be permissible. When the table is reduced to 6 cells by splitting combinations of techniques in two (i.e., tabulating each Long/Obl as one Longitudinal and one Oblique) and removing abrasion from the table, the results are significant ($\chi^2 = 61.615$; *df* = 2; p < .001).

Comparison of Baker and Chiggerville Antler Assemblages

Comparison of the Baker and Chiggerville antler assemblages indicates that the two assemblages are quite distinct from one another. The Chiggerville assemblage is characterized by more finished tools overall, and this assemblage contains many more antler projectile points. Additionally, composite antler implements such as atlatl hooks and handles are present only at Chiggerville, with the former representing the only form of stylized antler at the two sites. While Baker yielded a disproportionate number of latitudinally asymmetrical blunted implements, more precise stone tool manufacture tools like drifts are present only at Chiggerville.

Differences in antler reduction and antler tool manufacture are also represented by the two assemblages. The higher frequency of partially reduced and early stage antler reduction debitage at Baker suggests that whole antlers were brought to Baker for careful sectioning using predominantly a groove and snap technique. At Chiggerville, on the other hand, antlers were apparently more likely to be sectioned away from the site using crude techniques like slicing and hacking and only select portions returned to the site. The primary goal of antler reduction at both sites seems to be the production of antler tine tools like projectile points and lithic reduction tools.

The difference in antler shaping at the two sites may suggest that their inhabitants are not historically related, but represent two distinct antler reduction traditions (discussed further in the section on bone tools, below). The fact that antler tines were removed from beams with a circum g/s2 technique and then reduced with a longitudinally oriented lithic shaving technique at Baker, while a slicing or hacking technique and obliquely oriented lithic shaving or whittling was employed at Chiggerville illustrates well the historical difference between the two sites. While technologies and assertive styles are expected to change with time and tool types vary depending on site function, technological style (embodied by reduction techniques) are less likely to vary significantly through time. Historical connections might be asserted by citing the small numbers of objects manufactured via the non-dominant techniques at each site, but these objects can as easily be explained by reference to the limited Middle Archaic occupation at Chiggerville and Late Archaic occupation at Baker.

Bone Tool Production at Baker and Chiggerville

A total of 788 bone objects from Chiggerville and 363 from Baker were available for study. Artifacts from Chiggerville include 552 pointed implements; 67 bi-pointed implements; 17 spatulate implements; 1 unpointed, modified diaphysis; 2 bone tubes; 22 unpointed, perforated implements; 2 pieces of bone tool production debitage; 36 bone implement fragments; 13 pieces of cut bone; and 76 unmodified bones. Artifacts from Baker include 184 pointed implements; 18 bi-pointed implements; 99 spatulate implements; 4 bone tubes; 8 pieces of bone tool production debitage; 40 bone implement fragments; 1 piece of cut bone; and 9 unmodified bones. Unmodified bones were classified as tools by the WPA but were not found to exhibit any microscopic or macroscopic evidence of use or modification during this study. All other artifact categories are discussed and varieties and sub-varieties identified and described individually below. Unless otherwise stated in the sections below, measurements taken on bone tools (particularly pointed implements) are the same as those obtained from antler tools. Zooarchaeological data pertaining to species and elements used to manufacture the bone tools from Baker and Chiggerville could not be obtained within the timeframe laid out for this study.

Pointed Implements

As with antler pointed implements, bone pointed implements consist of all artifacts with a single converging functional end (including those traditionally classified as awls, projectile points, and daggers). In the past, these tools have been classified on the basis of taxa or anatomical elements from which they were made (e.g., Kidder 1932) and assigned functions based on morphological form (e.g., Winters 1969). As Bader (1992) has pointed out, such a classification has little relevance for determining tool functions. For instance, typical bone 'awls' have been found at Seip Mound and at the Great Mound at Anderson, Indiana. These bone tools were arranged around log tombs in such a way as to indicate they were used to tack down a shroud or blanket that had been placed over the burials. At Anderson, the pointed implements were manufactured from deer metatarsals (Vickery 1970). More typically, bone pointed implements exhibit microwear indicative of use in leather working, perforating, boring, weaving, basketry, or matting (Bader 1992). For instance, fine tipped bone pointed implements from Grasshopper Pueblo were likely used for piercing hides, while blunt-tipped pointed implements may have been used to enlarge these initial perforations (Olsen 1979:355).

Rather than classify bone pointed implements following a traditional system, these objects were subdivided following Bader (1992) and White (1990, 2005) on the basis of the degree to which bones utilized in their manufacture had been modified and shaped (Table 6-23). By far the most common pointed implement at the two sites is the modified splinter. Modified splinters (Figure 6-30) consist of fragments of bone that have been shaped and/or heavily utilized at one end. According to Bader (1992:168), "These tools are unfashioned except for the tapering of the tip to a sharp or nearly sharp tip... Some may exhibit rounding or polishing of the shaft due to handling, but generally the fractured edges of the shaft splinters are rough and unmodified." White (1990) also noted rounded edges from handling toward the bases of specimens from Carlston Annis.

Figure 6-30. Modified Splinters from Chiggerville.

Table 6-23. Varieties of Bone Pointed Implements from Baker and Chiggerville.

	Varieties				
	Modified Splinters	Shaped	Retained Articular Surface	Expedient	Unidentified
Baker	82	36	46	3	17
Chiggerville	304	97	59	5	87

Modified splinters from Tchefuncte, Coles Creek, and Mississippian sites in Louisiana were manufactured by either smashing the bone and using the resulting splinters or cutting a splinter out of a piece of bone (Kidder and Barondess 1981). According to Sommer (2006:9), at Site 20Sa1251 in Saginaw County, Michigan, modified splinter pointed implements were manufactured by "striking large mammal longbone shafts with a rock or other heavy object, causing them to splinter. The splinters may have simply been a fortuitous by-product of cracking the bones open for marrow extraction." A similar manufacture technique is suggested at Baker and Chiggerville, given the relative dearth of identifiable bone tool production debitage recovered from these sites. Such a technique makes identification of bone tool production debitage difficult as it has the same appearance as general bone refuse (see Binford 1981).

Typically, analysts further subdivide modified splinters into sub-varieties on the basis of tip form, and this practice was initially followed in this study. Sub-varieties are typically considered useful for determining pointed implement functions. For instance, Campana's (1989) study of flattened tipped pointed implements from Levantine Natufian sites indicated a perforation function for these tools, and Winters (1969:50) came to the same conclusion in his study of similar objects from the Robeson Hills site in Illinois. The Robeson Hills specimens exhibited perforation use polish only "along the narrow tips." Bader's (1992:293) study of round tipped modified splinters from KYANG indicated that these objects "had deep rotation striae… completely encircling the ends of the tips from two to 12 millimeters from the tip end… These striations were so pronounced that they might better be described as grooves. In addition, all eight tips had been crushed." This suggests that these tools were used as boring tools in a rotary motion against a resistant material such as wood (Bader 1992). Unfortunately, the relative lack of use-wear evident on any bone implements from Baker and Chiggerville precluded testing functional differences between flattened tipped, round tipped, and other sub-varieties of modified splinters. Additionally, the division of some of these objects by tip form was difficult as some specimens seemed to fall somewhere between round and flattened at their distal ends. As a result, all modified splinters are analyzed herein as a single class, and tip form is treated as a variable rather than a classificatory category.

Table 6.24. Summary Statistics for Modified Splinters from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Baker	Valid	42	66	67	42	42
	Missing	40	16	15	40	40
	Mean	83	11	6	9	5
	Median	79	11	5	9	5
	Mode	61, 67, 75, 79	10, 12	5	8, 9	4
	Std. Deviation	20.000	3.369	1.815	2.119	1.058
	Minimum	49	6	3	6	3
	Maximum	135	25	12	16	8
Chiggerville	Valid	130	217	226	127	130
	Missing	174	87	78	177	174
	Mean	81	12	6	10	6
	Median	78	12	6	10	5
	Mode	71	12	5	11	5
	Std. Deviation	17.751	3.222	1.986	2.739	1.584
	Minimum	45	5	3	4	3
	Maximum	131	23	16	19	12

Table 6.25. Additional Metric Data for Modified Splinters from Baker and Chiggerville.

		Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Baker	Valid	59	59	59	59	59	59	58	57	57	58	57
	Missing	23	23	23	23	23	23	24	25	25	24	25
	Mean	4	3	1.3	5	3	1.5	9	5	1.9	0.4	41
	Median	3	3	1.3	5	3	1.5	8	4	2	0.4	36
	Mode	3	3	1.0	5	3	1.7	7	4	2.0	0.4	28, 32
	Std. Deviation	1.017	0.628	0.345	1.340	0.877	0.428	2.398	1.013	0.514	0.131	18.236
	Minimum	2	2	0.7	3	2	0.6	4	2	1.0	0.2	14
	Maximum	8	5	2.0	12	7	3.0	20	8	3.5	0.8	120
Chiggerville	Valid	198	198	197	199	197	197	191	196	191	191	191
	Missing	106	106	107	105	107	107	113	108	113	113	113
	Mean	3	3	1.2	5	4	1.4	9	5	1.8	0.4	45
	Median	3	3	1.0	5	4	1.3	9	5	1.8	0.4	42
	Mode	3	3	1.0	4	3	1.3	7	5	1.8	0.3, 0.4	40
	Std. Deviation	0.693	0.603	0.297	1.054	0.679	0.319	2.367	1.238	0.538	0.121	19.182
	Minimum	2	1	0.7	3	2	0.8	4	2	0.4	0.2	15
	Maximum	6	4	2.5	8	5	2.3	17	9	4.0	1.0	153

A total of 82 objects from Baker and 304 from Chiggerville were classified as modified splinter pointed implements. Tables 6.24 and 6.25 provide summary statistics for modified splinters from the two sites. Modified splinters were considered broken at their proximal ends if rounding and handling polish did not extend over proximal breaks. Unlike antler pointed implements, bone pointed implements are not as constrained in size as splinters of any length and width can be selected for manufacture into one of these tools. Nevertheless, the pointed implements from the two sites are very similar in size in all dimensions. Additionally, the small standard deviation for tip and foreshaft widths and thicknesses suggests that if these tools were perforators or boring tools then they were being used to make holes of relatively uniform size. It is possible that with additional research a standard set of perforator or bore sizes could be derived from the pointed implement assemblages.

Non-metric traits are also similar at the two sites. Tip cross-sections at Baker are primarily asymmetrical (n = 45), with smaller numbers of oval (n = 14), round (n = 2), concave (n = 1), rectangular (n = 1), rhomboidal (n = 1), and semi-circular (n = 1) cross-sections present. Tip cross-sections at Chiggerville are also primarily asymmetrical (n = 117), with smaller numbers of oval (n = 44), round (n = 44), semi-circular (n = 13), triangular (n = 4), concave (n = 4), rectangular (n = 4), and square cross-sections. The high frequency of modified splinters with round cross-sections at Chiggerville may have significance, but this cannot be determined without additional research.

Tip plans-sides at Baker are blunted-beveled (n = 2), blunted-pointed (5), blunted-rounded (n = 14), blunted-blunted (n = 4), pointed-beveled (n = 1), pointed-rounded (n = 14), pointed-pointed (n = 3), rounded-beveled (n = 4), and rounded-rounded (n = 12).

Tip plans-sides at Chiggerville are identical, consisting of objects that are broken-beveled (n = 1), broken-rounded (n = 1), beveled-beveled (n = 2), blunted-beveled (n = 6), blunted-pointed (n = 10), blunted-rounded (n = 19), blunted-blunted (n = 9), pointed-rounded (n = 51), pointed-pointed (n = 39), rounded-beveled (n = 9), and rounded-rounded (n = 53).

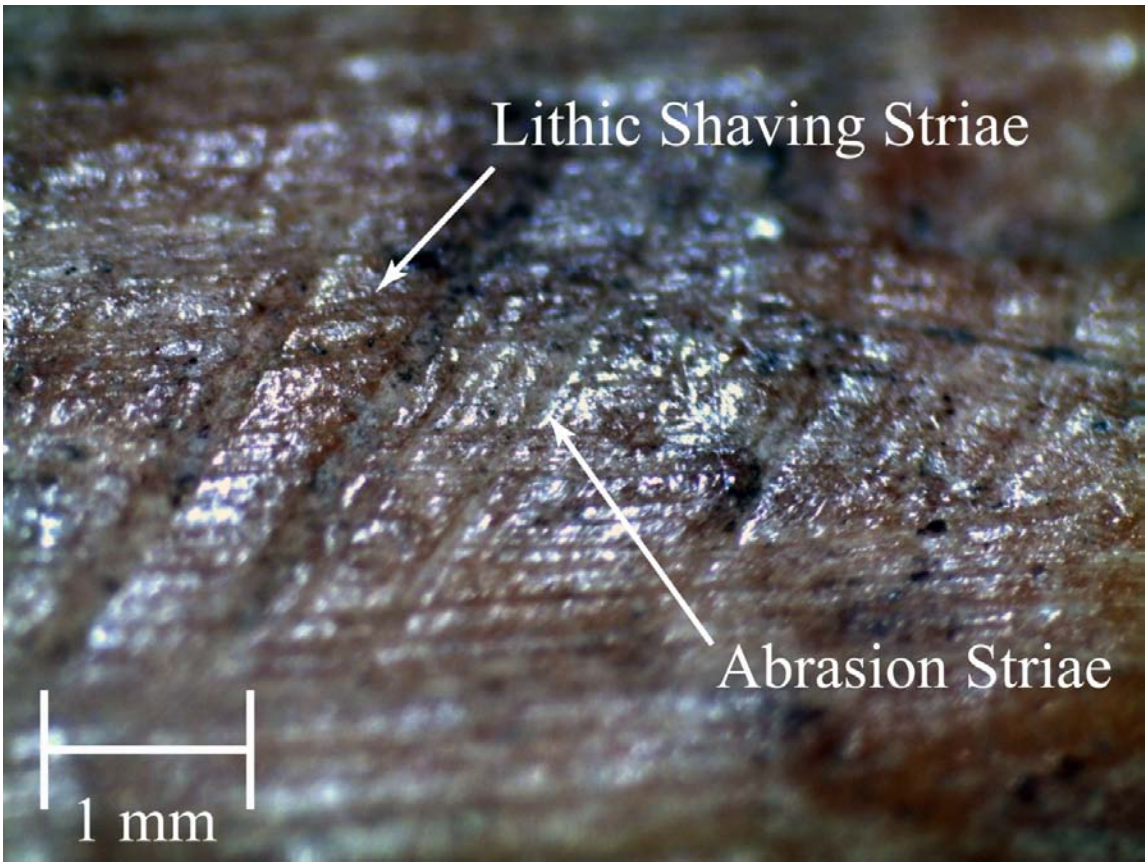


Figure 6-31. Abrasion Striae overlying Lithic Shaving Striae on Object B141 from Chiggerville.

Shaft outlines-sides at the two sites are also similar, with broken-asymmetrical (n = 2), asymmetrical-asymmetrical (n = 29), asymmetrical-converging (n = 16), asymmetrical-excurvate (n = 3), asymmetrical-incurvate/excurvate (n = 6), converging-converging (n = 4), converging-incurvate/excurvate (n = 1), converging-parallel (n = 1), excurvate-excurvate (n = 1), excurvate-incurvate/excurvate (n = 3), and excurvate-parallel (n = 1) forms at Baker. Shaft outlines-sides at Chiggerville are broken-asymmetrical (n = 4), broken-converging (n = 2), broken-incurvate/excurvate (n = 1), asymmetrical-asymmetrical (n = 55), asymmetrical-converging (n = 31), asymmetrical-excurvate (n = 14), asymmetrical-incurvate/excurvate (n = 17), asymmetrical-parallel (n = 1), converging-converging (n = 33), converging-excurvate (n = 18), converging-incurvate/excurvate (n = 25), converging-parallel (n = 4), excurvate-excurvate (n = 15), excurvate-incurvate/excurvate (n = 10), and incurvate/excurvate-incurvate/excurvate (n = 1).

Figure 6-32. Lithic Shaving Striae on Object B65 from Baker.

Based on these shaft outlines, it is not surprising that all 80 of the Baker modified splinters that were complete enough to record symmetry were asymmetrical. Modified splinters from Chiggerville were predominantly asymmetrical (n = 279), but one object exhibits bilateral symmetry.

Although modified splinter pointed implements exhibit less modification than most other bone artifacts from Baker and Chiggerville, many of these implements do exhibit some evidence of shaping. At Chiggerville, the dominant method of shaping the tips and shafts of modified splinters was abrasion (n = 51), as indicated by a variety of tightly spaced longitudinal, oblique, and transverse striations, some of which created distinct abrasion facets. Twenty-one other artifacts exhibit longitudinal lithic shaving striations from initial shaping of the tools. These initial shaping striae are then overlain by abrasion striae, indicating either resharpening or a two-stage shaping process (Figure 6-31). The former is most likely given the asymmetrical form of these implements, which suggests that little attention was given to their modification.

A variety of other manufacturing techniques are represented at Chiggerville. Six objects exhibit both longitudinal lithic shaving and abrasion striae but with no evidence as to which technique was used first. Other techniques include both longitudinal and oblique lithic shaving striae overlain by abrasion (n = 2), abrasion striae overlain by longitudinal lithic shaving striae (n = 3), abrasion overlain by longitudinal and obliquely oriented lithic shaving striae (n = 2), longitudinal and obliquely oriented lithic shaving striae without abrasion (n = 2), longitudinally oriented lithic shaving striae alone (n = 3) (Figure 6-32), longitudinal lithic shaving striae and evidence of whittling (n = 1), and one object has been abraded and then apparently recycled via whittling. The whittling marks on this last object may be widely spaced longitudinal lithic shaving striae, however. Four modified splinters represent expediently utilized naturally pointed bone splinters.

The smaller number of modified splinters from Baker means that a smaller sample was analyzed microscopically. Nevertheless, some differences can be discerned between the two assemblages. Whereas abrasion was by far the dominant manufacturing technique at Chiggerville, the use of lithic shaving and abrasion is much more balanced at Baker. At Baker, 5 objects were manufactured via abrasion alone, 5 by a combination of longitudinal lithic shaving and abrasion with no evidence as to which technique was used first, 1 by longitudinally oriented lithic shaving followed by abrasion, 1 by both longitudinal and obliquely oriented lithic shaving followed by abrasion, 1 by abrasion followed by longitudinally oriented lithic shaving, 6 by both longitudinally and obliquely oriented lithic shaving, 7 by longitudinally oriented lithic shaving alone, and 2 by obliquely oriented lithic shaving alone.

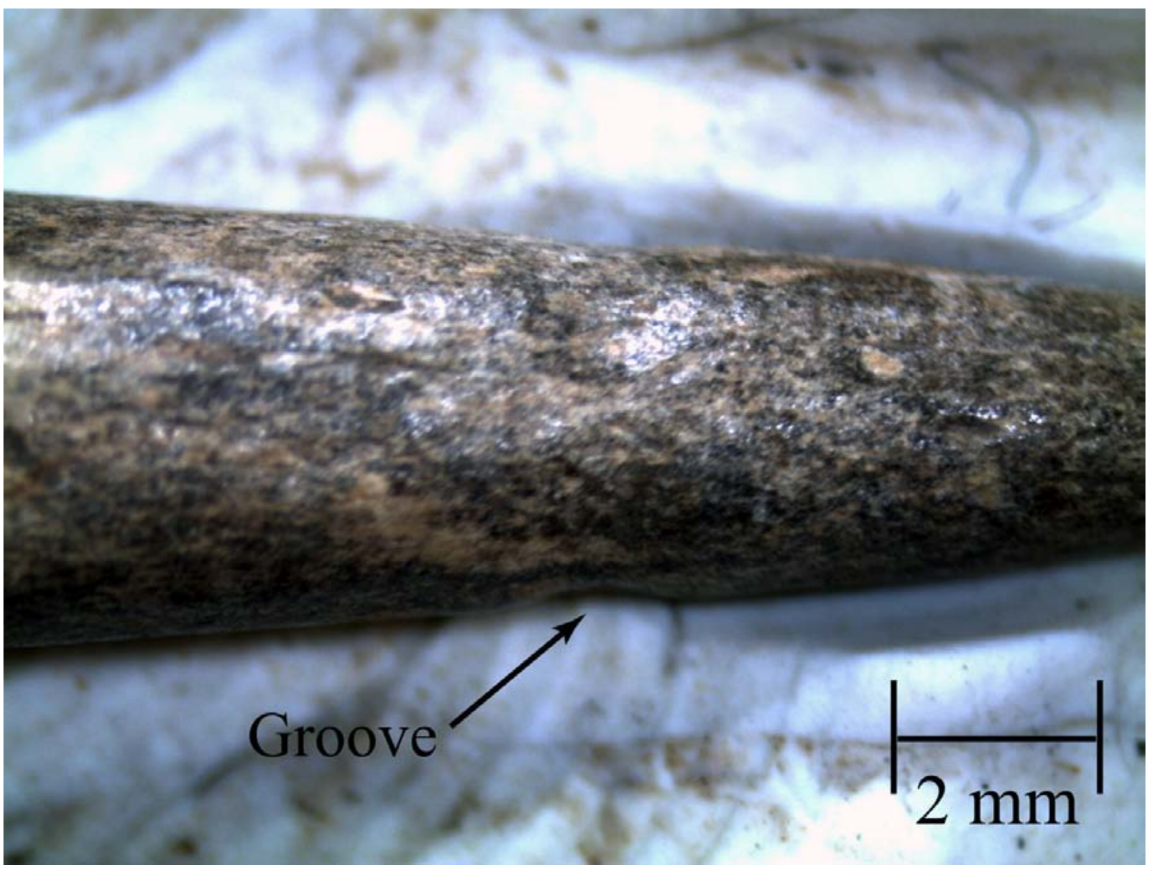


Figure 6-33. Groove on Object B43 from Chiggerville.

A few rare manufacturing strategies are represented at each site. Object B67 from Chiggerville and object B414 from Baker are blackened, suggesting they were intentionally heat treated prior to use. Object B681 from Chiggerville is blunted at the proximal end and one margin of the base is heavily abraded, suggesting this object was modified for hafting. The proximal end of object B327 from Chiggerville has been roughly shaped by percussion, resulting in the removal of longitudinally oriented bone chips. Object B833 was shaped at the proximal end by longitudinal and circumferential grooving and snapping. Object B206 at Chiggerville exhibits longitudinal cutmarks on one side situated so as to suggest that the interior of the bone was scraped clean of marrow via lithic shaving prior to manufacture of the modified splinter via abrasion. Similar manufacture striae were observed on 'light-duty awls' from Jarmo examined by Watson (1983:348). Object B43 from Chiggerville has a circumferential groove whittled into the foreshaft 9.8 mm below the tip (Figure 6-33), suggesting this may be a reaming tool that was grooved to prevent creation of an oversized perforation. Object B326 from Baker has heavy obliquely oriented longitudinal striae on one face and both margins (Figure 6-34) approximately located at the object's mid-section. These striae suggest the object was modified for tying of a line at the mid-point (i.e., the object is likely a fishing gorge). Object B57 from Baker constricts at the proximal end and is rounded at this location, suggesting it may have had a thong or string of some kind tied at this location.

Two objects from Chiggerville (B223 and B766) exhibit deep longitudinally oriented grooves that are wide relative to other manufacture grooves (Figure 6-35). These grooves may have been cut with a stone flake or a burin-like tool. Both objects have been interpreted as possible projectile points, and one (B766) may be a broken bi-pointed implement. If this functional interpretation is correct, the wide grooves may have been cut to facilitate the drainage of blood from wounded animals.

Figure 6-34. Modification of Object B326 from Baker, possibly for Tying a Line for Use as a Gorge.

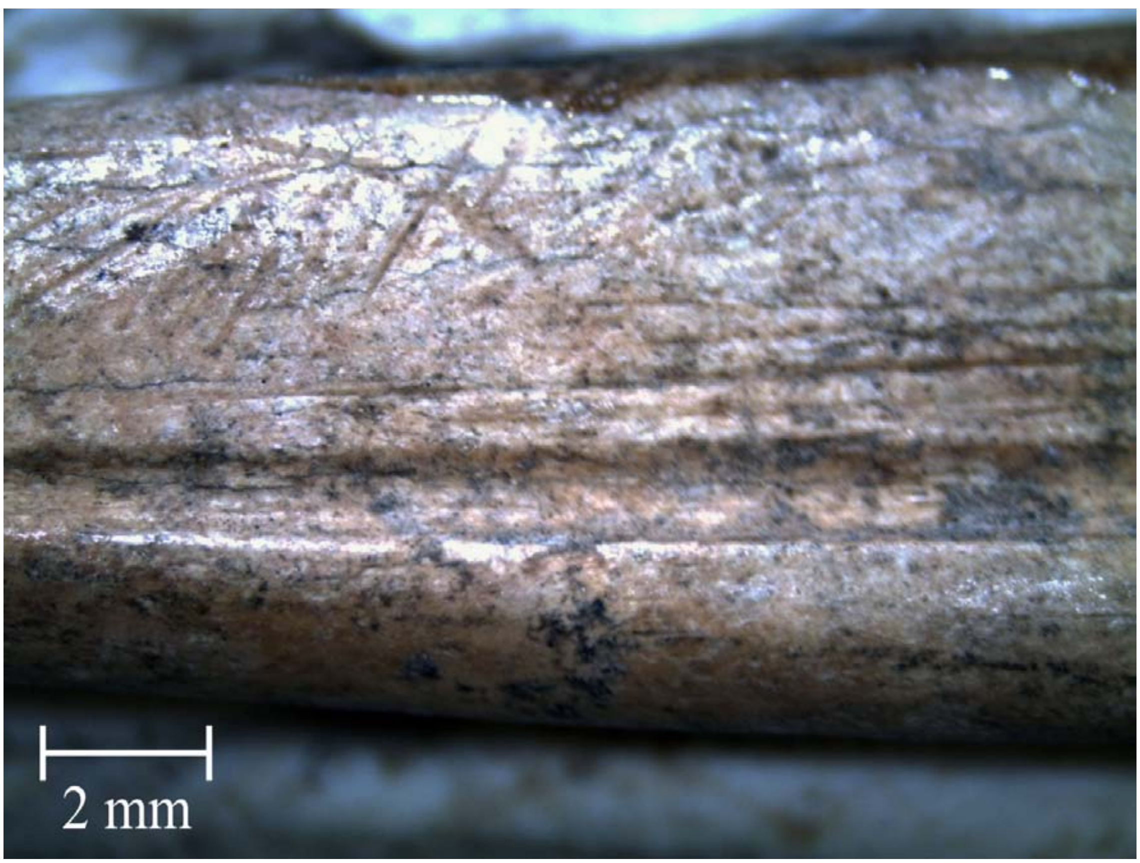


Figure 6-35. Possible Drainage Groove Running along Object B223 from Chiggerville.

As with the antler implements described above, examination by low power microscopy is inadequate for unequivocally identifying use-wear striations, and in no cases can the suggested functions provided here be accepted without additional study. Of those modified splinters from Chiggerville that do exhibit some evidence of use-wear, 18 have longitudinal (n = 5), rotational (n = 10), oblique-transverse (n = 1), oblique-longitudinal (n = 1) and/or randomly (n = 1) oriented striations consistent with use as awls, perforators, or boring tools. Three of these exhibit pitting at their tips. Two objects also exhibit oblique (n = 1) and/or transverse (n = 2) striations suggesting they may also have functioned as basketry, weaving, or matting tools (e.g., Bader 1992, Campana 1989). Two have impact fractures at one end, suggesting they were broken projectile points that had been recycled into awls, perforators, or boring tools. Four modified splinters from Baker exhibit similar rotational (n = 2) or longitudinal (n = 3) striations and pitting (n = 2) at their tips.

Another 8 modified splinters from Chiggerville exhibit transverse (n = 7), oblique-transverse (n = 2), and oblique-longitudinal striae (n = 1) striae consistent with use as basketry, weaving, or matting tools. One object is also pitted and one has longitudinal striae that may indicate it also functioned as an awl or perforator. Two objects from Baker exhibit similar oblique-transverse (n = 2) and/or transverse (n = 1) striations.

One modified splinter each from Baker and Chiggerville exhibits use-wear evidence that suggests these tools were lithic flaking tools. Object B699 from Chiggerville exhibits transverse striations, pitting, and deep grooves consistent with heavy use as a flaking tool. Object B333 from Baker has transverse and oblique-transverse striations and deep v-shaped gouges that resulted in heavy tip attrition. Similar attrition was described above for antler objects more traditionally associated with flintknapping activities.

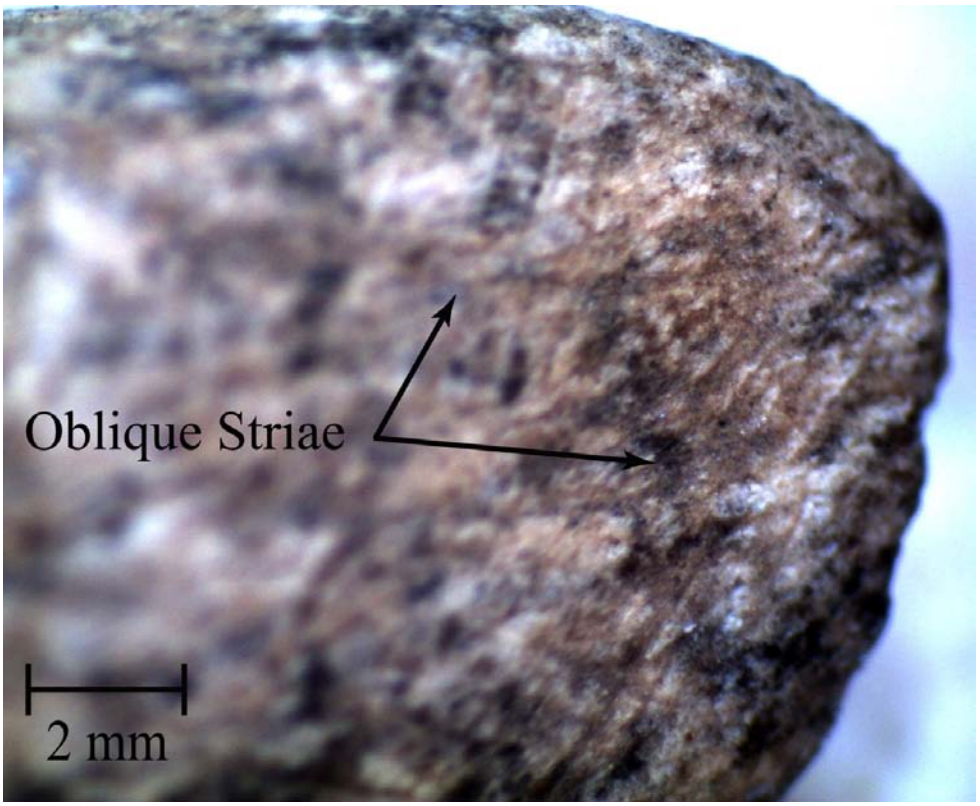


Figure 6-36. Use-Wear Striae on the Bevel of Object B330 from Chiggerville.

Finally, four modified splinters from Chiggerville (objects B303, B330, B732, and B943) are intentionally abraded at their tips to create a bevel (all other beveled tipped modified splinters have slight use-related bevels or bevels created by use damage and chipping) (Figure 6-10d, e, i). These four beveled pointed implements are similar to and may have functioned in the same way as shaped pointed implements with beveled tips (discussed below). All four implements were shaped via abrasion. Object B303 exhibits some use polish but is heavily weathered. Object B330 exhibits wide obliquely oriented grooves on its bevel that are likely related to use and some randomly oriented cuts or grooves that may be from use or manufacture (Figure 6-36). Object B732 exhibits a small chip opposite the bevel that is likely use-related. This object exhibits short parallel, longitudinally oriented use-wear striations at the tip of the bevel and on the opposite face. It possibly functioned as a burnishing tool. Finally, object B943 exhibits a break at the tip that may be use-related. Also toward the tip, on the margin opposite the bevel, are transverse and obliquely oriented striations that may be use-related. Adhering to the object in these striations is some kind of substance. It is possible that this object was a burnishing or pigment processing tool.

Shaped pointed implements are those that have been formed from formal blanks cut from bone or splinters that have been heavily modified by lithic shaving, abrasion, cutting, drilling or polishing to create an object with a smooth, regular form. In some regions, shaped pointed implements are formed by a combination of longitudinal and circumferential grooving and snapping bone blanks to remove standard-sized bone slivers that are then modified into pointed implements. Clark (1980:36) identified use of a longitudinal groove and snap technique in the manufacture of 'metapodial awls' at the Late Archaic McCutchan-McLaughlin shell midden in Oklahoma, and Kidder and Barondess' (1981:92) 'Type I' pointed implements were manufactured by a circumferential groove and snap technique. Olsen (1980:59) provides the following description of this technique as used to produce 'cut awls' at the Kinishba ruin in Arizona:

> They are made by incising two parallel longitudinal grooves in a long bone of a large mammal, snapping out the section between, and sharpening it to a point at one end. The edges that were grooved and snapped and the base are usually abraded quite smooth. The finished product is a symmetrical awl with smooth surfaces and a well-formed point. The base is plain and no articular condyles are retained.

Given that the majority of the shaped pointed implements from Baker and Chiggerville are asymmetrical in form, it is likely that most were manufactured from splinters that were heavily modified and polished. Exceptions include the shaped pointed implements with cylindrical or oval cross-sections, which were likely manufactured from deer longbones in the manner described by Olsen (1980). Although the shaped pointed implements with cylindrical or oval cross-sections from Baker and Chiggerville are only undecorated fragments, it is likely these bone artifact sections are pieces of bone pins similar to those manufactured at Koster from longitudinally grooved and snapped deer metapodials (Cook 1976:201).

Figure 6-37. Flat, Polished Shaped Pointed Implements from Chiggerville.

A total of 36 pointed implements from Baker and 97 from Chiggerville are shaped. Of these, 12 from Baker and 4 from Chiggerville are unidentified shaped pointed implements. Three from Baker and 14 from Chiggerville are flat, polished. Eighteen from Baker and 25 from Chiggerville are perforated. One from Baker and 10 from Chiggerville have cylindrical or oval cross-sections. One from Baker and 28 from Chiggerville are notched. One from Baker and 3 from Chiggerville are very small. Five from Chiggerville have beveled tips, 7 are incised, and 1 is classified as 'other'.

Figure 6-38. Perforated Shaped Pointed Implements from Chiggerville.

Unidentified shaped pointed implements are those pointed implements that exhibit heavy modification but that are too fragmented to otherwise classify as to form. Object B41 from Baker was a shaped pointed implement that was later recycled to manufacture a fishhook, leaving behind a pointed implement that is also Stage IV fishhook manufacturing debitage. This object is included in the discussion of fishhook debitage provided below.

Flat, polished shaped pointed implements (Figures 6-37, 6-40c-h) are more heavily modified than modified splinters and tend to have more regular margins and smoother, intentionally polished surfaces. According to White (2005), bases of these forms at Carlston Annis were usually squared off by the groove and snap technique and then ground to a smooth surface. Bases may be square or rounded, with rounded forms possibly resulting from handling. Bader (1992:149) states that the "overall polishing and edge rounding present on all of these artifacts was likely a task specific modification rather than a result of use. It was probably created during tool manufacture to facilitate passage of the tool through the material being worked. A smooth finish and glossy surface would allow the tool to pass through fibers without pulling and snagging." Microtrace analyses of these tools suggest that they were used in sewing, matting, basketry, and/or weaving activities, but not to perforate leather or other materials (Bader 1992; White 1990, 2005).

Metric data pertaining to flat, polished shaped pointed implements from Chiggerville can be found in Tables 6-26 and 6-27. Only three such objects were recovered from Baker. Object B242 is 54 mm long, 10 mm wide, 4 mm thick, 9 mm wide at the mid-section, and 3 mm thick at the mid-section. The Tip W5 of this object is

Table 6-26. Basic Metric Data for Flat, Polished Shaped Pointed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Base Width	Base Thickness	Base W/T
Valid	8	11	11	6	6	8	8	8
Missing	6	3	3	8	8	6	6	6
Mean	85	12	5	11	5	10	4	2.4
Median	76.5	12	5	9	4.5	11.5	4.5	2.1
Mode	74, 79	11	5	8	4	12	5	N/A
Std. Deviation	24.483	2.994	0.701	4.416	1.169	4.400	1.061	0.945
Minimum	60	8	4	7	4	5	3	1.3
Maximum	129	18	6	19	7	18	6	4.0

Table 6-27. Additional Metric Data for Flat, Polished Shaped Pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	11	11	11	11	11	11	11	11	11	11	11
Missing	3	3	3	3	3	3	3	3	3	3	3
Mean	3	3	1.1	4	4	1.2	8	5	1.7	0.4	41
Median	3	3	1	4	4	1.0	8	5	1.8	0.4	35
Mode	3	3	1.0	4	4	1.0	5, 7, 9, 10	4, 5	2.0	0.4	25, 36
Std. Deviation	0.539	0.505	0.209	0.905	0.522	0.338	2.427	1.328	0.464	0.081	24.058
Minimum	2	2	1.0	3	3	1.0	5	3	1.0	0.2	18
Maximum	4	3	1.5	6	4	2.0	13	8	2.3	0.5	104

3 mm, Tip T5 is 2 mm, Foreshaft W10 is 5 mm, Foreshaft T10 is 3 mm, Shaft W30 is 9 mm, Shaft T30 is 4 mm, outline index is 0.3, and robusticity index is 36. This object is rectangular in cross-section, asymmetrical in form, with a rounded-rounded tip plan-side and a converging-asymmetrical shaft outline-side.

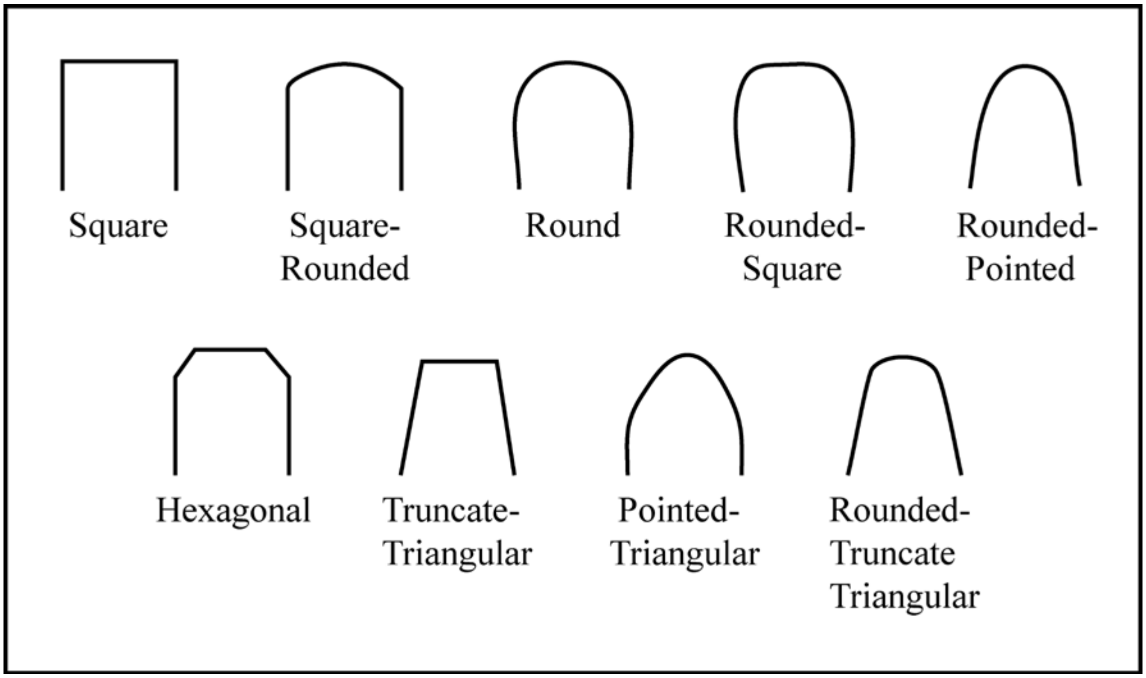


Figure 6-39. Shaped Pointed Implement Base and Spatula Outline Forms.

Objects B265 and B331 from Baker are broken. Object B265 is 14 mm wide and 5 mm thick and asymmetrical in form. Object B331 is 12 mm wide and 5 mm thick with an asymmetrical cross-section and form.

Cross-sections of the flat, polished shaped pointed implements from Chiggerville are asymmetrical (n = 4), oval (n = 2), and round (n = 6). Symmetries of these artifacts are asymmetrical (n = 10) and bilateral (n = 2). Tip plans-sides consist of blunted-blunted (n = 1), blunted-pointed (n = 2), blunted-rounded (n = 2), pointed-pointed (n = 3), pointed-rounded (n = 2), and rounded-rounded (n = 1). Shaft outlines-sides are asymmetrical-asymmetrical (n = 2), asymmetrical-excurvate (n = 3), asymmetrical-incurvate/excurvate (n = 1), asymmetrical-converging (n = 1), converging-converging (n = 4), converging-excurvate (n = 1), and excurvate-incurvate/excurvate (n = 1).

Flat, polished shaped pointed implements from Chiggerville were manufactured by a combination of longitudinally and obliquely oriented (n = 1) or longitudinally oriented (n = 1) lithic shaving or by abrasion (n = 2). Both objects from Baker that were examined microscopically exhibit both longitudinally and obliquely oriented lithic shaving striae. Object B232 from Chiggerville exhibits localized overlapping obliquely oriented striations at the proximal end that are likely the beginning of a perforation. No use-wear striae were evident on sampled flat, polished implements from either site.

Perforated shaped pointed implements (Figures 6-38, 6-40k-n) are identical to flat, polished shaped pointed implements, with the exception that perforated tools have a perforation located toward their proximal ends, indicating that they were either suspended or used to pull a thread or cord through some material. Like flat, polished shaped pointed implements, perforated implements were found to have been used in matting, basketry, and/or weaving activities by Bader (1992) and White (2005), an interpretation that was supported by Campana's (1989:77-78) analysis of similar Natufian tool forms.

All 24 perforated implements from Carlston Annis have hourglass shaped perforations indicative of biconical (two-sided) drilling with a stone drill (White 1990:76). Similar, highly polished drilled forms were identified by Breitburg (1982:924) at Black Earth, who classified these tools as 'needles'. Watson (1983:351) also classified similar tool forms from Jarmo as needles, but the specimens from Jarmo have perforations produced by cutting "longitudinal scratches from both sides until the grooves met; this opening was then enlarged slightly." Both drilling and this cutting or gouging technique have been identified at Baker and Chiggerville. The latter technique had likely just been started on the flat, polished implement (object B232) from Chiggerville discussed above.

Figure 6-40. Various Shaped Pointed Implements from Chiggerville.

Like the other pointed implements from Baker and Chiggerville, the perforated shaped pointed implements from the two sites are similar in overall dimensions and form (Tables 6-28 and 6-29). Perforated shaped pointed implements from Chiggerville have asymmetrical (n = 6), oval (n = 4), and round (n = 5) cross-sections and are asymmetrical

Table 6-28. Basic Metric Data for Perforated Shaped Pointed Implements from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Base Width	Base Thickness	Base W/T
Baker	Valid	4	12	11	4	4	10	10	10
	Missing	14	6	7	14	14	8	8	8
	Mean	63	13	5	11	4	13	4	3
	Median	66.5	13	5	10.5	4	13.5	4.5	3.1
	Mode	N/A	13, 15	5	N/A	4	10, 13, 14, 15	3, 5	2.5
	Std. Deviation	9.069	2.250	1.191	2.380	0.500	2.616	1.776	0.910
	Minimum	50	9	4	8	4	8	2	1.8
	Maximum	70	17	8	13	5	16	8	4.7
Chiggerville	Valid	4	11	12	3	3	10	10	10
	Missing	21	14	13	22	22	15	15	15
	Mean	82	14	6	11	6	14	5	3.2
	Median	80	15	6	9	6	15	4.5	3.25
	Mode	N/A	15	6	N/A	N/A	15	4	2.4, 3.8
	Std. Deviation	14.142	3.771	0.965	3.786	1.000	3.836	0.966	0.915
	Minimum	68	9	4	8	5	8	3	1.8
	Maximum	100	21	7	15	7	21	6	4.8

Table 6.29. Additional Metric Data for Perforated Shaped Pointed Implements from Baker and Chiggerville.

		Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Baker	Valid	9	9	9	9	9	9	9	9	9	9	9
	Missing	9	9	9	9	9	9	9	9	9	9	9
	Mean	4	3	1.2	5	4	1.6	10	4	2.2	0.4	41
	Median	4	3	1.3	5	4	1.7	9	4	2.3	0.4	40
	Mode	N/A	3	1.3	5	4	1.7	8, 9, 12	4	1.8	0.4	40
	Std. Deviation	0.866	0.441	0.224	1.130	0.527	0.265	1.810	0.500	0.480	0.093	9.422
	Minimum	3	3	1.0	4	3	1.0	7	4	1.6	0.3	28
	Maximum	5	4	1.7	7	4	1.8	12	5	3.0	0.6	60
Chiggerville	Valid	12	12	12	12	12	12	11	11	11	11	11
	Missing	13	13	13	13	13	13	14	14	14	14	14
	Mean	4	3	1.2	5	4	1.4	9	5	1.9	0.4	44
	Median	3	3	1.0	5	4	1.3	8	5	2.0	0.4	44
	Mode	3	3	1.0	4	4	1.3	8	5	1.3	0.4	35, 48
	Std. Deviation	0.674	0.426	0.242	0.996	0.622	0.363	2.892	0.751	0.652	0.094	15.539
	Minimum	3	2	1.0	4	3	1.0	5	4	1.3	0.3	20
	Maximum	5	4	1.7	7	5	2.3	15	6	3.0	0.6	75

(n = 17) in form. Those from Baker have asymmetrical (n = 7), oval (n = 3), and rhomboidal (n = 1) cross-sections and exhibit asymmetrical (n = 13), bifacial (n = 1), or bilateral (n = 2) symmetry. Base forms at Chiggerville are asymmetrical (n = 5), rounded (n = 1), rounded-square (n = 3), square (n = 1), and bifurcated by a broken initial but abandoned perforation (n = 1). Base forms of perforated shaped pointed implements from Baker are asymmetrical (n = 2), expanding crutch-top (n = 1), modified epiphyses (n = 4), oval (n = 1), rounded (n = 1), and rounded-square (n = 1). Geometric shapes are the same as those used to describe spatula outlines for spatulate implements (Figure 6-39). For implements with rounded base forms, base widths were recorded immediately distal to where the rounding begins.

Tip plans-sides and shaft outlines-sides of perforated shaped pointed implements from the two sites are nearly identical. Tip plans-sides at Baker are beveled-blunted (n = 1), blunted-rounded (n = 2), pointed-rounded (n = 2), and rounded-rounded (n = 4), while those at Chiggerville are beveled-blunted (n = 1), beveled-rounded (n = 1), blunted-rounded (n = 2), blunted-blunted (n = 2), pointed-pointed (n = 1), pointed-rounded (n = 2), and rounded-rounded (n = 3). Shaft outlines-sides at Baker are broken-converging (n = 1), asymmetrical-asymmetrical (n = 4), asymmetrical-incurvate/excurvate (n = 1), asymmetrical-converging (n = 2), asymmetrical-excurvate (n = 1), converging-converging (n = 1), and converging-excurvate (n = 1), while those at Chiggerville are asymmetrical-asymmetrical (n = 3), asymmetrical-excurvate (n = 6), converging-converging (n = 1), converging-excurvate (n = 2), converging-incurvate/excurvate (n = 1), and excurvate-excurvate (n = 3).

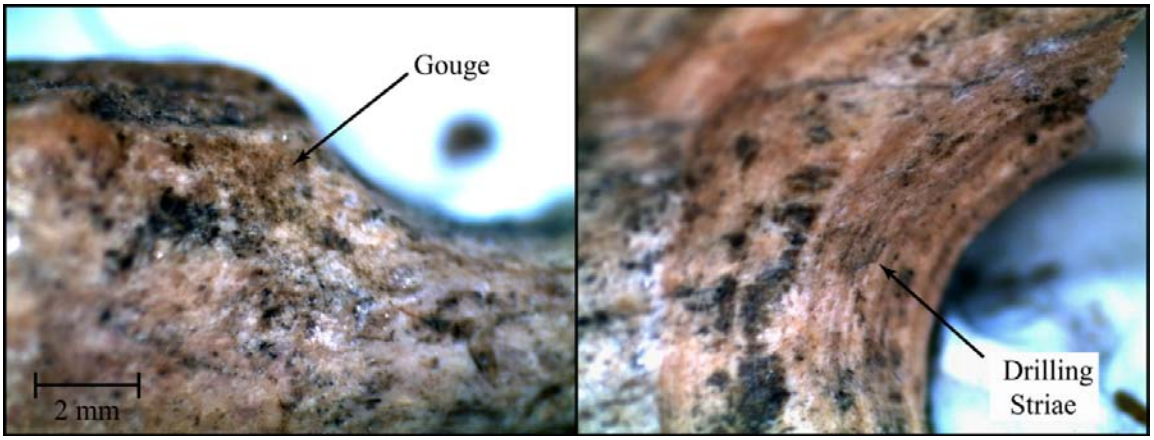


Figure 6-41. Gouging and Drilling Striae on Perforated Shaped Pointed Implements from Chiggerville.

Manufacture striations evident on sampled perforated shaped pointed objects are difficult to interpret given that most manufacture microtrace has been obliterated by heavy polishing. Nevertheless, use of longitudinal lithic shaving (n = 2), whittling (n = 1), abrasion (n = 3), obliquely oriented lithic shaving followed by abrasion (n = 1), longitudinally oriented lithic shaving followed by abrasion (n = 1), and longitudinally and obliquely oriented lithic shaving followed by abrasion (n = 1) was recorded at Chiggerville. Only longitudinally oriented lithic shaving (n = 2) and abrasion overlain by longitudinally oriented lithic shaving (n = 1) was recorded at Baker. Object B17 at Baker exhibits a transverse cut above the perforation, indicating initial shaping of the tool via a groove and snap technique.

The perforation technique used to shape these objects was evident macroscopically on most specimens from the two sites. At Chiggerville, 19 perforations were created by biconical drilling (Figure 6-41 right), 1 by unidirectional drilling, 1 by drilling in an unidentified manner, 1 by initially gouging a perforation and then drilling in the gouge (Figure 6-41 left), and 2 by gouging alone. At Baker, biconical drilling (n = 11) was the predominant technique, followed by initial gouging and biconical drilling in the gouge (n = 3), initial gouging followed by drilling in an unidentified manner (n = 2), and unidirectional drilling (n = 2). Drilling with a stone drill at both sites includes drilling both at a 90 degree angle and obliquely, creating an elongate perforation. Sometimes, the two drill holes on a biconically drilled implement do not exactly match up, which also creates an elongate perforation.

Very little use-wear was evident at low power on perforated shaped pointed implements from the two sites. Objects B28 and B397 form Chiggerville both exhibit rotational striae suggesting use as awls or perforators. Object B289 from Baker exhibits obliquely and randomly oriented striae that may indicate use as a basketry, weaving, or matting tool. However, these striations are not well patterned and so may not be use-wear.

Shaped pointed implements with cylindrical or oval cross-sections (Figure 6-40j) are typically long, pointed to blunted tool forms with round or sub-round to wedge-shaped cross-sections and parallel to slightly converging shafts (Bader 1992). These tools were manufactured from longbone splinter blanks formed by a longitudinal groove and snap technique, with final shaping involving grinding and polishing. Finished specimens exhibit a high sheen across their margins (Jefferies 2004). At many sites throughout the Midwest, these artifacts were oftentimes incised after polishing, which resulted in the obliteration of nearly all traces of manufacture. Of fourteen specimens from KYANG, 45 percent exhibited incising, although none exhibited use-wear striae. This is apparently not atypical, as Olsen (1979:367) observed the same lack of use-wear on specimens interpreted as hairpins at Grasshopper Pueblo.

In the Midwest, many shaped pointed implements with cylindrical or oval cross-sections have carved or decorated proximal ends. Some of these implements from Green River sites are composite forms with proximal ends decorated by the addition of shell beads attached in various shapes and forms by asphaltum (Webb 1974:292). According to Bader (1992:167), “The fact that these artifacts were incised with decorative motifs supports the idea that they were used as ornamentation. It would seem counterproductive to expend time creating an incised design only to have it muted with the wear that would result from its contact with some resistant material.” The fact that they were oftentimes recovered near the heads of individuals in burials along the Green River in Kentucky led Jefferies (2004) to conclude that many were hairpins, while others may have been used to fasten clothing or burial wraps. In support of the hairpin function is a mummy from Ventana Cave in Arizona that had four hairpins wrapped in a human hair wig and two male burials from Kinishba ruin with dagger hairpins through their hair at the top of their heads. Bone hairpins with notches at one end were observed in 1886 being used as hairpins during times of mourning and to scratch lice by Apache-Yuman males living on the San Carlos Indian Reservation (Olsen 1979:369-370).

Nine of the ten shaped pointed implements with cylindrical or oval cross-sections from Chiggerville are broken distal ends, and two (objects B828 and B829) are fragments of the same object (one of which is a distal end). Tip and foreshaft metric data are provided in Table 6-30. As their name implies, the majority of these implements have oval (n = 5) or rounded (n = 1) cross-sections, but some are slightly asymmetrical (n = 3) in form. Tip plans-sides are pointed-rounded (n = 4) and rounded-rounded (n = 5). Shaft outlines-sides are asymmetrical-asymmetrical (n = 3), asymmetrical-converging (n = 1),

Table 6-30. Metric Data for Shaped Pointed Implements with Cylindrical/Oval Cross-sections from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	9	9	9	9	9	9	9	9	9	9	9
Missing	0	0	0	0	0	0	0	0	0	0	0
Mean	3	2	1.3	4	3	1.4	6	4	1.5	0.5	22
Median	3	2	1.3	4	3	1.3	6	4	1.3	0.5	20
Mode	3	2	1.0, 1.5	4	3	1.3	6	4	1.3	0.5	20, 30
Std. Deviation	0.601	0.500	0.251	0.707	0.601	0.289	0.882	0.782	0.291	0.097	6.528
Minimum	2	2	1.0	3	2	1.0	4	3	1.2	0.4	12
Maximum	4	3	1.5	5	4	2.0	7	5	2.0	0.7	30

asymmetrical-excurvate (n = 1), asymmetrical-incurvate/excurvate (n = 1), excurvate-excurvate (n = 1), excurvate-parallel (n = 1), and excurvate-incurvate/excurvate (n = 1).

As with the other shaped pointed implements, manufacture microtrace is difficult to interpret due to the tendency for these striations to be heavily impacted by polishing during the manufacturing process. Nevertheless, abrasion (n = 2), longitudinally oriented lithic shaving (n = 2), longitudinally oriented lithic shaving followed by abrasion (n = 1), and abrasion followed by longitudinally oriented lithic shaving (n = 1) are evident. Two objects (B265 and B273) have compressed divets on at least one edge and transverse (n = 1), obliquely oriented (n = 1) and/or oblique-transverse (n = 1) striations consistent with use as basketry, matting, or weaving tools. If these objects did function in this way, it is possible that they represent recycled fragments of broken bone hairpins. Object B279 appears to also have been recycled into an unidentified tool given that the tip has been worn through the manufacturing polish and the object has an isolated patch of transverse cutmarks overlying the polish toward the object's mid-section. Object B265 is intentionally blackened, indicating use of a heat treatment technique prior to polishing.

The one shaped pointed implement with a cylindrical or oval cross-section from Baker (object B115) is also a fragment that has been recycled into an unidentified tool. This new tool is 68 mm long, 7 mm wide, 4 mm thick, 6 mm wide at the mid-section, and 4 mm thick at the mid-section. The Tip W5 and T5 are 3 mm, Foreshaft W10 is 4 mm, Foreshaft T10 is 3 mm, Shaft W30 is 6 mm, Shaft T30 is 4 mm, outline index is 0.5, and robusticity index is 24. The object has an oval cross-section, a rounded-rounded tip plan-side, an asymmetrical-asymmetrical shaft outline-side, and is currently asymmetrical in form. The object has been broken at the proximal end, but this break is heavily polished over, indicating that the object has been recycled. Longitudinally oriented striations on all four edges indicate use of a lithic shaving technique to shape the pointed implement. No use-wear striations were noted at low power.

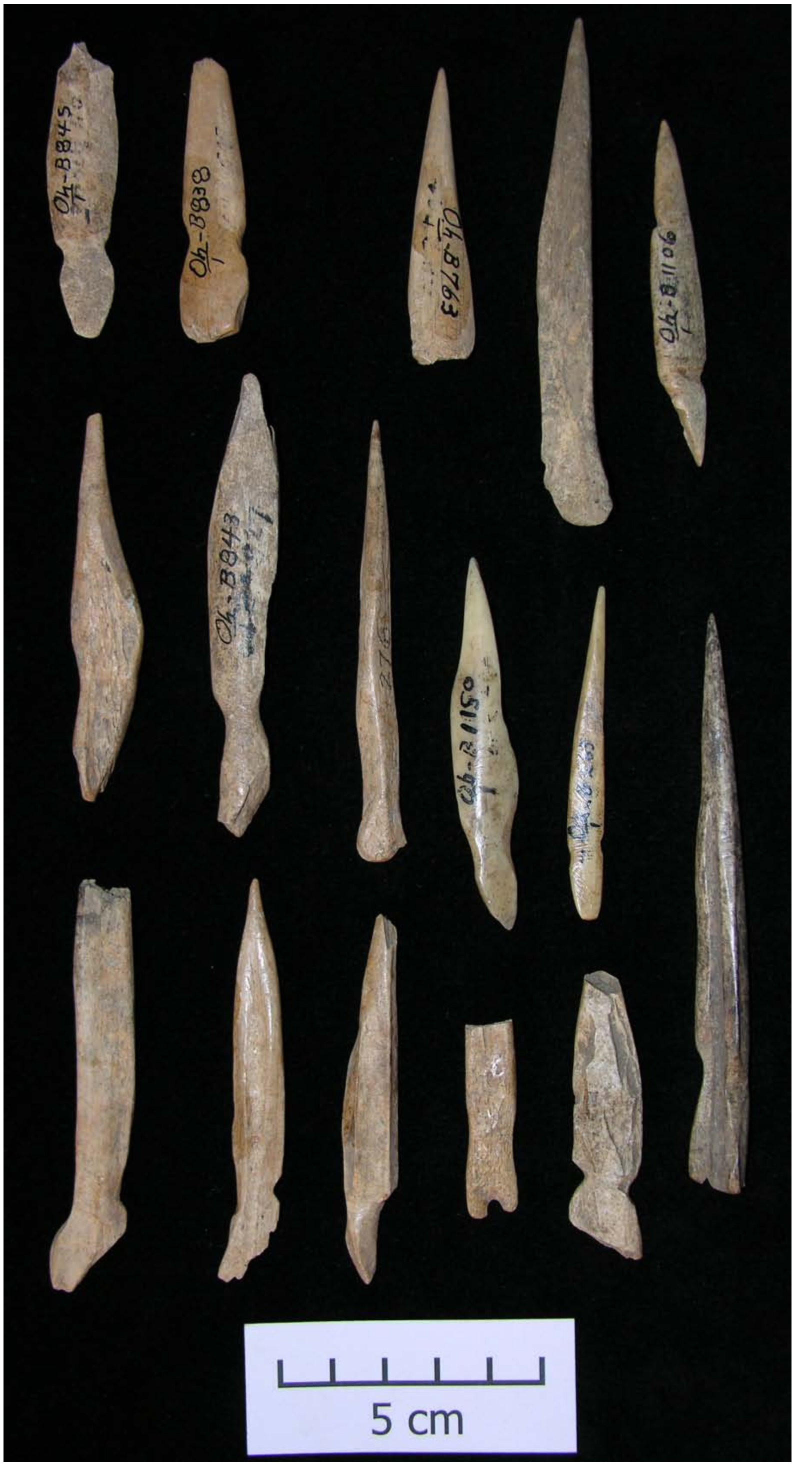


Figure 6-42. Notched Shaped Pointed Implements from Chiggerville.

That shaped pointed implements with cylindrical or oval cross-sections are present in much higher numbers at Chiggerville than at Baker may be temporally or culturally significant, but the fact that all of these objects are broken fragments makes interpretation of these differences difficult. The greater frequency of notched shaped pointed implements (Figure 6-42) at Chiggerville (n = 28) than at Baker (n = 1) is almost certainly meaningful, however.

Notched implements were first identified by Webb (1974) in collections from Indian Knoll. These tools are similar in overall rounding and degree of polish to flat, polished pointed implements and are sometimes perforated. They are distinguished from these two categories, however, by the presence of “wide abraded notches on either side of the base” (White 1990:80) between 25 and 45 mm from their tips. According to Bader (1992:172, 174):

> The constrictions [notches] are not always directly opposite each other, and one side may exhibit a more pronounced indentation than the other. Judging by the consistent patterning of the constrictions on the shaft, it appears that they were deliberately manufactured and may represent notches, suggesting that the tools were hafted… Flattened facets on some of the tips suggest that they may have been resharpened.

Hafting is further supported by Bader’s (1992:296) microtrace analysis, which indicated the presence of transverse (binding) grooves within or near the constrictions on all twelve analyzed implements from KYANG. This, in addition to the fact that seven had broken at the constriction, suggested that these tools were hafted bone projectile points (Bader 1992:301).

Metric data for notched shaped pointed implements from Chiggerville are provided in Tables 6-31 and 6-32. Additionally, 27 of these artifacts have a minimum notch width ranging from 5 to 13 mm and a minimum notch thickness ranging from 2 to

Table 6-31. Basic Metric Data for Notched Shaped Pointed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Base Width	Base Thickness	Base W/T
Valid	14	25	25	14	14	23	24	23
Missing	14	3	3	14	14	5	4	5
Mean	78	12	6	10	6	10	5	2.1
Median	69	12	6	10	6	9	5	2.0
Mode	57	11	6	10	5, 7	9	5	1.8, 2.0, 2.3
Std. Deviation	20.912	2.814	1.675	2.914	1.730	2.628	1.606	0.932
Minimum	57	7	3	6	3	5	2	1.0
Maximum	115	19	9	17	9	15	8	5.0

Table 6-32. Additional Metric Data for Notched Shaped Pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	15	15	15	15	15	15	15	15	15	15	15
Missing	13	13	13	13	13	13	13	13	13	13	13
Mean	4	3	1.2	5	4	1.3	9	5	1.8	0.4	50
Median	3	3	1.0	5	4	1.3	10	5	1.9	0.4	50
Mode	3	N/A	1.0	6	3	1.0, 1.2, 1.3	6	5	2.0	0.3	50
Std. Deviation	1.125	0.845	0.309	1.414	0.834	0.320	2.484	1.265	0.421	0.099	21.653
Minimum	2	2	0.8	3	3	0.8	6	3	1.0	0.3	18
Maximum	6	4	1.7	8	5	2.0	13	7	2.6	0.6	91

8 mm. The mean, median, and mode notch widths are 8 mm (standard deviation is 2.019). The mean notch thickness is 5 mm (standard deviation is 1.593), and the median and mode are 4 mm. Cross-sections of these implements are asymmetrical (n = 11), oval (n = 2), rhomboidal (n = 1), and round (n = 1). All 26 of those that are complete enough to identify are asymmetrical in overall form.

Tip plans-sides on these implements are beveled-blunted (n = 2), blunted-blunted (n = 2), blunted-pointed (n = 2), pointed-rounded (n = 3), and rounded-rounded (n = 6). Shaft outlines-sides are asymmetrical-asymmetrical (n = 8), asymmetrical-converging (n = 2), asymmetrical-excurvate (n = 1), asymmetrical-incurvate/excurvate (n = 2), converging-converging (n = 1), excurvate-excurvate (n = 1), and excurvate-incurvate/excurvate (n = 1).

Manufacture and use-wear striations were difficult to discern on notched shaped pointed implements due to the heavy polish present on many of these tools. Four objects from Chiggerville were shaped via abrasion, two via longitudinally oriented lithic shaving overlain by abrasion, and one by abrasion overlain by obliquely oriented lithic shaving. Hafting elements of 17 of these tools were created via a heavy abrasion whose striae were visible macroscopically. One of these hafts was also shaped by cutting, and object B848 has a transversely oriented incision on one face, presumably also to facilitate hafting. Objects B263 and B842 exhibit very narrow hafting notches, suggesting use of a cylindrical sandstone abrader to form these hafting elements, and object B842 exhibits polish on the hafting element that confirms that at least this one object was hafted in this location. Object B963 exhibits a bifurcated base that likely indicates this was a perforated shaped pointed implement that broke at the perforation and was then recycled into a notched pointed implement.

The presence of a distinct hafting element on notched shaped pointed implements provides strong evidence that these tools functioned as projectiles. This function is supported by the presence of impact fractures on six of these objects, and possible impact breaks on two more. Three objects (B120, B263, and B392) may have functioned in some other capacity, however. Object B263 (Figure 6-42) exhibits heavy use-polish at its tip and is smaller than most notched implements interpreted as projectile points. Object B120 also exhibits use polish at its tip. Object B392 exhibits a blunted tip that would likely not have functioned well as a projectile designed to penetrate hide.

Object B510 is the one notched shaped pointed implement from Baker. This object is 75 mm long, 8 mm wide, 5 mm thick, 9 mm wide at the mid-section, 3 mm thick at the mid-section, has a Tip W5 of 4 mm, a Tip T5 of 3 mm, a Foreshaft W10 of 6 mm, a Foreshaft T10 of 3 mm, a Shaft W30 of 9 mm, a Shaft T30 of 3 mm, a base width of 8 mm, a base thickness of 5 mm, a minimum notch width and thickness of 5 mm, an outline index of 0.4, and a robusticity index of 27. This object is rectangular in cross-section with an asymmetrical form, a tip side-plan that is pointed-rounded, and a tip outline-side that is excurvate-parallel. Obliquely oriented longitudinal striae on all four faces indicate shaping via lithic shaving, but the method of shaping the notches cannot be determined.

Very small shaped pointed implements (Figure 6-40a-b) that exhibit rounded to flattened cross-sections, parallel margins, a high degree of polish (either intentional or from use), and a lack of protuberances or expanded bases may have functioned as needles. The recovery of eyed bone needles from Paleoindian sites from Alaska to Texas and Washington state to Missouri testifies to the antiquity and widespread distribution of these forms (Moore and Schmidt 2009). Unfortunately, no published microtrace analyses are currently available to confirm the function of these implements. Experimental replication of eyed and grooved needles similar to those from sites on the Aleutian Islands by Hoffman (2002) suggested that grooved needles were more appropriate for the manufacture of finely sewn decorative bags, skins, and clothing used in trade since grooved specimens could be ground much thinner than the eyed needles.

Only three very small shaped pointed implements were recovered from Chiggerville. Object B85 (Figure 6-40b) is 53 mm long, 5 mm wide, 4 mm thick, 4 mm wide and thick at the mid-section, has a Tip W5 and T5 of 2 mm, a Foreshaft W10 and T10 of 3 mm, a Shaft W30 and T30 of 4 mm, a base width of 5 mm, a base thickness of 3 mm, an outline index of 0.5, and a robusticity index of 16. This object is round in cross-section and base form, has a blunted-blunted tip plan-side, a converging-excurvate shaft outline-side, and exhibits bilateral symmetry. Manufacture microtrace has been obliterated by heavy polish, but the object exhibits longitudinally and obliquely oriented use-wear striae just below the tip. These striae and an opaline sheen present at the tip seem consistent with use as a needle.

Object B343 (Figure 6-40a) is 57 mm long, 7 mm wide, 3 mm thick, 6 mm wide at the mid-section, 3 mm thick at the mid-section, has a Tip W5 and T5 of 3 mm, a Foreshaft W10 of 4 mm, a Foreshaft T10 of 3 mm, a Shaft W30 of 6 mm, a Shaft T30 of 3 mm, a base width of 6 mm, a base thickness of 2 mm, an outline index of 0.5, and a robusticity index of 18. The object is asymmetrical in cross-section and rounded in base form. It has a pointed-rounded tip plan-side, an excurvate-excurvate shaft outline-side, and is asymmetrical in overall form. Oblique-longitudinal abrasion striae are present on all four faces, and these create a heavily abraded, roughened bevel at the proximal end that suggests intentional modification for attachment of something. It is possible this bevel may be for attachment of a thread or cord, but this object may also represent the barb of a composite fishhook similar to those found at the Read shell midden (Moore 2008a). Some pitting present at the tip of this object may be from use.

Object B826 is broken at its proximal end, but it has a Tip W5 of 3 mm, a Tip T5 of 1 mm, a Foreshaft W10 of 4 mm, a Foreshaft T10 of 1 mm, a Shaft W30 of 4 mm, a Shaft T30 of 2 mm, an outline index of 0.8, and a robusticity index of 8. The object is asymmetrical in cross-section, has a blunted-pointed tip plan-side, and an asymmetrical-parallel shaft outline-side. Manufacture striae are present but highly reduced by intentional manufacture polish. These striae suggest use of an abrasion technique, but this cannot be said for certain. Two chips have been removed from the tip and later polished over, likely by use. No use-wear striations are present at low power.

Object B230 is the only very small shaped pointed implement from Baker. This object is broken but has a width of 8 mm and a thickness of 2 mm. It is asymmetrical in cross-section and overall form and has an asymmetrical-asymmetrical shaft outline-side. Obliquely oriented lithic shaving striae are present on all four faces of this intentionally polished implement. The break at the object's tip is likely from use and is slightly polished over, suggesting minimal re-use after breaking. Prior to breaking, the tip would have been acute in form, suggesting a perforating function, although use as a needle cannot be ruled out.

Shaped pointed implements with beveled tips (Figure 6-10f-h) are similar in form to shaped pointed implements with cylindrical or oval cross-sections, with the exception that the former exhibit a short bevel, rather than a rounded point, at their distal ends. It is likely that these implements are functionally equivalent to the four modified splinters from Chiggerville with beveled tips discussed above, which were felt to be burnishing or polishing tools. Unfortunately, no microtrace or functional interpretations of similar implements could be found in the literature. These implements were only recovered from Chiggerville.

Object B210 is the only complete beveled shaped pointed implement from the site. It is 156 mm long, 12 mm wide, 7 mm thick, 10 mm wide at the mid-section, and 5 mm thick at the mid-section. Table 6-33 provides other metric data for these objects. Cross-sections are oval (n = 3) or asymmetrical (n = 2), and the overall form tends to be asymmetrical (n = 3). Tip plans-sides are blunted-beveled (n = 5), and shaft outlines-sides are asymmetrical-incurvate/excurvate (n = 2), converging-incurvate/excurvate (n = 1), and parallel-parallel (n = 2).

Table 6-33. Metric Data for Beveled Shaped Pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
B210	5	2	2.5	6	3	2.0	7	4	1.8	0.7	28
B320	5	3	1.7	5	4	1.3	7	5	1.4	0.7	35
B342	6	3	2.0	6	4	1.5	7	5	1.4	0.9	35
B712	5	3	1.7	5	3	1.7	6	3	2.0	0.8	18
B1059	5	2	2.5	5	3	1.7	6	3	2.0	0.8	18

Shaped pointed implements with beveled tips were manufactured either by abrasion (n = 2) or by longitudinally oriented lithic shaving followed by abrasion (n = 3). Object B342 (Figure 6-10g) is blackened form intentional heat treatment. Object B1059 represents the discarded distal (beveled) end of a tool that was apparently recycled into another tool form. This object exhibits a circum g/s1 cut at its proximal end. This cut truncates abrasion striae and the grooves are not rounded from handling or use, indicating that the cut was made just prior to discard.

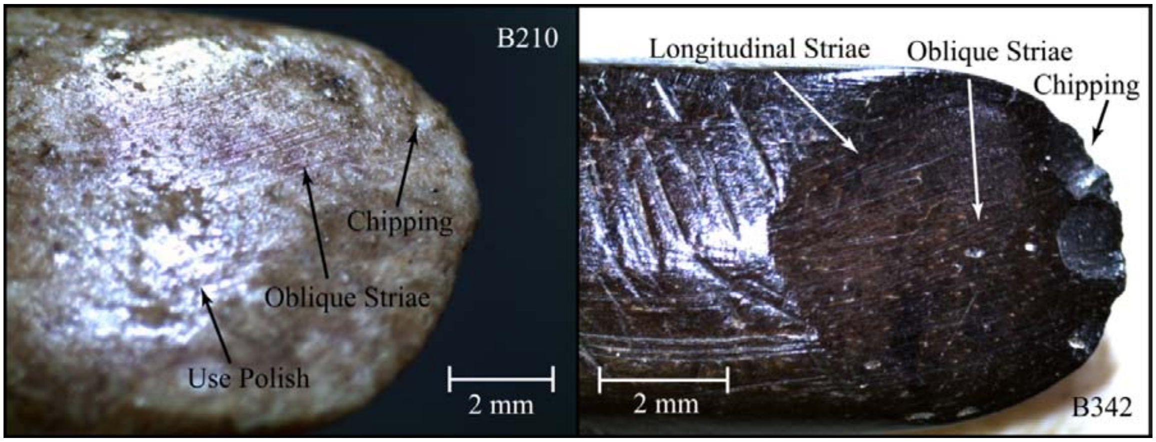


Figure 6-43. Micrographs of Beveled Shaped Pointed Implements from Chiggerville.

Figure 6-44. Incised Shaped Pointed Implements from Chiggerville.

Although no experimental, ethnographic, ethnohistoric, or comparative archaeological data exist to test the function of these tools, it is hypothesized that they functioned like beveled modified splinters as polishing or burnishing tools. The presence of deep obliquely (n = 4), longitudinally (n = 5), and/or transversely (n = 1), oriented use-wear striations on the bevels and on the tool face opposite the bevels on these tools, along with chipping (n = 3) and heavy use-wear polish (n = 3) on their bits indicates they were used against a hard medium (Figure 6-43). Similar use-wear was found on modified teeth and beveled tip ulnae interpreted as burnishing tools or bark stripping tools from the Early Archaic Windover site in Florida (Penders 1997, 2002).

Incised shaped pointed implements (Figure 6-44) were only recovered from Chiggerville. These implements are similar to notched implements except that they are grooved or incised at their proximal ends rather than notched. It is thought that these cuts are functionally equivalent to notches, however, and that these are projectiles designed to be hafted to a dart or foreshaft. Metric data are provided in Tables 6-34 and 6-35.

Cross-sections of incised shaped pointed implements from Chiggerville are asymmetrical (n = 4). Tip plans-sides are broken-blunted (n = 1), pointed-rounded (n = 1), and rounded-rounded (n = 2), and shaft outlines-sides are asymmetrical-asymmetrical (n = 1), asymmetrical-converging (n = 2), and asymmetrical-excurvate (n = 1). All seven are asymmetrical in overall form. A likely impact fracture at the tip of object B850, a haft snap similar to those exhibited on stone projectile points at the incised portion of object B763, and a possible impact fracture on object B207 may confirm the projectile function for these tools. Object B1106 exhibits longitudinally oriented use-wear

Table 6-34. Basic Metric Data for Incised Shaped Pointed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Base Width	Base Thickness	Base W/T
B128	102	11	8	11	7	11	8	1.4
B207	Broken	8	4	Broken	Broken	7	4	1.8
B763	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
B836	Broken	10	9	Broken	Broken	10	8	1.3
B844	Broken	11	8	Broken	Broken	9	7	1.3
B850	Broken	14	10	Broken	Broken	10	6	1.7
B1106	69	10	5	10	5	8	5	1.6

Table 6-35. Additional Metric Data for Incised Shaped Pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
B128	3	3	1.0	4	4	1.0	8	7	1.1	0.4	77
B763	3	3	1.0	4	4	1.0	9	5	1.8	0.3	45
B1106	4	2	2.0	5	3	1.7	9	4	2.3	0.4	36

striations on its tip suggesting this tool may have functioned as an awl/perforator, but whether the tool was initially manufactured for this task or recycled is uncertain.

Four incised shaped pointed implements were manufactured via abrasion, one exhibits longitudinally oriented striations from lithic shaving, and another exhibits both longitudinally oriented lithic shaving striae and abrasion. The order of use of lithic shaving and abrasion on this tool cannot be discerned since the striae do not overlap.

One shaped pointed implement from Chiggerville was classified as ‘other’ (Figure 6-40i). The tip of this object is broken, but it is 9 mm wide, 6 mm thick, has a base width of 9 mm, and a base thickness of 5 mm. The object is asymmetrical in cross-section and overall form and has an excurvate-excurvate shaft outline-side. Heavy polish has obliterated most evidence of the manufacture techniques employed to shape the artifact, but some remnant striae indicate use of both an abrasion and a longitudinally oriented lithic shaving technique. The break at the tip is likely from use, but no use-wear or other evidence of the object’s function could be discerned. The base of this artifact is rounded and well polished.

Pointed implements that retain a complete or partial articular surface of the anatomical element used in their manufacture are separated as a distinct class of artifacts. The expanding or irregular nature of articular ends of bones restricts the movement of pointed implements manufactured on these elements, indicating that such tools were not intended to pass through materials during their use. Furthermore, the fact that the bases are “sometimes modified by the removal of processes or protrusions on the bone, and exhibit varying degrees of polish” suggests that they served as handles (Bader 1992). Articular surfaces of these tools may be modified and still qualify for this category.

These tools are commonly manufactured on ulnae, which according to Kidder and Barondess (1981:96) is to "take advantage of the semi-lunar notch of the ulna by using it as a finger grip with the butt of the ulna resting in the palm of the hand."

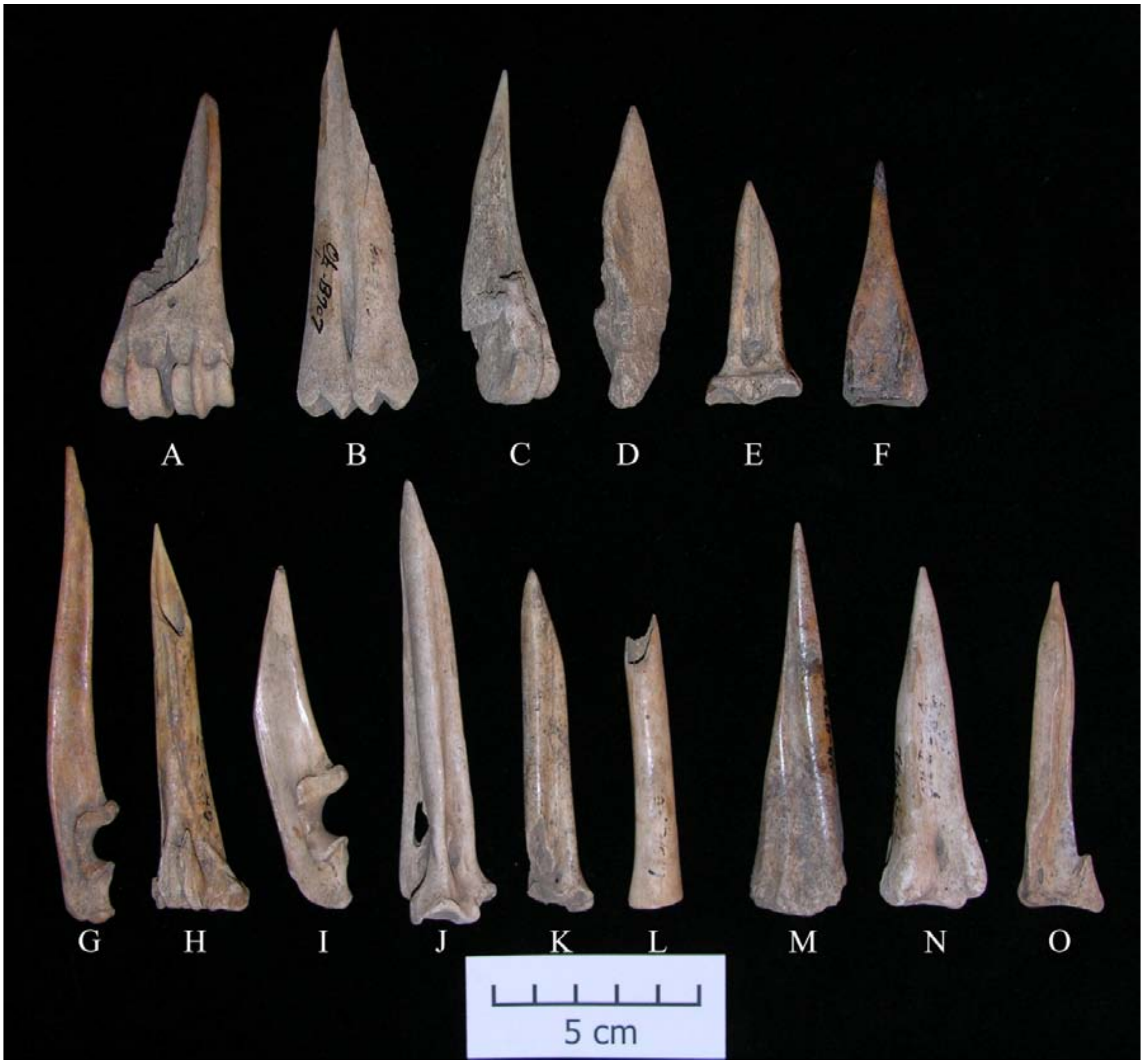


Figure 6-45. Pointed Implements that Retain Articular Surfaces from Chiggerville.

Pointed implements that retain articular ends were further subdivided into those that have concave cross-sections (Figure 6-45g-l), those that are flat and pointed (Figure 6-45a-f), and those with round tips (Figure 6-45m-o). Broken pointed implements that retain articular surfaces were noted at both Baker (n = 5) and Chiggerville (n = 8). These are not discussed further herein.

Those with concave cross-sections represent “one-half of the longbone which is split longitudinally and then reamed of cancellous bone” (Bader 1992:134). Concave cross-sections can be formed by cutting a longbone diagonally to form a triangular point. Many specimens are broken tips that can be placed within the ‘retained articular surface’ category on the basis of their form. The lateral edges of these tools are typically rounded by grinding, possibly to strengthen the tools and facilitate passage through the material being worked. Avian specimens tend to have shorter working ends than those manufactured from mammal bones. Microtrace analysis of specimens from KYANG indicates that these implements were used in basketry, weaving, and/or matting activities, possibly to hold down weft and split stitches (Bader 1992:257-258).

Although the specimens from Baker and Chiggerville are almost certainly functional tools, Davis et al. (1983) provide examples of similar forms from Coles Creek and Mississippian contexts in Louisiana that are debitage from the production of bone points. The manufacturing trajectory for the production of these implements involves grooving two convergent lines across the shaft of a raccoon longbone and then snapping away the now pointed epiphysis. These objects are nearly identical to pointed implements with concave cross-sections except that they are shorter than those used as tools and are never polished or secondarily modified. The pointed implements that are manufactured during this process are then grooved and snapped, crushed, or broken to remove the other articular facet. These modified base pointed implements with concave cross-sections are hollow cylinders that are thought to have functioned as bone projectile points (Davis et al. 1983).

Tables 6-36 and 6-37 illustrate that pointed implements that retain articular surfaces and have concave cross-sections from Chiggerville are slightly larger than those from Baker, but whether this has any functional or cultural significance is currently unknown. All implements from both sites are asymmetrical in overall form due to the asymmetrical nature of their articular ends. Base forms at both sites include both modified (n = 11 at Baker and n = 9 at Chiggerville) and unmodified (n = 19 at Baker and n = 9 at Chiggerville) varieties.

Table 6.36. Basic Metric Data for Pointed Implements that Retain Articular Surfaces and have Concave Cross-sections from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Baker	Valid	14	29	28	14	14
	Missing	20	5	6	20	20
	Mean	79	12	11	8	7
	Median	81.5	11	10.5	8	7
	Mode	N/A	11	11	6, 8, 9, 11	5, 7, 9
	Std. Deviation	13.057	4.572	3.685	2.269	1.950
	Minimum	54	6	5	4	5
	Maximum	98	23	20	11	11
Chiggerville	Valid	7	16	19	7	7
	Missing	18	9	6	18	18
	Mean	95	13	16	9	10
	Median	95	13	16	10	11
	Mode	N/A	10, 13	23	N/A	11
	Std. Deviation	27.891	4.226	5.165	3.259	1.826
	Minimum	48	8	8	5	7
	Maximum	133	23	23	14	12

Tip plans-sides at Baker are beveled-rounded (n = 1), blunted-blunted (n = 1), blunted-pointed (n = 2), blunted-rounded (n = 3), pointed-rounded (n = 2), pointed-pointed (n = 4), and rounded-rounded (n = 1), while at Chiggerville they are beveled-pointed (n = 1), blunted-blunted (n = 1), blunted-rounded (n = 3), pointed-pointed (n = 3),

Table 6.37. Additional Metric Data for Pointed Implements that Retain Articular Surfaces and have Concave Cross-sections from Baker and Chiggerville.

		Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Baker	Valid	14	14	14	14	14	14	14	14	14	14	14
	Missing	20	20	20	20	20	20	20	20	20	20	20
	Mean	3	2	1.8	5	3	1.6	8	7	1.1	0.5	57
	Median	3.5	2	1.85	5	3	1.6	7.5	7	0.95	0.5	50.5
	Mode	2, 4	2	2	N/A	2, 3	2.0	N/A	9	0.9	0.6	30, 42, 56
	Std. Deviation	1.158	0.679	0.545	1.406	1.167	0.450	2.243	1.847	0.331	0.167	28.725
	Minimum	2	1	1.0	3	2	0.8	4	4	0.8	0.2	20
	Maximum	5	3	3.0	7	5	2.5	11	10	1.8	0.8	110
Chiggerville	Valid	11	11	11	11	11	11	11	11	11	11	11
	Missing	14	14	14	14	14	14	14	14	14	14	14
	Mean	4	2	1.7	6	4	1.7	8	9	1.0	0.5	75
	Median	4	2	1.7	5	4	1.7	9	8	1.0	0.5	64
	Mode	3	2	1.5, 2.0	5	4	1.7	10	8	0.9	0.4, 0.5	110
	Std. Deviation	0.786	0.405	0.403	1.191	0.820	0.395	2.162	1.809	0.176	0.127	30.837
	Minimum	3	2	1.0	4	2	1.0	5	5	0.8	0.3	25
	Maximum	5	3	2.5	8	5	2.5	11	11	1.3	0.7	110

pointed-rounded (n = 2), and rounded-rounded (n = 1). Shaft outlines-sides at Baker are broken-asymmetrical (n = 5) and asymmetrical-asymmetrical (n = 26), while at Chiggerville they are broken-asymmetrical (n = 1), broken-converging (n = 1), asymmetrical-asymmetrical (n = 13), asymmetrical-converging (n = 1), and converging-converging (n = 1).

Manufacturing techniques differ considerably at the two sites. All of these implements at Baker were manufactured via either longitudinally (n = 4), obliquely (n = 1), or both longitudinally and obliquely (n = 6) oriented lithic shaving. At Chiggerville, on the other hand, abrasion (n = 2), longitudinally oriented lithic shaving followed by abrasion (n = 1), abrasion followed by longitudinally oriented lithic shaving (n = 2), and longitudinally and obliquely oriented lithic shaving (n = 2) were practiced. One implement even exhibits evidence of three manufacturing episodes—longitudinally oriented lithic shaving followed by abrasion followed by a second longitudinally oriented lithic shaving episode.

Objects B542 at Baker and B940 at Chiggerville exhibit cuts or grooves on two edges near the base, possibly indicating these implements were hafted or a line was tied at this location for suspension. The proximal end of object B889 from Chiggerville has been cut via a circum g/s2 technique, polished, and rounded (Figure 6-45l). This object is not unlike the hollow bone projectiles described by Davis et al. (1983).

Use-wear was uncommon on pointed implements that retained an articular surface and had concave cross-sections. Three objects from Chiggerville have obliquely (n = 1) or transversely oriented (n = 2) striations on their concave faces or the edge directly opposite the concavities. One of these implements also exhibits microchipping and compressed bone on one face. These objects may be basketry, weaving, or matting tools, but red pigment in the use-wear striations of object B903 indicates that a red pigment was involved in whatever tasks these implements were employed. One object from Baker exhibits transversely oriented use-wear striations opposite its concavity suggesting a basketry, weaving, or matting function. Object B875 at Chiggerville has longitudinally and obliquely oriented striae just below the tip that may be indicative of use as an awl or perforator.

Objects classified as flat, pointed implements that retain articular surfaces (Figure 6-45a-f) exhibit flattened shafts and tip cross-sections (Bader 1992). These objects tend to be slightly modified longbone elements, oftentimes deer ulnae. Microtrace analysis of objects from KYANG concluded that they were used in basketry, weaving, and matting, but not to perforate leather or other materials (Bader 1992:271). A total of 19 flat, pointed implements retaining articular surfaces were recovered from Chiggerville, and another 7 were recovered from Baker. Metric data pertaining to these tools can be found in Tables 6-38 through 6-41.

Flat, pointed implements that retain articular surfaces from Chiggerville have asymmetrical (n = 11), oval (n = 3), and square (n = 1) cross-sections, and those from Baker are all asymmetrical (n = 5). Base forms at both sites are both modified (n = 14 at Chiggerville and n = 3 at Baker) and unmodified (n = 3 at Chiggerville and Baker). Overall form is asymmetrical at both sites (n = 19 at Chiggerville and n = 7 at Baker). Tip plans-sides at Chiggerville are blunted-blunted (n = 1), blunted-rounded (n = 1), pointed-pointed (n = 1), pointed-rounded (n = 2), and rounded-rounded (n = 8). At Baker they are blunted-rounded (n = 4) and pointed-rounded (n = 1). Shaft outlines-sides at

Table 6-38. Basic Metric Data for Flat, Pointed Implements that Retain Articular Surfaces from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	11	17	18	11	11
Missing	8	2	1	8	8
Mean	79	21	15	14	8
Median	73	20	14	12	6
Mode	N/A	13	13	10, 12, 19	5, 8
Std. Deviation	22.975	8.478	4.957	5.317	5.344
Minimum	54	11	7	7	3
Maximum	136	40	23	24	23

Table 6-39. Additional Metric Data for Flat, Pointed Implements that Retain Articular Surfaces from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	12	12	12	13	13	13	13	13	13	12	13
Missing	7	7	7	6	6	6	6	6	6	7	6
Mean	4	3	1.3	6	4	1.6	12	6	2.2	0.3	87
Median	3	2.5	1.5	5	4	1.3	11	5	2.0	0.3	50
Mode	3	2	1.5	5	4	1.3	10	5	2.0	0.3	50
Std. Deviation	0.996	1.128	0.378	2.488	0.927	0.591	3.678	4.073	0.707	0.039	87.816
Minimum	3	2	0.8	4	2	0.8	7	3	1.0	0.3	28
Maximum	6	5	2.0	13	5	2.6	19	19	3.7	0.4	361

Table 6-40. Basic Metric Data for Flat, Pointed Implements that Retain Articular Surfaces from Baker.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
B3	83	36	23	21	20
B53	94	36	23	22	23
B99	Broken	21	10	Broken	Broken
B224	Broken	Broken	Broken	Broken	Broken
B307	99	12	7	6	4
B346	Broken	16	6	Broken	Broken
B383	69	30	17	18	13

Table 6-41. Additional Metric Data for Flat, Pointed Implements that Retain Articular Surfaces from Baker.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
B3	6	3	2.0	9	4	2.3	16	15	1.1	0.4	240
B53	6	3	2.0	9	3	3.0	14	6	2.3	0.4	84
B224	6	3	2.0	8	3	2.7	Br	Br	Br	Br	Br
B307	3	3	1.0	4	3	1.3	5	4	1.3	0.6	20
B383	8	3	2.7	11	3	3.7	17	15	1.1	0.5	255

Chiggerville are asymmetrical-asymmetrical (n = 7), asymmetrical-converging (n = 3), asymmetrical-excurvate (n = 1), asymmetrical-incurvate/excurvate (n = 1), and converging-converging (n = 1). At Baker they are asymmetrical-asymmetrical (n = 4), asymmetrical-incurvate/excurvate (n = 1), and asymmetrical-parallel (n = 1).

Like other pointed implements from these sites, different manufacturing strategies were employed to manufacture flat, pointed implements that retain articular surfaces. At Chiggerville, abrasion (n = 3) and longitudinally and obliquely oriented lithic shaving (n = 3) microtrace occur in equal numbers. One implement was manufactured by longitudinally oriented lithic shaving overlain by abrasion and one (object B677) by a combination of longitudinally and obliquely oriented lithic shaving, abrasion, and whittling. This latter object exhibits whittling and a groove cut with a stone tool at its proximal end. These modifications were likely made to facilitate hafting or binding. Only lithic shaving was identified at Baker, as four objects exhibited longitudinally and obliquely oriented striae indicative of this technique. One object also exhibited short, linear striae from lithic shaving used to shape the object's tip. Object B99 from Baker has a long, curvilinear groove along one edge that may be evidence of use of a longitudinal groove and snap technique to initially reduce this implement.

No use-wear was recorded on sampled objects from Chiggerville, but objects B707 and B1010 had three and eight v-shaped nocks, respectively, cut into one edge. The purpose of these nocks is unknown but it is likely they are related to the object's use. Similar v-shaped nocks were present on object B71, a modified splinter from Chiggerville. Three objects at Baker exhibited obliquely (n = 1), transversely (n = 2), and/or oblique-transversely (n = 1) oriented use-wear striations consistent with use as basketry, weaving, or matting tools.

Round tipped pointed implements that retain articular surfaces (Figure 6-45m-o) are identical to those with flattened tips except for the difference in tip form. Seven of these objects were recovered from Chiggerville and none were found at Baker. Metric data are provided in Tables 6-42 and 6-43. Cross-sections of these seven implements are asymmetrical (n = 3) and rounded (n = 4), and the overall form of all seven is asymmetrical. All bases are modified epiphyses. Tip plans-sides are blunted-rounded (n = 1) and rounded-rounded (n = 3). Shaft outlines-sides are broken-converging (n = 1), asymmetrical-asymmetrical (n = 3), converging-converging (n = 1), and converging-excurvate (n = 1).

Five of the seven round tipped pointed implements that retain articular surfaces were manufactured via abrasion and one exhibits obliquely and longitudinally oriented lithic shaving striae overlain by abrasion striae. Object B326 has a deep u-shaped nock on one edge and two smaller v-shaped grooves on the opposite edge. These cuts may be an aborted attempt to remove the proximal end during manufacture or may be modifications to facilitate hafting or binding. Three of these implements exhibit rotational (n = 2), longitudinally oriented (n = 1), and/or transversely oriented (n = 1) use-wear striae consistent with use as awls or perforators.

Expedient pointed implements consist of naturally pointed bone artifacts exhibiting use-wear or other modification striae. Bader (1992:175) identified 42 such artifacts at KYANG. Most of these were utilized fish spines, but six vestigial splints of whitetail deer and three avian metatarsi had also been expediently used. Microtrace

Table 6-42. Basic Metric Data for Round Tipped Pointed Implements that Retain Articular Surfaces from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
B317	Broken	18	9	Broken	Broken
B326	68	15	11	10	8
B691	79	19	10	12	7
B729	Broken	15	11	Broken	Broken
B742	81	25	15	15	8
B774	Broken	18	11	Broken	Broken
B995	93	Broken	Broken	13	8

Table 6-43. Additional Metric Data for Round Tipped Pointed Implements that Retain Articular Surfaces from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
B326	4	4	1.0	5	5	1.0	10	8	1.3	0.4	80
B691	3	3	1.0	7	6	1.2	12	7	1.7	0.3	84
B742	4	3	1.3	6	4	1.5	13	7	1.9	0.3	91
B995	3	3	1.0	4	4	1.0	8	7	1.1	0.4	56

analyses were ambiguous as to the function of these artifacts, although some of the fish spines may have been used as needles (Bader 1992:306). Campana (1989:81) found that two fish vertebral spines from Levantine Natufian contexts exhibited polish and rotational scratches indicative of use as perforators. A group of fish spines of unidentified function were found in burial lot 90 at Windover.

Five fish spines from Chiggerville and three from Baker are classified as expedient pointed implements based on the presence of rounded and polished tips and possible handling polish at the proximal ends. One implement from Baker exhibits obliquely oriented lithic shaving striations on four edges, and one object from Chiggerville has oblique-transversely oriented striations near the tip that may be from use or abrasion. The function of expedient pointed implements from the two sites is unknown.

Bi-pointed Implements

Bi-pointed implements vary considerably in overall form but typically consist of slightly to heavily modified bone splinters and worked bone blanks with two pointed or slightly blunted shaped or utilized ends. Modified splinters with two pointed ends, one modified and one that is unmodified and unutilized, are not included in this category. Unfortunately, bi-pointed implements are currently under-theorized and functional interpretations are ambiguous, so the categories developed herein should be used as a set of working hypotheses and not as a refined set of classificatory units. Unidirectionally forked or pronged bi-pointed implements are remnants from the production of fishhooks from spatulate blanks, so discussion of these bi-pointed implements are included in the section on fishhook production below.

Small, roughly latitudinally symmetrical bi-pointed implements that sometimes exhibit notching, grooving, or grinding at their mid-sections are typically interpreted as fishing gorges (Lewis and Lewis 1995:155; Penders 1997, 2002; White 2005). Definitive use-wear analyses to confirm or refute this interpretation have yet to be conducted. Campana (1989:89) suggested that similarly shaped Levantine Natufian tools may have been buttons or clothing fasteners but found no evidence of wear indicating that they were tied at their mid-sections, although scoring marks were present at these locations. According to Penders (2002:105), gorges were tied to fishing lines in groups of a dozen or more. Attempts to fish with replicated fishing gorges were unsuccessful (Penders 1997:88).

One latitudinally symmetrical bi-pointed implement (object B328) was recovered from Chiggerville. This point is broken at the proximal end, but is 8 mm wide and thick and has a distal Tip W5 of 6 mm, Tip T5 of 5 mm, Foreshaft W10 and T10 of 6 mm, Shaft W30 of 8 mm, Shaft T30 of 7 mm, a distal outline index of 0.8, and a robusticity index of 56. The distal tip is asymmetrical in cross-section, has a tip plan-side that is blunted-pointed, distal and proximal shaft outlines-sides that are asymmetrical-asymmetrical, and the object is asymmetrical in overall form. Primary shaping of the latitudinally symmetrical bi-pointed implement was achieved using abrasion, but deeper transverse cuts were made at the mid-section using a chipped stone tool. This cutting created a u-shaped divet at this location that may have facilitated tying a line. It is possible this object functioned as a fishing gorge, but several parallel obliquely to transversely oriented use-wear striae located just below the broken end may indicate another function.

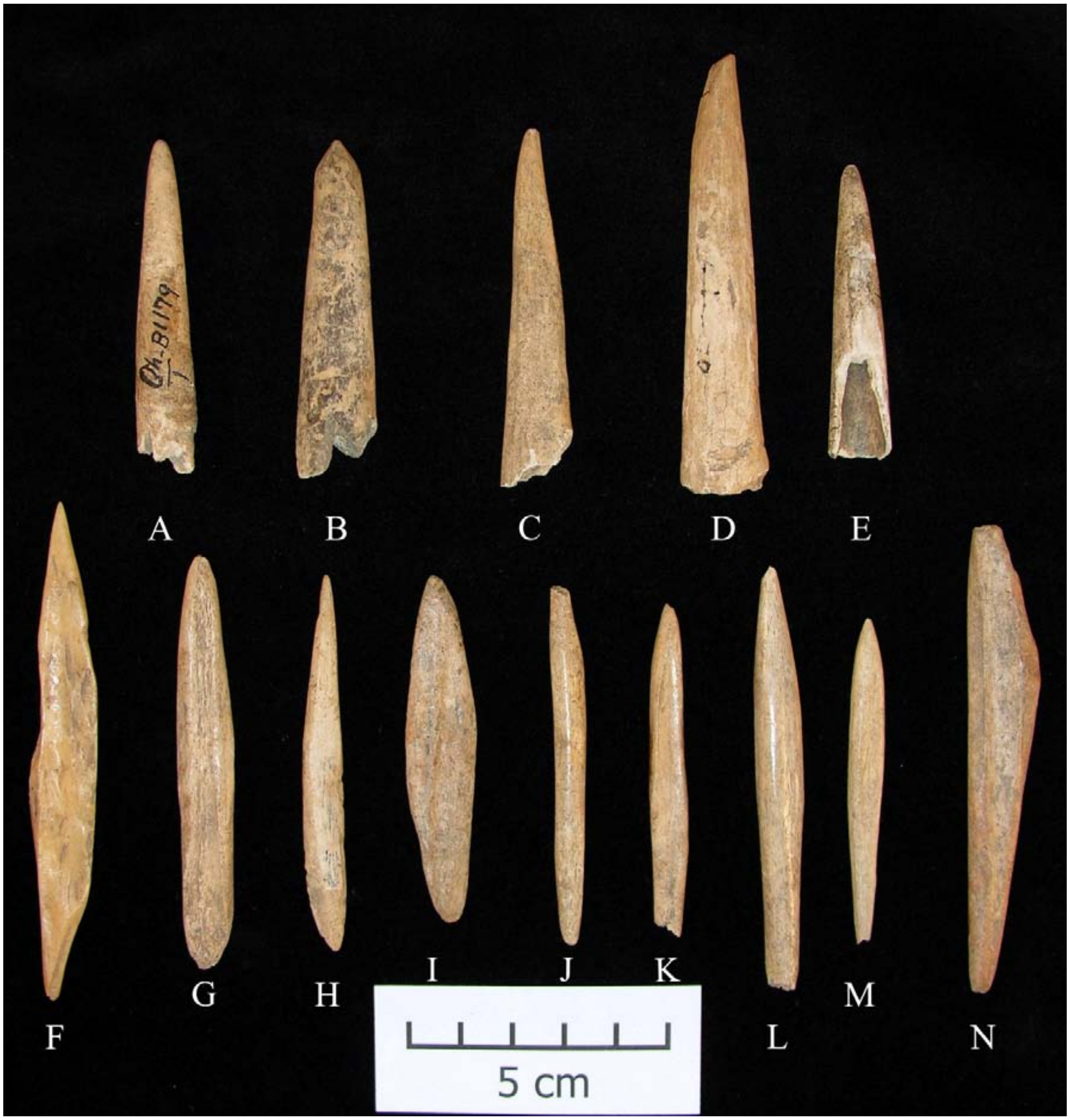


Figure 6-46. Antler Reamed, Pointed Implements (a-e) and Bone Latitudinally Asymmetrical, Bi-pointed Implements from Chiggerville (f-n).

Latitudinally asymmetrical, shaped bi-pointed implements (Figure 6-46f-n) are typically heavily ground and polished, well formed tools that constrict along both shafts to a distal point on one end and along one lateral edge to a beveled point on the other. These objects must be shaped over nearly their entire surfaces. Numerous examples are known from sites throughout eastern North America, including the Indian Knoll site in

Kentucky (Webb 1974:294) and various sites in the Pickwick Basin (Webb and DeJarnette 1942). Webb (1974:294) interprets these objects as projectile points and describes them as consisting of one heavy blunt end with a sharpened tip and an opposing tapering end that is:

> …not nearly so well worked. This is the end which was attached to the projectile shaft. It is believed that this type of point was used with a hollow shaft, perhaps made of a cane stalk. Some of these stems show annular scratches as if they had been set in some form of socket, and a few have been found showing asphalt covering their entire stem end… It is just possible that such points were never intended to be firmly attached to a shaft, but if inserted in a hollow cane shaft when projected, they might on impact with the target penetrate it and remain imbedded in it. This would allow the shaft to fall off, making the removal of the point more difficult.

Several of the bi-pointed bone projectiles from Indian Knoll were slightly discolored and thought by Webb (1974) to have been intentionally fire-hardened. Discoloring on a similar specimen from Windover was interpreted as potential evidence that the object was mounted to a wooden shaft (Penders 1997:72).

The tendency for the two ends of bi-pointed implements interpreted as projectiles to be differentially worked is also noted by Purdy (1973) in her study of bone points from Florida. The proximal ends of bi-pointed bone points from Florida tend to be more roughly shaped and sometimes exhibit evidence of pitch, while distal ends are smooth and polished or show signs of impact or use (Purdy 1973:146-147). Socketed bone and antler points and barbed points were also identified in her sample (Purdy 1973).

According to Tyzzer (1936), latitudinally asymmetrical bi-pointed implements from shell middens in Maine (as well as seven points from Alabama analyzed by Tyzzer in Webb and DeJarnette [1942:283-284]) exhibit varying degrees of asymmetry due to resharpening episodes and may be either short or long in overall size. Replicated bone points shot with a bow and arrow into gravelly loam by Tyzzer tended to develop a polish at their distal ends and broke or chipped when they impacted rocks. In similar experiments, Penders (1997:71) threw darts tipped with bone bi-pointed implements into soil. These points became dull or polished and were observed to penetrate more deeply into the sand and tree limbs than antler points due to the narrower diameters of the bone points. Five of Penders' (1997) experimental points broke after 20 throws each, primarily from hitting tree limbs and nearby objects.

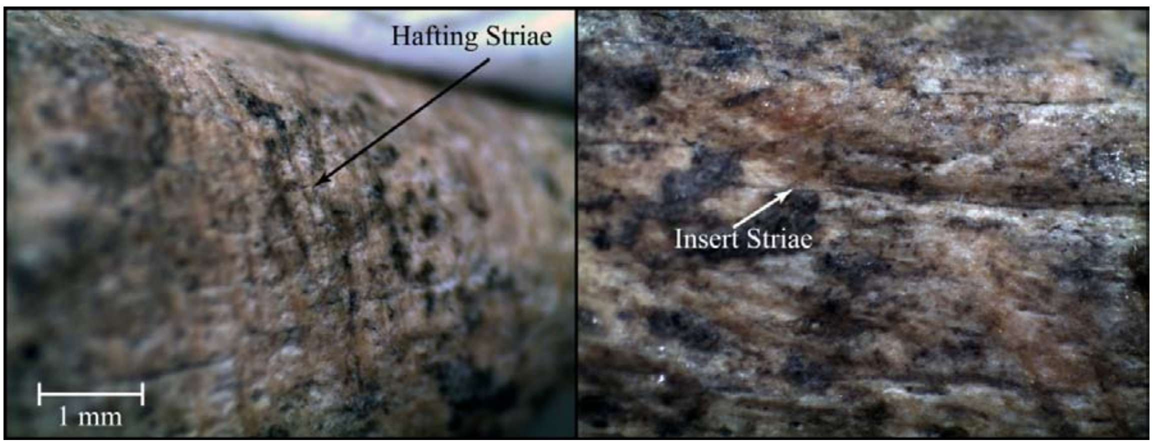


Figure 6-47. Striations to Aid Hafting (left) and Possible Insert Striae (right) on Latitudinally Asymmetrical, Bi-pointed Implements from Chiggerville.

Arndt and Newcomer (1986) used a bow and arrow to shoot replicated bone points into a lamb shoulder backed by ox bones. These authors found that breakage occurred when the points impacted thick cortical bone, but that they were able to easily penetrate scapular blades and other thin bones. Breakage did not occur when penetrating meat alone. Breakage was found to be more common in bone points that were antler or ivory. Arrow shafts tended to split if the points were not wrapped in sinew, but the presence of sinew binding more often resulted in point breakage (Arndt and Newcomer 1986).

In Arndt and Newcomer's (1986:167) experiments, most point damage occurred near the tip:

> …appearing as crushing, rounding or beveled breaks. When slight damage is found at the tip, it generally consists of crushing, which blunts the end by compressing the apex and removing small, irregular fragments of material… Beveled breaks at the tip result from the detaching of one or more flakes by means of an oblique fracture… Rounding is a phenomenon which may be visible on the crushed tip or the uppermost edge of a beveled break, extending in some cases down part of the fracture surface… This rounding probably occurs in the instant after the tip breaks away, as the arrow's momentum pushes the broken tip against the target.

Breaks also occurred at the mid-sections of these projectiles. The jagged edges of the impact breaks differentiated them from the smooth post-depositional breaks observed on some archaeological specimens (Arndt and Newcomer 1986).

The use of bone in the production of projectile points has a long history, dating to at least the early Upper Paleolithic in Europe (Knecht 1991, 1993). In North America, bone, antler, and ivory rods have been recovered from Paleoindian sites from Alaska to New Mexico and from California to Florida (Moore and Schmidt 2009). Sometimes interpreted to have functioned as foreshafts for stone projectiles, replication experiments have demonstrated that these tools are effective at penetrating a carcass (Guthrie 1983) and that breakage patterns on bone rods used as projectiles are identical to those observed on archaeological specimens from Agate Basin (Frison and Craig 1982, Frison and Zeimens 1980). Impact damage and microwear on bone rods from Sheriden Cave are also consistent with the projectile hypothesis (Redmond and Tankersley 2005:515). That at least one of the latitudinally asymmetrical shaped bi-pointed implements from the Green River region was used as a projectile is confirmed by Burial No. 132 at the Ward site, which had one of these objects embedded in its right innominate and a stone projectile point embedded in its right femur (Mensforth 2001:129, Figure 4a).

Fourteen latitudinally asymmetrical, shaped bi-pointed implements thought to be projectile points were recovered from Chiggerville. Metric data for these objects are provided in Tables 6-44 through 6-46. Cross-sections of all unbroken proximal (n = 9) and distal (n = 6) ends are asymmetrical, and the nine complete or nearly complete points are asymmetrical in overall form. Distal tip plans-sides are blunted-rounded (n = 2) and pointed-rounded (n = 2). Proximal tip plans-sides are beveled-blunted (n = 1), blunted-blunted (n = 5), blunted-rounded (n = 1), and pointed-rounded (n = 1). Distal shaft outlines-sides are asymmetrical-asymmetrical (n = 1), asymmetrical-excurvate (n = 3), and excurvate-excurvate (n = 2). Proximal shaft outlines-sides are asymmetrical-asymmetrical (n = 6), asymmetrical-excurvate (n = 1), and excurvate-excurvate (n = 1).

Manufacture of latitudinally asymmetrical shaped bi-pointed implements at Chiggerville seems to have primarily involved abrasion (n = 4). Three of these have longitudinal lithic shaving striae at their distal tips, two overlying the original abrasion striae. It is likely that lithic shaving was used to resharpen broken or damaged points in these three cases. Six transverse cuts on one edge of the proximal end of object B399 may be to facilitate hafting. Object B340 has rotational and transverse scoring and polish over approximately 44 mm of the proximal end of the bi-pointed implement (Figure 6-47 left). These are interpreted as hafting polish and scoring to facilitate hafting. Deep curvilinear striae at the base may be from forcing the base into a haft or shifting in the haft on impact (Figure 6-47 right). It is also possible that these striae are from use of this object as a perforator or reaming tool.

Table 6-44. Basic Metric Data for Latitudinally Asymmetrical Shaped Bi-pointed Implements from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	1	13	13	1	1
Missing	13	1	1	13	13
Mean	--	10	6	--	--
Median	--	9	7	--	--
Mode	--	N/A	7	--	--
Std. Deviation	--	2.555	1.450	--	--
Minimum	65	6	4	13	7
Maximum	65	14	9	13	7

Table 6-45. Distal End Metric Data for Latitudinally Asymmetrical Shaped Bi-pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	4	4	4	4	4	4	4	4	4	4	4
Missing	10	10	10	10	10	10	10	10	10	10	10
Mean	5	4	1.3	6	5	1.4	9	6	1.7	0.5	52
Median	4.5	3.5	1.3	6.5	4.5	1.45	8.5	5.5	1.7	0.55	51.5
Mode	N/A	N/A	1.3	N/A	N/A	N/A	N/A	N/A	N/A	0.6	N/A
Std. Deviation	1.291	0.577	0.206	1.708	0.577	0.263	2.630	1.291	0.378	0.096	22.485
Minimum	3	3	1.0	4	4	1.0	7	4	1.3	0.4	28
Maximum	6	4	1.5	8	5	1.6	13	7	2.2	0.6	78

That the latitudinally asymmetrical shaped bi-pointed implements from Chiggerville functioned as projectiles is confirmed by the presence of impact fractures at the distal ends of four of these implements. Two others have possible distal impact damage and one has chipping that likely was created by impact. Three other objects are broken at their proximal ends. These breaks may be haft snap breaks that formed upon impact. Object B394 is shaped like the other objects interpreted as projectiles, but this implement exhibits longitudinally and transversely oriented use-wear striations at the distal tip. It is possible this is a projectile point that was recycled into a basketry, weaving, or matting tool.

Object B222 is the only latitudinally asymmetrical shaped bi-pointed implement from Baker. This object exhibits an impact fracture at its distal tip. The proximal end has a Tip W5 of 6 mm, a Tip T5 of 3 mm, a Foreshaft W10 of 7 mm, a Foreshaft T10 of 4 mm, a Shaft W30 and T30 of 6 mm, a proximal outline index of 1.0, and a robusticity index of 36. The object has a semi-circular cross-section, a blunted-pointed tip plan-side, an asymmetrical-asymmetrical shaft outline-side at the proximal end, and is asymmetrical in overall form. The object was manufactured via a heavy longitudinally oriented lithic shaving technique on all four margins. No use-wear striations are evident at low power.

Latitudinally asymmetrical unshaped bi-pointed implements with evidence of use polish and/or use-wear striations on both ends (and possibly toward the mid-section) are suggested to be bi-pointed awls. Such implements may have been held in the hand or mounted in a haft to facilitate usage. Rotational scratches indicative of use as perforators were found on some Levantine Natufian examples studied by Campana (1989:89). Some examples may have deep incisions near their mid-sections resulting from artisans

Table 6-46. Proximal End Metric Data for Latitudinally Asymmetrical Shaped Bi-pointed Implements from Chiggerville.

	Tip W5	Tip T5	W5/ T5	FS W10	FS T10	W10/ T10	Sh W30	Sh T30	W30/ T30	OT W5/ W30	RB W30 x T30
Valid	7	7	7	7	7	7	7	7	7	6	6
Missing	7	7	7	7	7	7	7	7	7	8	8
Mean	5	4	1.2	7	5	1.3	10	6	1.7	0.5	54
Median	5	4	1.3	7	5	1.4	11	5	1.7	0.5	57.5
Mode	5	4	1.0, 1.3	7	5	1.4	11	5	N/A	0.5	60
Std. Deviation	1.215	1.069	0.302	1.618	1.069	0.329	2.854	1.528	0.518	0.147	22.993
Minimum	3	3	0.8	4	4	0.8	5	5	1.0	0.4	25
Maximum	7	6	1.7	9	7	1.8	13	9	2.4	0.8	91

pressing their fingernails into the tools during use (Christine Pappas, personal communication 2005).

Five latitudinally asymmetrical unshaped bi-pointed implements were recovered from Chiggerville. Object B393 was the only complete specimen recovered. It measures 98 mm long, 14 mm wide, 5 mm thick, 13 mm wide at the mid-section, 5 mm thick at the mid-section, has a distal Tip W5 and T5 of 3 mm, Foreshaft W10 of 5 mm, Foreshaft T10 of 4 mm, Shaft W30 of 10 mm, Shaft T30 of 5 mm, a distal outline index of 0.3, a distal robusticity index of 50, a proximal Tip W5 of 3 mm, Tip T5 of 5 mm, Foreshaft W10 and T10 of 5 mm, Shaft W30 of 12 mm, Shaft T30 of 5 mm, a proximal outline index of 0.3, and a proximal robusticity index of 60. At the distal end, object B393 is asymmetrical in cross-section with a pointed-rounded tip plan-side and an asymmetrical-excurvate shaft outline-side. At the proximal end the object is asymmetrical in cross-section with a blunted-rounded tip plan-side and an asymmetrical-asymmetrical shaft outline-side. The object is asymmetrical in overall form and was manufactured by longitudinally oriented lithic shaving followed by abrasion.

Object B696 is 8 mm wide and 4 mm thick with an asymmetrical distal tip cross-section and an asymmetrical-excurvate distal shaft outline-side. This object is asymmetrical in overall form and was manufactured via abrasion. Object B731 is 7 mm wide and 4 mm thick with an asymmetrical distal tip cross-section and an asymmetrical-asymmetrical distal shaft outline-side. This object is asymmetrical in overall form and was also manufactured via abrasion. Heavy shaping at the proximal end may be to facilitate hafting. A large chip removed from the distal end is likely from impact, indicating this tool functioned as a projectile point. This chip is polished over, however, suggesting it was recycled for some other purpose.

Object B730 is 10 mm wide, 6 mm thick, has a proximal Tip W5 and T5 of 4 mm, a Foreshaft W10 of 6 mm, a Foreshaft T10 of 5 mm, a Shaft W30 of 10 mm, a Shaft T30 of 5 mm, a proximal outline index of 0.4, and a proximal robusticity index of 50. The object is asymmetrical in cross-section at both the proximal and distal ends and is asymmetrical in overall form. The proximal and distal shaft outlines-sides are asymmetrical-asymmetrical, and the proximal tip plan-side is blunted-pointed. Object B730 was initially shaped via abrasion, but longitudinally oriented striae at the distal end indicate resharpening via lithic shaving. This resharpening episode did not completely sharpen the tip to a point, however. Longitudinal use-wear striations and heavy use polish is present on a chip at the proximal end, suggesting use as an awl or perforator.

Object B1136 is 12 mm wide, 4 mm thick, has a proximal Tip W5 of 5 mm, a Tip T5 of 3 mm, a Foreshaft W10 of 7 mm, a Foreshaft T10 of 4 mm, a Shaft W30 of 11 mm, a Shaft T30 of 4 mm, a proximal outline index of 0.5, and a proximal robusticity index of 44. The object has a distal shaft outline-side that is asymmetrical-incurvate/excurvate and a proximal shaft outline-side that is asymmetrical-asymmetrical. The proximal cross-section and overall form is asymmetrical, and the tip plan-side is pointed-rounded. Object B1136 was manufactured via abrasion.

Spatulate Implements

Spatulate implements are similar in many respects to pointed implements save for the fact that spatulate tools have broad rounded or square working ends. Spatulate tools have been further subdivided into ground and shaped, beveled, perforated and polished, perforated and unpolished, and other spatulate forms. Ground and shaped and perforated and unpolished spatulates are interpreted as stages in the production of fishhooks so these forms are discussed in the section on fishhook manufacture below.

Figure 6-48. Beveled Spatulate Implements from Baker.

Beveled spatulate implements (Figures 6-48 and 6-49) exhibit straight to slightly excurvate bits that tend to have flattened to convex cross-sections and beveled working edges. Based on the available ethnographic and archaeological record it would appear that these tools possessed a variety of functions. Those that are heavily polished with little edge damage may have functioned as scraping or flensing tools, while those with more heavily battered edges may have been used as woodworking tools.

Figure 6-49. Beveled Spatulate Implement (Object B1102) from Chiggerville.

Replicative experiments on beveled bone spatulates conducted by Campana (1989) indicated that these tools could be used efficiently as flensing tools, gouges, and wedges, but not as chisels. All three functions resulted in similar rounding and polish of the functional edges of the tools with little to no chipping or fracture damage (although a single chip was broken from one experimental specimen after 1400 strokes as a gouge) (Campana 1989:62). All activities resulted in microscopic striae parallel with the axis of the tip. One Protoneolithic beveled deer tibia studied by Campana (1989) was interpreted to be a hide dresser on the basis of the presence of these striae at the tip and halfway up the shaft of the artifact and by a "series of shallow, parallel grooves, apparently worn into the surface, running axially back from the tip edge for a distance of a few millimeters. These are fairly evenly spaced across the tip edge and have smoothly curved rounded profiles. The fine scratches are superimposed upon them" (Campana 1989:120).

Use of beveled bone and antler implements as flensing tools or scrapers is common in the ethnohistoric and archaeological literature. Steinbring (1966) provides an ethnoarchaeological account of the use of beveled spatulates (known as *mekingun*) as scraping and flensing tools by the Black River Band of the Ojibwa in Manitoba. *Mekingun* are typically manufactured from the metatarsal or metacarpal bone of a recently deceased moose. Upon removal from the animal, a bevel is created at one end by chopping with an axe or abrasion. These implements retain one articular end as a handle, and the marrow is typically left in the bone to act as a lubricant. The last step in the manufacture of *mekingun* is to cut small nocks or serrations in the distal end to prevent excessive penetration of the hide and to collect tissue during use. *Mekingun* were known to have been curated for generations (Steinbring 1966).

Similar beveled spatulate tools with articular joints were recorded at Southwestern archaeological sites by Kidder (1932). The dry environment of the American Southwest preserved specimens that retained articulated foot and ankle bones on some metatarsal flensing tools. These bones remained attached by dried ligaments. Just fewer than half of the specimens studied by Kidder (1932) exhibited serrations similar to those described by Steinbring (1966).

Lemoine (1989) replicated both serrated and unserrated beveled spatulates and used them to remove hair and flesh from cow and elk hides. Her experiments showed that these tools developed rounded and smoothed edges characterized by light striations and a few notches. The striations developed from abrasion of the bone against hair. Comparison of these replicated wear patterns with 14 tools from the Late Prehistoric H.M.S. Balzac site in Alberta, Canada confirmed that at least 8 of the archaeological tools were used in hide preparation (Lemoine 1989).

Winters (1969) describes a formal beveled spatulate antler tool type (the Robeson gouge) at Riverton Culture sites in Illinois, but two bone beveled spatulates manufactured from mammal longbones were recovered from Swan Island. These objects were interpreted as gouges, but they may have functioned as flensing tools. Winters (1969:61) describes a "very high sheen" on all surfaces of these rectangular implements and states that, "Heavy striations on the bit suggest that resharpening was done with a file." Beveled spatulate metapodials were also recorded at the Schultz site. These tools were "flaked and ground" at their distal ends and were interpreted to be beamers (Murray 1972:234).

Winters' (1969) description of beveled spatulates as gouges is not without ethnographic support. According to Thomson (1936:73), the Koko Tai'yuri of the Edward River in North Queensland, Australia used sharpened emu or kangaroo tibia gouges to hollow out wooden troughs used to carry water and process plant foods. These gouges were around a foot in length and were curated for long periods of time. Other possible uses of similarly shaped tools include Griffitts and Bonsall's (2001) replication of Mesolithic beveled bone spatulates. In this case, the bevel was a result of abrasion against stones during use as tools to remove limpets from coastal rocks. The tools were also found to function effectively at scooping the limpets from their shells.

Based upon these experimental and ethnoarchaeological data, then, the seven beveled spatulates from Baker and one beveled spatulate from Chiggerville may have functioned in a variety of ways. Table 6-47 provides metric data for these objects. As can be seen from Figures 6-48 and 6-49, the beveled spatulates from Baker consist of flattened forms with unformed (n = 5) or roughly chipped (n = 2) bases, while the specimen from Chiggerville is manufactured on a deer humerus and retains one unmodified articular end more like the specimens described by Kidder (1932), Murray (1972), and Steinbring (1966). The bases on the two roughly chipped specimens are 15 and 12 mm wide and 3 and 4 mm thick, respectively. The Chiggerville specimen exhibits a concave cross-section at the bit, while those from Baker exhibit square-rounded (n = 2), rounded-square (n = 1), rounded (n = 1), hexagonal (n = 1), and asymmetrical (n = 1) spatula outlines.

Not surprisingly, the beveled spatulates from the two sites have different manufacture trajectories. At Baker, most of these implements were shaped by lithic shaving. One exhibits longitudinally oriented lithic shaving striae overlain by abrasion and followed by a second longitudinally oriented lithic shaving episode, another was shaped by longitudinally oriented lithic shaving alone, two were shaped by longitudinally and obliquely oriented lithic shaving, and object B470 was shaped by longitudinally and obliquely oriented lithic shaving followed by abrasion to form the bevel. Object B303 from Baker has large chips removed from its edges, suggesting the longbone from which this tool was made was split with the assistance of a pièce esquillée or other kind of

Table 6-47. Basic Metric Data for Beveled Spatulates from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Width at Spatula	Thickness at Spatula
Baker	B166	96	17	5	16	5	15	3
	B243	66	12	6	12	5	11	4
	B246	131	25	13	16	9	13	5
	B303	Broken	16	5	Broken	Broken	Broken	Broken
	B429	Broken	21	7	Broken	Broken	14	3
	B447	113	20	12	19	9	15	6
	B470	106	22	9	20	8	11	4
Chiggerville	B1102	100	Broken	Broken	20	20	15	7

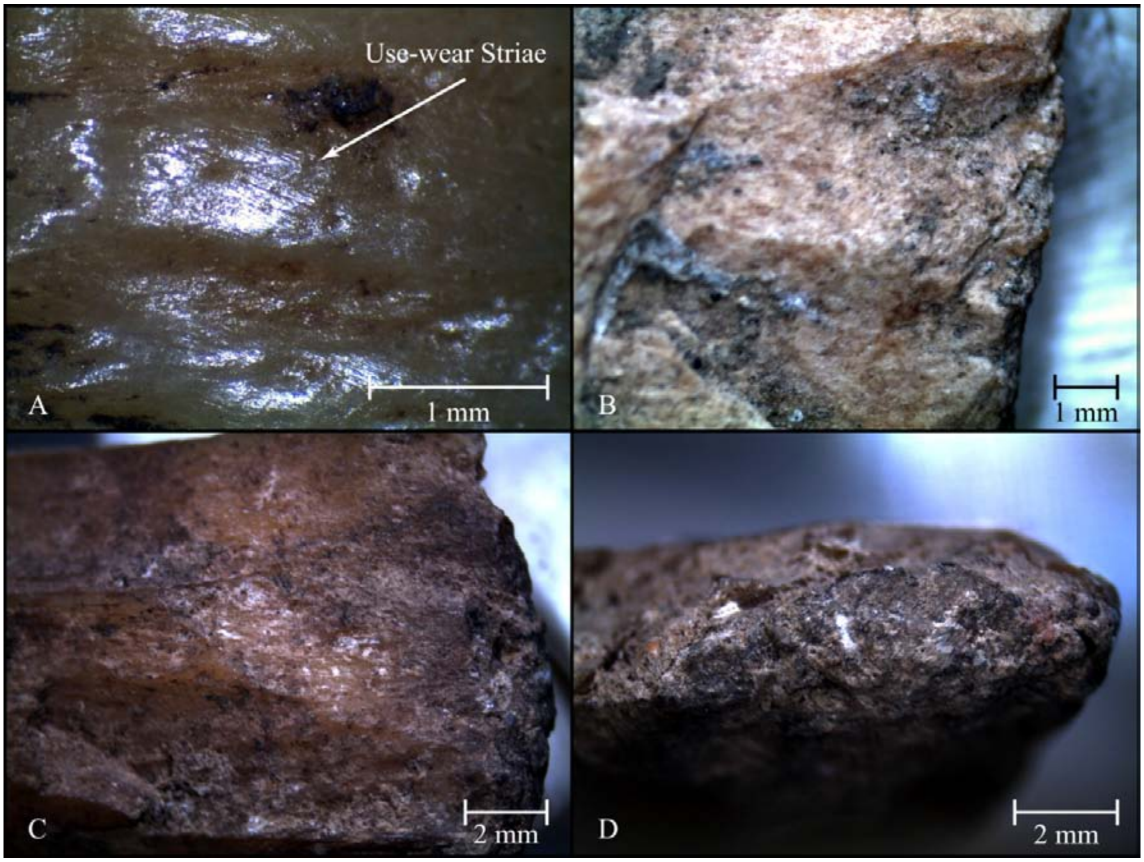


Figure 6-50. Use-wear Damage and Striations on Beveled Spatulates from Baker (a, c-d) and Chiggerville (b).

wedging device. Object B1102 from Chiggerville is a spirally fractured deer humerus that was beveled by the spiral fracture and then used as a spatulate.

Although it is possible that longitudinal, obliquely, and/or transversely oriented striations evident on all but object B429 from Baker are evidence for use as flensing or scraping tools (Figure 6-50a), most evidence suggests these are wedging or gouging tools. The chipped bases on objects B166 and B243 have been interpreted as intentional shaping of the base (Figure 6-48d-e), but compressed bone on the proximal end of object B243 may indicate that this chipping is from striking this end of these beveled spatulates with a percussor. Chipping at the distal ends of both of these objects provides confirmation for a wedging or gouging function for these tools, and object B243 also exhibits crushing at the working end (Figure 6-50c-d). Heavy crushing and chipping is also present on object B246, and object B447 exhibits crushing. Object B429 exhibits no use-wear damage or striae and is apparently a spatulate tool that was used expediently.

Figure 6-51. Perforated, Polished Spatulate (Object B1143) from Chiggerville.

Object B1102 exhibits heavy chipping on one edge and blunting at the end of the spatula from heavy use (Figure 6-50b). Chips at the worked end have been removed parallel to the long axis of the tool and are consistent with use as a wedging or gouging tool. No use-wear striations were present at low power on this object.

Object B1143 from Chiggerville is the only perforated, polished spatulate implement from either site (Figure 6-51). The object has two perforations, one complete and the other, located just above the complete perforation, that is broken and rounded. Apparently object B1143 was initially perforated, broken, and then repaired by drilling a second perforation. This scenario is supported by the fact that the complete perforation cut through the intentional manufacture polish at this location. A circum g/s1 groove and snap is located at the flaring end. The cortical bone was first thinned by longitudinally oriented lithic shaving on at least one face and then by abrasion on both faces. Edges were then shaped by longitudinally oriented lithic shaving over the abrasion. The two perforations were created by biconical drilling with a stone drill. The object has a maximum width of 20 mm and a maximum thickness of 5 mm. A red pigment is located in the groove and snap break, which is rough and not polished from use or handling. This object's function is unknown and may be ornamental.

Any spatulate implements that are not related to fishhook manufacture and that do not exhibit the characteristics of the categories described above are included in the other spatulate category (Figure 6-52). It is possible that the other spatulate category contains a variety of functional types, and the literature is filled with possible interpretations of these tools from a variety of sites. Most of these objects are manufactured from deer ulnae, and it is possible that deer ulnae other spatulates functioned differently from other spatulates manufactured from longbone fragments and ribs. It is also possible that the other spatulates from Baker and Chiggerville functioned in some other way not discussed herein.

Webb (1974) originally interpreted the Green River spatulates as flintknapping tools, similar in function to antler flakers, or as preforms for the manufacture of fishhooks. Only heavily worked spatulates have been assigned to the 'fishhook preform' category, and these are discussed further below. Eight other spatulates from Baker have been assigned a possible lithic flaking tool function. These objects exhibit grooves, faceting, or deep striae that may be associated with use, although these may also be related to manufacture. Two others exhibit deep longitudinal use-wear striations and one exhibits deep transverse and oblique-transverse use-wear striations (Figure 6-53). Three other spatulates from Baker exhibit macroscopically visible pitting and 15 exhibit chipping at their spatulate ends that may indicate use as lithic flaking tools, but these are also consistent with use as gouges and possibly with flensing or scraping tools (Figure 6-54). One object (B236) exhibits a bending snap at the spatula that may be from use as a flaker.

Figure 6-52. Other Spatulates from Baker.

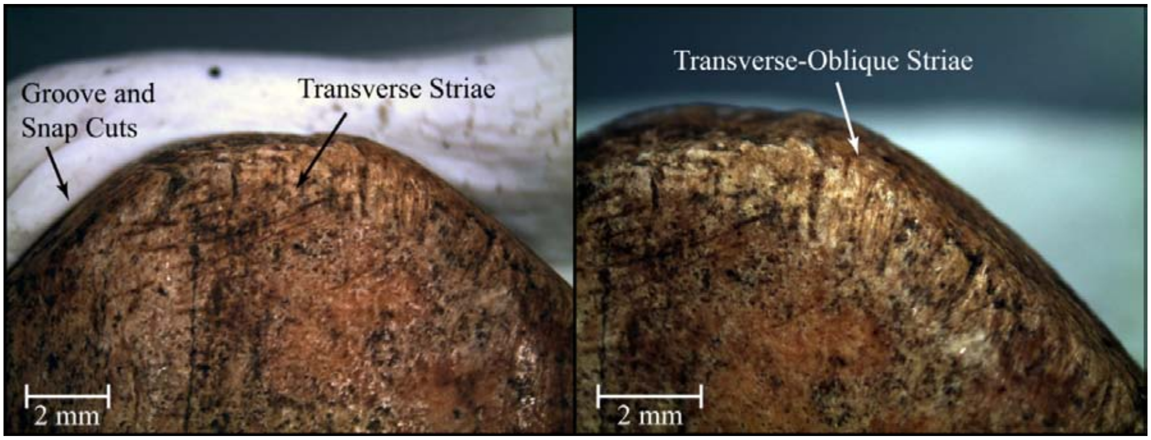


Figure 6-53. Possible Lithic Flaking Use-wear on Object B345 from Baker.

Figure 6-54. Use-wear Damage on Object B382 from Baker.

Penders (1997) argues that other spatulates from the Windover site functioned as gouges used in woodworking activities and as fish filleting tools. Although he does not specify how these tools were used to butcher animals, he describes successfully using the tools at 45 to 75 degree angles to chip wood. Use as a gouge was easily accomplished when working along the wood grain but required use of a hammer when working across the grain. Use as gouges created a worn and smoothed spatula and obliterated manufacture wear at this location. Use of a hammer caused the spatula to break and flakes to be removed at both ends. Such use damage was not present among the Windover tools, but may explain some of the chipping on the Baker tools. These tools were also found to be efficient at stripping bark from trees (Penders 1997:94).

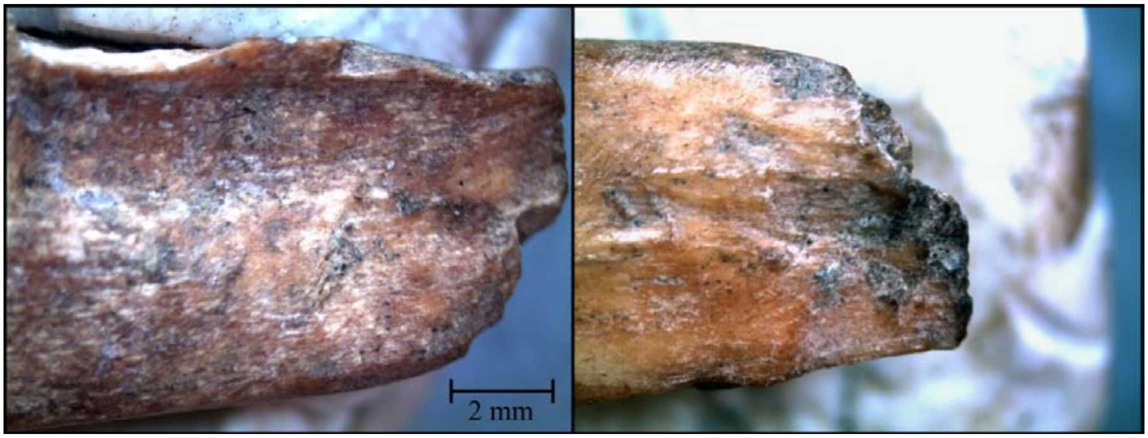


Figure 6-55. Use-wear Damage on Object B93 from Chiggerville.

Aside from the chipping identified above, three tools from Baker and one from Chiggerville exhibit obliquely and/or longitudinally oriented use-wear striations suggestive of use as gouging tools. This use created slight beveling or faceting on the distal edges of two of these tools. Chipping on some of these tools, such as object B93 from Chiggerville (Figure 6-55), is heavier than what would be expected from use as flintknapping tools and almost certainly indicates use against a resistant material in a direction parallel to the long axis of the tool. Two objects from Baker exhibit deep longitudinally oriented striations at the distal end that are likely associated with use as gouges but that may also be related to manufacture (Figure 6-56).

Two objects from Chiggerville and one from Baker are interpreted as possible scrapers based on the presence of polish and/or rounding at their distal ends and lack of heavy use damage like chipping or pitting. One of these objects (B1131) does exhibit a break at the distal end resulting from a twisting motion that removed a flake from the

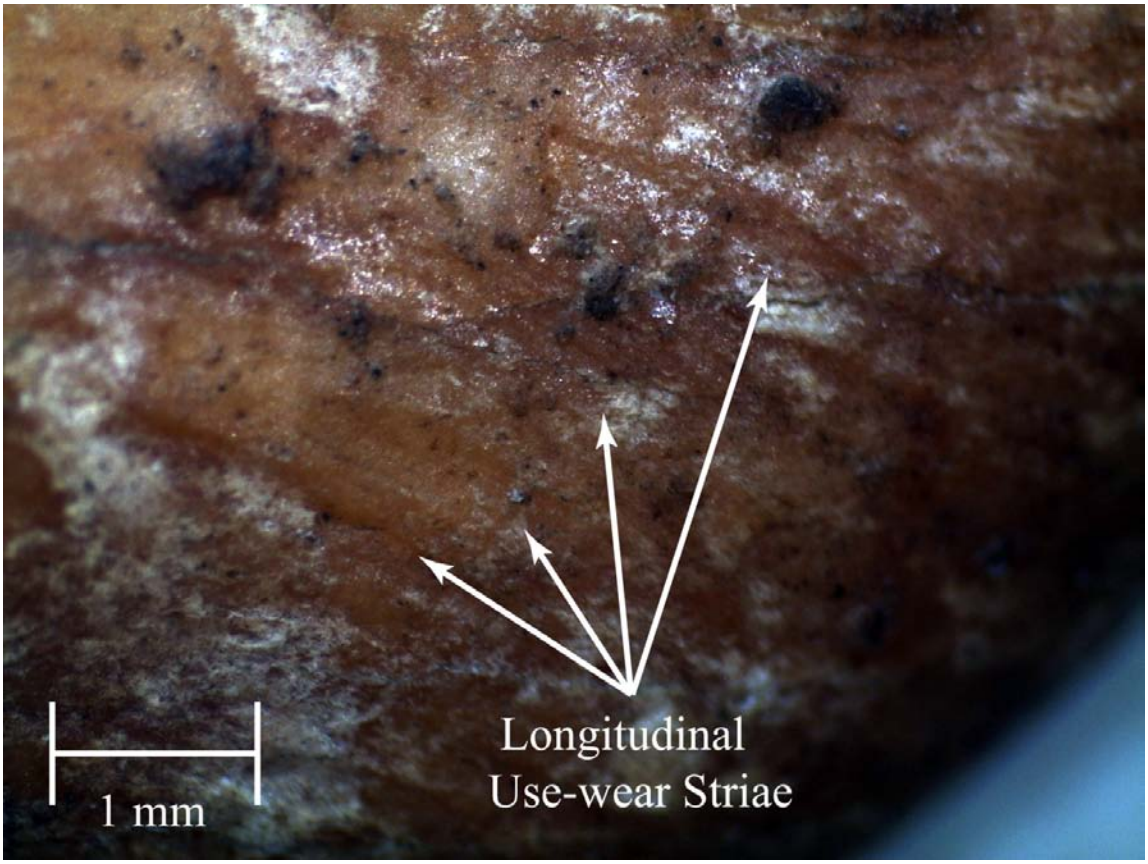


Figure 6-56. Use-wear Striae on Object B165 from Baker.

edge of the spatula. It is possible this tool functioned both as a scraping tool and as a prying tool.

Object B518 from Baker (Figure 6-52, upper left) is the best candidate for an other spatulate scraping or flensing tool. This artifact is manufactured from a large mammal rib and exhibits many parallel, light transverse striae at the mid-section of one face that are overlain by longitudinal striae and heavy polish (Figure 6-57). This wear pattern is attributed to hafting, with the polish and longitudinally oriented striae attributed to slippage in the haft. This object is interpreted as a hafted scraper that may have been used in hide preparation.

Of course, it is possible that none of these suggested functions explain the use-wear damage and striations exhibited by the Baker and Chiggerville other spatulates. It is

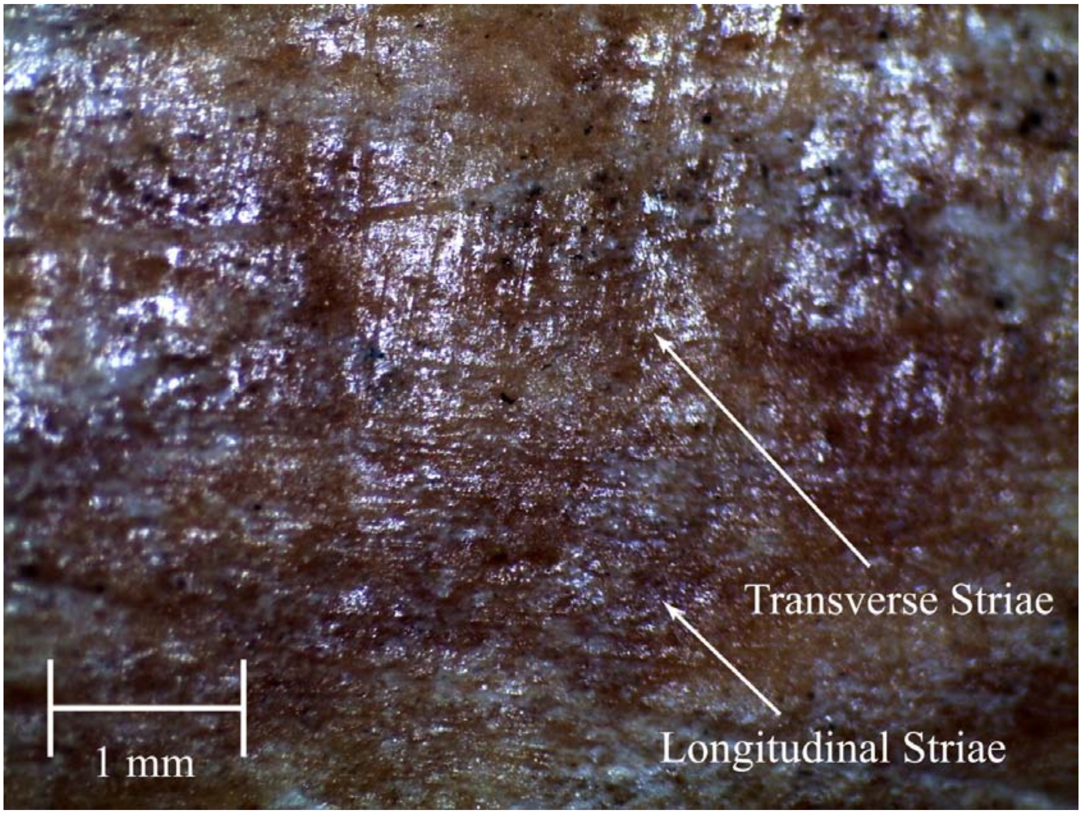


Figure 6-57. Longitudinal and Transverse Striae on Object B518 from Baker.

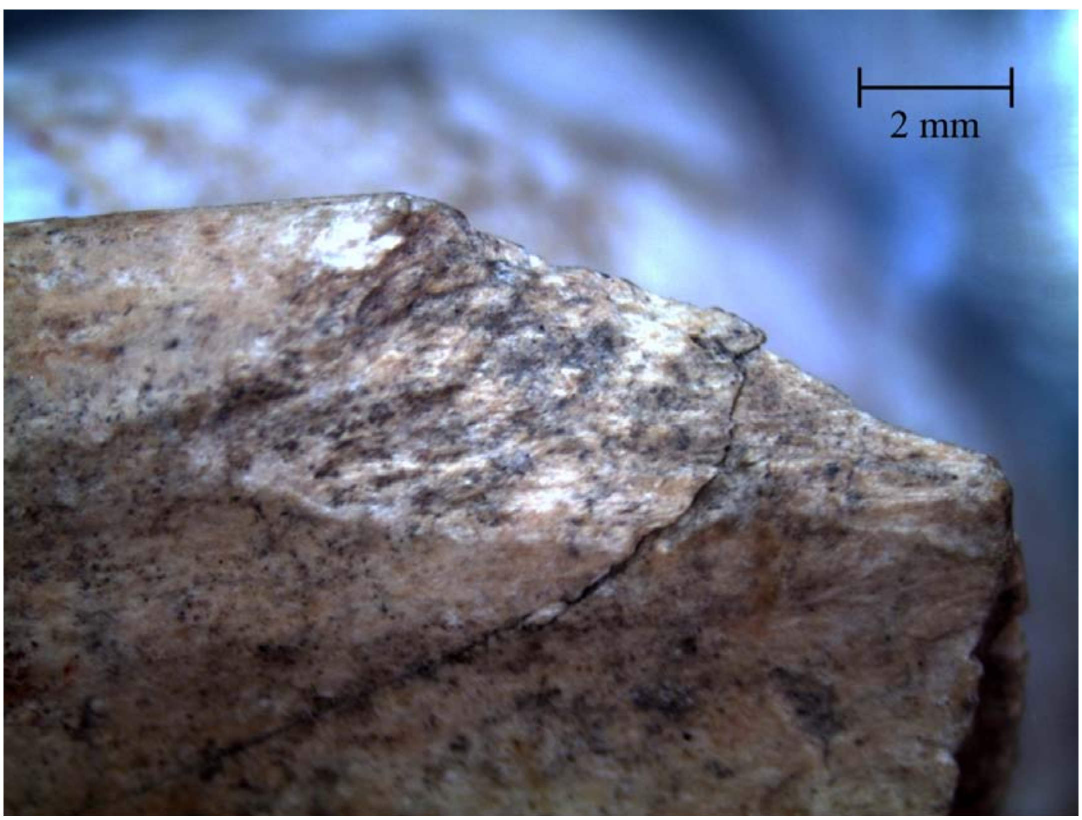


Figure 6-58. Twisting Snap Fracture at the Distal End of Object B962 from Chiggerville.

possible, for instance, that these tools functioned as freshwater mussel processing tools, possibly to pry open mussels and extract the animals residing inside. This hypothesis is based on the possible use of beveled spatulates in this way by Mesolithic groups (Griffitts and Bonsall 2001), but requires replication to test. It is known that use-wear striations similar to those described herein for gouges could also be created by using the tools as digging implements (D'Errico and Backwell 2009). It is possible that digging in the ground could also create the chipping and pitting damage evident on some tools.

Object B962 from Chiggerville (and one possible scraping tool mentioned above) may even have functioned as a prying tool. This object exhibits oblique-transverse use-wear striations at the spatula and a flake removed from the distal end that indicates movement in a twisting motion consistent with prying (Figure 6-58). Whether this is a primary or secondary function is unknown. Replication is required to confirm this functional hypothesis.

Watson (1983:354-355) identified spatulate tools from Jarmo as possible burnishing tools or hide smoothers. Object B61 from Chiggerville may have functioned in a similar manner. This object exhibits many longitudinally oriented use-wear striae and some faceting at its distal end (Figure 6-59 left). A break along one edge of the distal end is likely from collapse of the edge during use, indicating that significant pressure was exerted against this end. The possible use of this tool as a burnishing tool is based on dark brown discoloration at the distal end that is likely the result of a slight chemical change resulting from friction against this location during use (Figure 6-59 right). The use-wear damage and striations present on this tool are not inconsistent with a gouging function and it is possible that the friction of a gouge pressing against wood could create

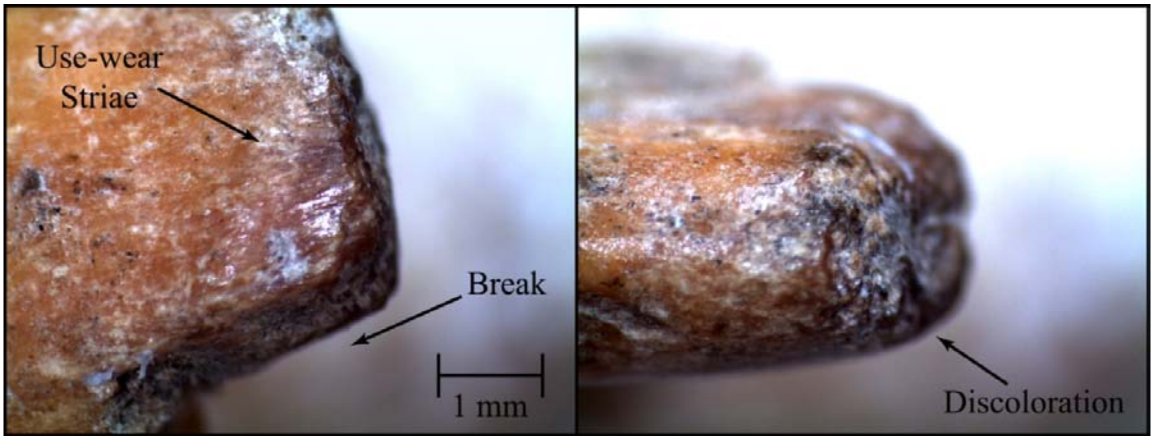


Figure 6-59. Use-wear Striae, Damage, and Discoloration on Object B61 from Chiggerville.

Figure 6-60. Use-wear Striae on Object B142 from Baker.

the discoloration identified in Figure 6-59. Replication is needed to test these functional hypotheses.

Soffer (2004) provides data on ethnographic collections from 30 cultural groups containing spatulates utilized as basketry, matting, and weaving tools (battens, loom or weaving sticks, mat needles, and net gauges). These ethnographic examples exhibit diagnostic edge wear consisting of transversely and/or obliquely oriented, parallel linear striations along the edges of these tools perpendicular the objects' long axes. Two objects from Baker exhibited transversely and oblique-transverse striations that may indicate such use (Figure 6-60).

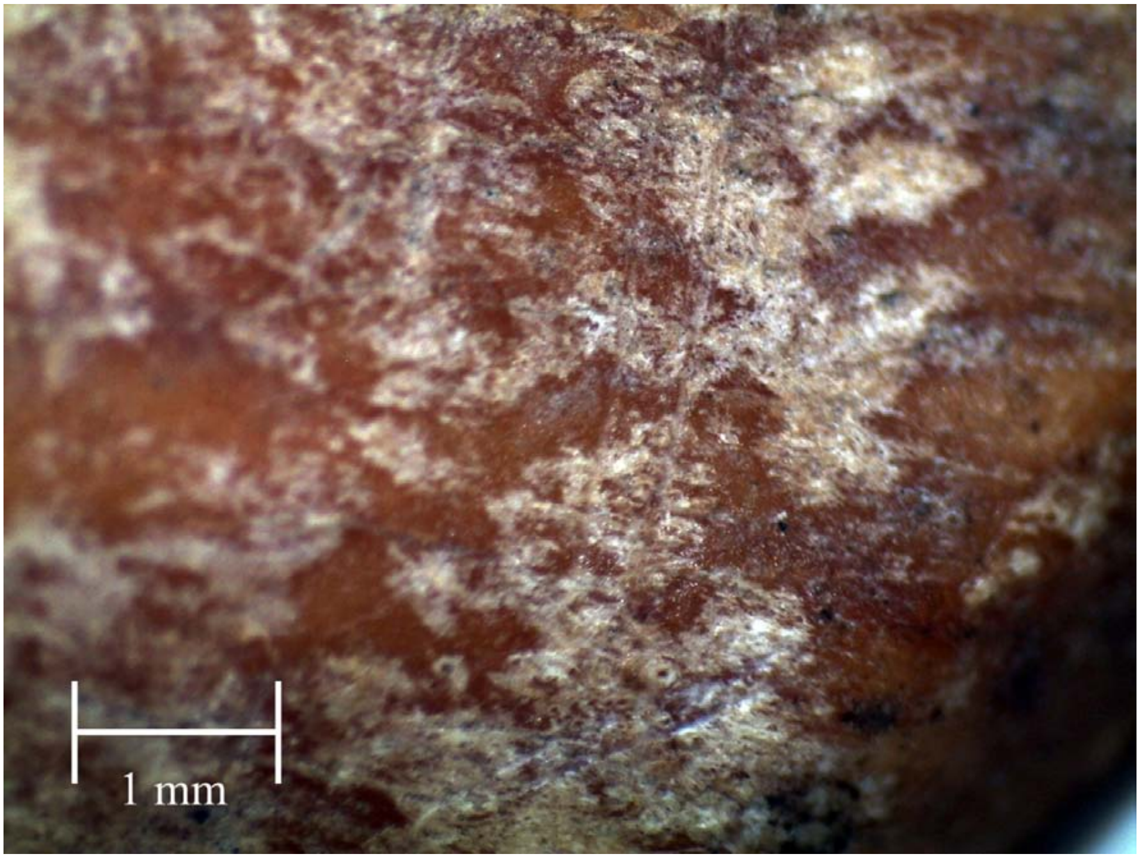


Figure 6-61. Striae from Misplaced Groove and Snap Cuts.

While the exact function(s) of other spatulates is currently unknown and possibly highly variable, these objects were apparently manufactured in a fairly standard manner. At Baker, spatulates were manufactured on complete or nearly complete deer ulnae and ribs or relatively flattened bone splinters. In one case (object B155) a large mammal longbone was apparently split by use of a pièce esquillée or other wedging tool, although it is possible that this splitting was accomplished to split the bone for marrow extraction prior to manufacture of the spatulate. Once the bone was obtained, a groove and snap technique was used to shape the spatulate in at least 9 cases (Figures 6-53 and 6-61).

As with the other bone tool types at these sites, Baker and Chiggerville differ in terms of the types of manufacture striae evident. At Baker, all spatulate blanks were further shaped by lithic shaving that runs either longitudinally (n = 4), obliquely (n = 3), longitudinally and obliquely (n = 14), or longitudinally and transversely (n = 1). At Chiggerville, two objects were used without additional modification once the spatulate blank was formed. One other spatulate was shaped via abrasion, and a second was initially shaped by longitudinally oriented lithic shaving, followed by abrasion. These abrasion striae were then overlain by a second longitudinally oriented lithic shaving episode. Object B299 from Baker is an other spatulate formed on a large mammal longbone fragment that exhibits blackening from intentional heat treatment.

At least seventeen other spatulate implements from Baker and two from Chiggerville exhibit cuts on their proximal ends, particularly under the lateral articular process located adjacent to the semi-lunar notch (see Figure 6-69). This cutting was also identified by Breitburg (1982) on three awls and 29 spatulates at Black Earth. According to Breitburg (1982:921), “Since this groove does not represent a procedure used in the butchering process, it probably relates to some functional aspect of the tool.” This cut was only recorded on one deer ulna pointed implement from Baker. If this modification is functional, its purpose remains unknown.

Metric data pertaining to other spatulates from the two sites are provided in Tables 6-48 and 6-49. As can be seen, these objects vary in overall size. This is likely due to the above-mentioned functional variation suggested by this class. The spatula outline form is also highly variable (see Figure 6-39). Spatula outlines at Baker are asymmetrical (n = 27), hexagonal (n = 2), pointed-triangular (n = 8), rounded (n = 9), rounded-square (n = 3), rounded-pointed (n = 7), square-rounded (n = 6), truncate triangular (n = 2), and rounded truncate triangular (n = 2). Due to the small number of other spatulates present at Chiggerville, the relevance of spatula outlines as an attribute

Table 6-48. Basic Metric Data for Other Spatulates from Baker.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Width of Spatula	Thickness of Spatula
Valid	36	47	56	35	34	69	69
Missing	36	25	16	37	38	3	3
Mean	96	36	19	25	12	13	4
Median	93.5	38	21	24	12	13	4
Mode	84, 91, 93, 102	41	21	25	12	11, 12	4
Std. Deviation	18.655	8.740	5.001	7.279	3.716	3.692	1.133
Minimum	42	10	4	10	3	5	2
Maximum	140	44	26	43	23	21	7

Table 6-49. Basic Metric Data for Other Spatulates from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½	Width at Spatula	Thickness at Spatula
B61	74	10	8	9	4	Broken	3
B93	89	17	8	16	6	Broken	Broken
B915	90	41	20	26	18	15	4
B961	Broken	Broken	Broken	Broken	Broken	Broken	Broken
B962	Broken	34	20	Broken	Broken	Broken	Broken
B1063	Broken	Broken	19	Broken	Broken	Broken	Broken
B1131	93	37	19	22	19	13	4

was not realized until after the bone tools from Chiggerville were analyzed. As a result, these spatula outlines were not recorded. Spatula widths were recorded where the constricting end meets the widened portions of each object, approximately 5 to 10 mm interior of the distal end.

Unpointed, Modified Diaphyses

Unpointed, modified diaphyses consist of large mammal longbones with expediently utilized or intentionally shaped and utilized diaphyses. Direction of movement on these artifacts is perpendicular to the long axis of the bone. The most common form of unpointed, modified diaphysis is the bone scraping tool (or beamer), but other functional types may exist. Some unpointed, modified diaphyses may not be artifacts at all as ethnoarchaeological research has demonstrated that chipping and impact scarring can occur along diaphyses of longbones broken during marrow extraction (Binford 1981:154, 157).

According to McAlpine (2005:8), metacarpals and metatarsals are commonly used in the production of beamers as:

> … removing one side of the shaft, either posterior or anterior, leaves the user with two edges that can be scraped against the animal hide instead of just one. As the beamer is used, it wears away in a distinctive pattern. Viewing the beamer from a mesial or lateral view, a newly formed beamer starts out with a flat surface (on the side which was removed). As it wears away, the flat surface turns into an ever deepening concave arch. Eventually the concave arch will wear thin enough that the beamer will snap in two.

At Site 20Sa1251 in Michigan, one beamer was "made by gouging out the posterior border and grinding the lateral edges into blade-like forms" (Sommer 2006:9). Functional interpretations are limited to use as bone scrapers in the preparation of hides, although published use-wear analyses have yet to be conducted.

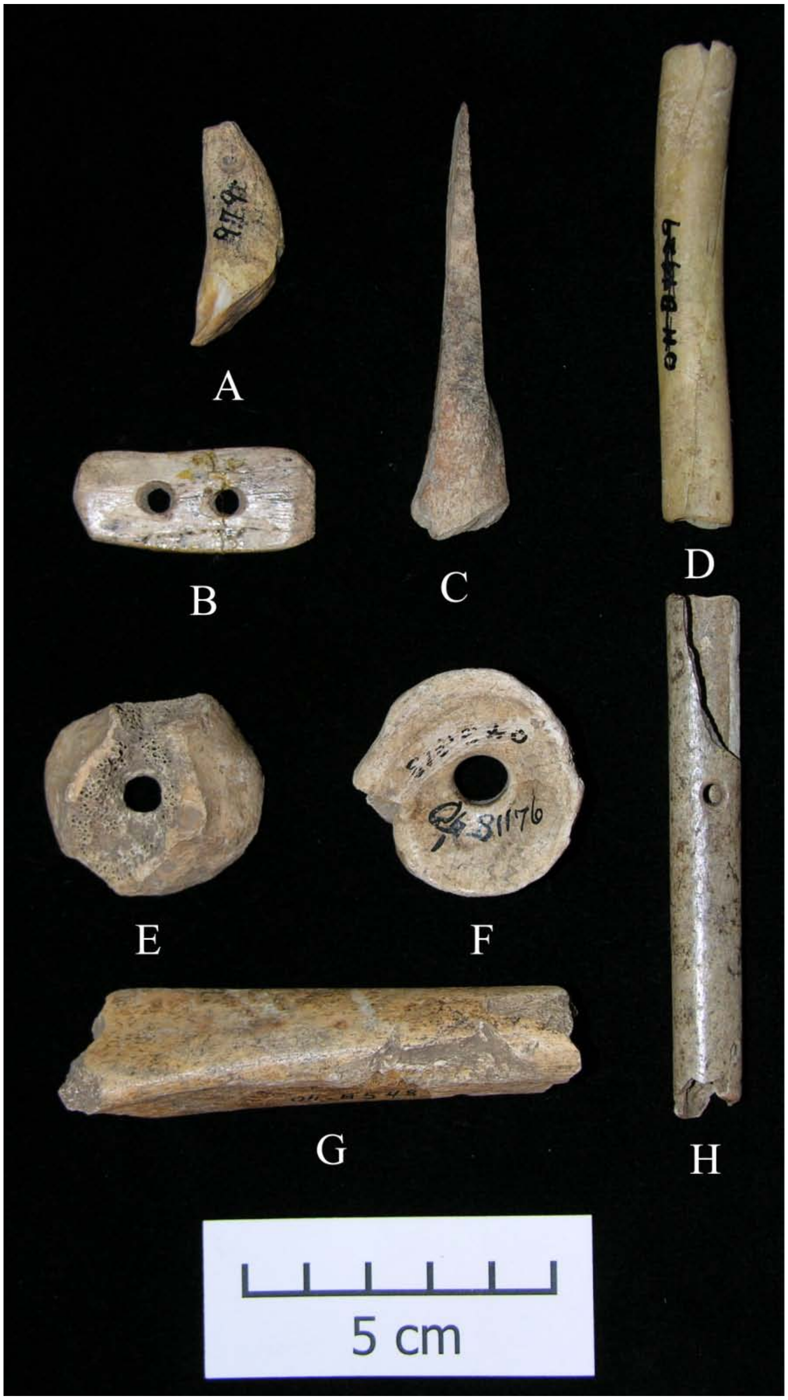


Figure 6-62. Bone Tubes, Perforated Glenoids, and Other Artifacts from Chiggerville.

One unpointed, modified diaphysis (object B669) was recovered from Chiggerville (Figure 6-62c). Object B669 is 74 mm long, 15 mm wide, 6 mm thick, 6 mm wide at the mid-section, and 3 mm thick at the mid-section. The size of the worked area on this object is 6 mm long and 3 mm wide. Abrasion striae are present on two faces at the worked area. The function of this object is unknown.

Bone Tubes

Bone tubes consist of highly polished longbone fragments that have been hollowed by the removal of the interior cancellous tissue through reaming or some other technique. Bird bone tubes are most common, and tubes are typically restricted to the diaphyseal portions of longbones. Epiphyses are typically removed through the groove and snap technique, and polish is thought to be intentionally produced, not the result of handling or use-wear. It should be noted, however, that avian longbones tend to be naturally shiny so that identification of intentionally manufactured polish may be difficult.

Figure 6-63. Bone Tubes from Baker.

Although both large and small varieties of bone tubes are known from the archaeological record, only large bone tubes were recovered from the Baker and Chiggerville sites (Figures 6-62d and 6-63a-b, d). Small bone tubes are typically interpreted as tubular bone beads. Both rounded and rough cut ends were noted by Winters (1969) on specimens from Riverton Culture contexts in Illinois, suggesting that at least some represent fragments of specimens broken during manufacture. Some rough specimens may represent groove and snap debitage from the manufacture of baculum fishhooks (Moore 2008a). Small bone tube beads were recovered from the Firehouse site (Moore 2007).

Large, unperforated, polished bone tubes are known from various contexts from throughout the Midwest. The function of these tools is currently unknown and a number of possible functions have been suggested. Penders (1997, 2002) describes five bird bone tubes from burial contexts at Windover. These objects were manufactured from large bird humeri by scraping and grinding, and three exhibit "geometric rectilinear and zoned hachure and diamond" incised decorations (Penders 2002:105). Two of these objects exhibit pitch residues on their surfaces, and Penders (1997:81) has suggested they would have functioned well as containers. Bone tubes from Late Prehistoric contexts in the Chickamauga Basin in Tennessee exhibit discoloration from fire and may have functioned as pipe stems (Lewis and Lewis 1995:155). Penders (1997:81) confirms that replicated bone tubes used as smoking tubes became blackened on their interiors and exteriors. Use as pipe stems would likely result in smoke residue, teeth marks, and striations from mounting the pipe stem. None of these use-wear traces were evident on the Windover specimens (Penders 1997:82).

Two incised bone tubes manufactured from bird humeri were also recovered from Burial Nos. 78-1 and 78-2 at the Carlston Annis site. Both tubes are highly polished and one is broken at the mid-section. Each tube exhibits four zoned areas of incised decorative cross-hatching. The function of these tubes is unknown (White 1990, 2005). Two of the three large bone tubes from Baker are incised (see section on style below).

Webb (1974) suggested that bird bone tubes from Indian Knoll functioned as handles for rodent incisor graving tools. This hypothesis is based upon the recovery of a bone tube with a rodent incisor mounted in the tube in association with a burial from the site (Webb 1974:297, figure 49).

Morse (1977) describes a highly polished right human femur tube recovered from a Late Archaic burial at the Snideker site in Arkansas. This bone tube consists of a 243 mm long polished shaft of a right human femur. The lip at one end of the tool is straight and the other is beveled on its exterior surface. According to Morse (1977:44) the object provides no evidence "of use as a tool so the possibilities are that this is an unused scraping tool, a socket for hafting another tool or an artifact not meant to be used technologically." A similar such human bone tube was recovered from Indian Knoll (Webb 1974:304) and another manufactured from a section of a metapodial of a large ungulate, probably elk, was recovered from the Firehouse site (Moore 2007). Based on ethnohistoric documentation among groups such as the Creek, these tubes may be shaman's sucking tubes used in curing ceremonies (Morse 1977:44).

Three large bird bone tubes were recovered from the Baker site and one was recovered from Chiggerville. Object B120 (Figure 6-63b) from Baker is 88 mm long, 13 mm wide, 9 mm thick, 12 mm wide at the mid-section, 9 mm thick at the mid-section, and is oval in cross-section. One end of the bone tube measures 13 x 9 mm, but the other end is broken (it is 12 mm wide at this end). Discoloration from smoke or fire is present at both ends of the tube, suggesting it functioned as a smoking tube or pipe stem. The object exhibits heavy obliquely and longitudinally oriented lithic shaving striations on all four margins. Both articular ends were removed with a circumferential groove and snap technique. Polished over chipping at one end may be from use.

Object B215 (Figure 6-63d) from Baker is 148 mm long, 8 mm wide and thick, 8 mm wide and thick at the mid-section, and is trianguloid in cross-section. One end of the tube measures 8 x 7 mm and the other 8 x 6 mm. Epiphyses of this tube were removed via a circumferential groove and snap technique with the linear turn and cut method. Shallow transverse cuts of unidentified purpose are present at various locations along the shaft. This object may represent a blank for the manufacture of bone beads (by sectioning) or a flute or whistle (by perforation).

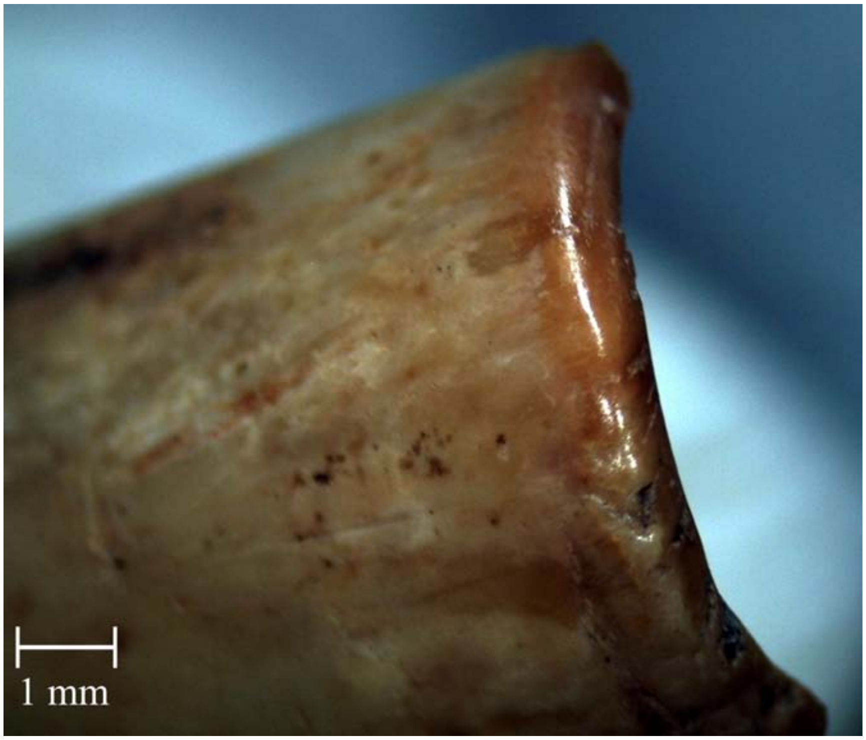


Figure 6-64. Polish on the End of Object B369, a Bone Tube from Baker.

Object B369 (Figure 6-63a) from Baker is a fragmentary bone tube that exhibits some longitudinally oriented lithic shaving manufacture striae. One end was shaped via a circum g/s1 technique using the linear turn and cut method. Since this object is broken it was possible to determine that the polish present at the end of the artifact extends a short distance into the interior of the bone (Figure 6-64), but why the distal end is so much more heavily polished than the rest of the object is unknown. If object B369 was a bone bead, it is possible this polish is from contact with a string or thong during suspension.

Object B977 (Figure 6-62d) from Chiggerville is 80 mm long, 12 mm wide and thick, and 11 mm wide and thick at the mid-section. One end of the bone tube measures 13 x 12 mm and the other 12 x 10 mm. Longitudinal lithic shaving striae are overlain on all four margins by abrasion striae, and both articular ends were removed via a circum g/s1 technique using the linear turn and cut method. The function of object B977 is unknown.

Medium to large-sized polished bone tubes exhibiting unidirectional perforations are not uncommon in eastern shell midden sites both on the coast and in the interior (e.g., Hadlock 1943:349, Webb 1974:304-306). Winters (1969:70-74) provides a detailed discussion of the ethnographic and ethnohistoric evidence that these objects functioned as flutes or whistles. In the Green River region, flutes are oftentimes found in association with burials, although a secular function is suggested by the recovery of fragments from midden contexts and by ethnohistoric accounts of the secular use of the flute among eastern North American tribes (Winters 1969:73). It should be noted, however, that wooden panpipes adorned with copper have been recovered in Middle Woodland Hopewellian contexts, suggesting a non-secular social or ritual function for some musical instruments (Carr 2005). Baby (1962) describes an elaborately carved bone whistle manufactured from a right human radius from the Bourneville Mound in Ross County, Ohio. It is possible, then, that bone flutes and whistles may have been used for similar purposes when adorned with socially charged perishables or interred with human burials.

Kidder (1932) describes perforated bone tubes manufactured from golden eagle ulnae at Pecos. Kidder (1932) felt that these objects were intended to be played from their ends and that they should, therefore, be interpreted as flageolets rather than flutes. According to Kidder (1932:250), "Dr. Charles Peabody was able to use one of the Pecos specimens as a flute after closing its large-stop end with wax, but had this been the usual method, and if the plugging had been necessary, it remains to be explained why both ends were always so carefully cut open." Olsen (1980:44) experimented with generating sound from perforated bone tubes from Kinishba ruin:

> If one of these whistles is held to the mouth so that air is blown across the perforation, a clearly audible tone is produced. The tone can be slightly varied by rotating the whistle to change the angle at which the air strikes the hole or by tightening the lips. Generally, a lower note is emitted by whistles with larger diameters or greater length.

According to Olsen (1979), whistles from Grasshopper Pueblo were manufactured from bird or small mammal longbones by removing the articular ends by a circumferential groove and snap technique. Typically these cut ends were then ground smooth and their surfaces polished. Most whistles were perforated by drilling, but one has a transverse slit formed by sawing, one has a perforation that has been gouged out, and a third has a square cut out near one end (Olsen 1979:359).

Only two perforated bone tubes were recovered – one each from Baker and Chiggerville. Object B59 (Figure 6-63c) from Baker is broken but measures 17 x 14 mm at the one complete end. The perforation on this object measures 18 x 11 mm. This object was manufactured from a large mammal longbone. Longitudinal striae indicate the use of a lithic shaving technique to shape object B59. The articular end was removed via a circum g/s1 technique with the linear turn and cut method. The perforation was cut via a gouging technique by removing narrow slivers of bone from one face until a perforation was created. Choppy cuts located around the interior of the perforation indicate that it was further shaped and expanded by slicing around the interior walls of the perforation. A gouging technique was also used to cut the decorative divets present on this object (described below in the section on style). Polish present along the broken lateral margin of object B59 may indicate that it was curated after breaking.

Object B1087 (Figure 6-62h) was manufactured from a large bird longbone. The object is broken at both ends, so measurements were not possible. A single small perforation at one end measures 6 x 5 mm. This perforation exhibits circumferential striae indicative of use of a stone drill. Both ends were cut via the circum g/s1 technique using the linear turn and cut method. Most manufacture striae have been removed by intentional manufacture polish, but enough remain to indicate use of an abrasion technique.

Unpointed, Perforated Implements

Unpointed, perforated implements include a variety of forms that cannot be confidently placed in any other category. Perforations are typically centrally located on these artifacts, although longitudinal and perpendicular perforations are both common. Unpointed, perforated implements were only recovered from Chiggerville.

Webb (1974:286-287) identified a number of centrally perforated deer scapula glenoids (Figure 6-62e-f) in collections from the Green River region. According to Webb (1974), these tools are unique in that they are otherwise unmodified and typically exhibit a rough, broken edge where the glenoid was detached from the element. As a result, these objects were interpreted as broken fragments of a scapula tool, perhaps used to steady chert drills in perforating activities (Webb 1974). No such complete scapula tools have been recovered from any known site in the Green River region and no perforated glenoids are known from outside this region. Microtrace analysis of the perforated glenoids from Chiggerville illustrate that Webb's (1974) description of these tools is incorrect, although his functional interpretation may remain valid.

A total of five perforated glenoids were recovered from the Chiggerville site, but one of these (object B1012) was not available at the time of this study. Object B1065 is 28 mm wide and has a perforation that measures 7 x 7 mm. The perforation exhibits circumferential striations from drilling with a stone drill. The edges of the perforation have been smoothed, but this smoothing does not extend along the edges of the inferior (broken) side of the object as would be likely if the object was suspended from a cord. Some polish from manufacture, handling, or use is present on the edges and on the inferior side. This polish suggests that the object was not attached to the scapula at the time of use, although the method of detachment cannot be determined. This polish is not consistent with Webb's (1974) functional hypothesis.

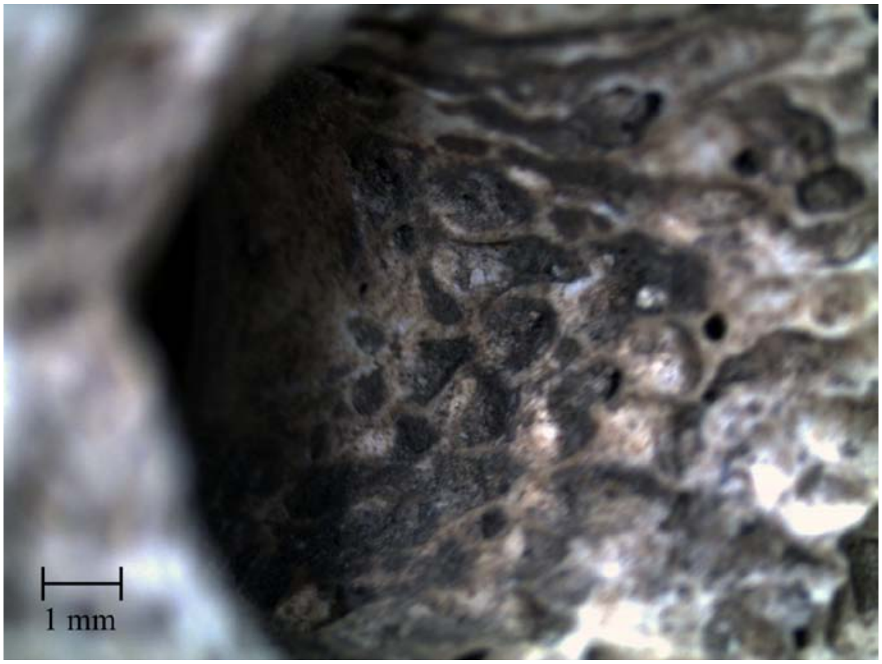


Figure 6-65. Smoothing of the Perforation on Object B1176, a Perforated Glenoid from Chiggerville.

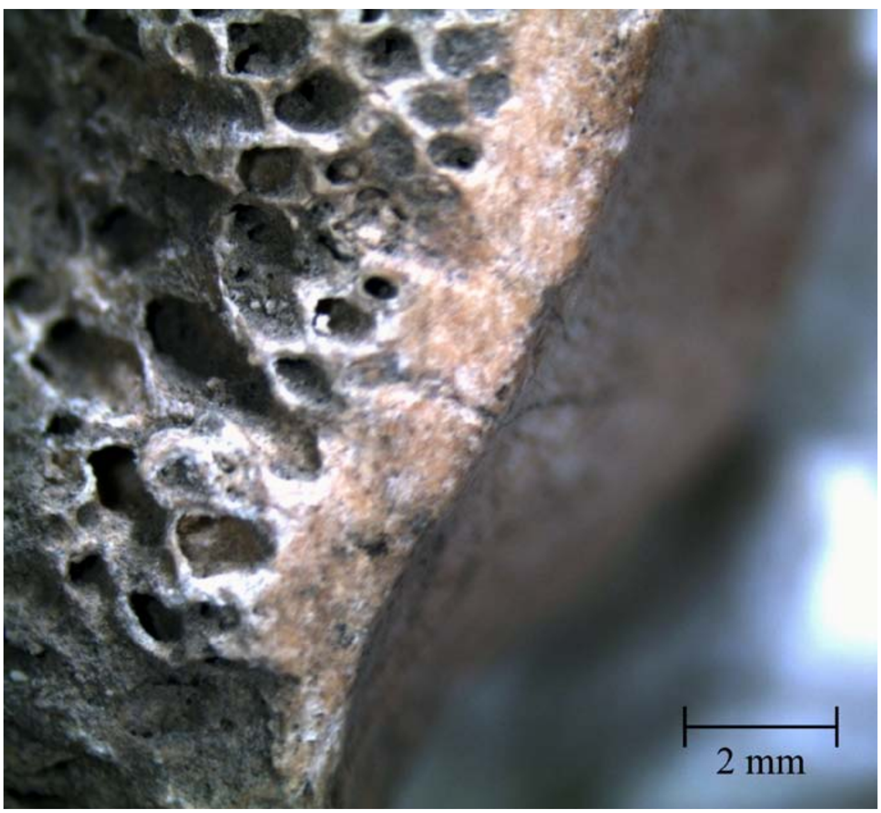


Figure 6-66. Removal Scar at the Base of Object B1206, a Perforated Glenoid from Chiggerville.

Object B1153 is 36 mm wide and has a perforation that measures 6 x 6 mm. The perforation on this object was created at an angle by an unknown method. The interior of the perforation is slightly smoothed. Light manufacture, handling, or use polish is present on all edges, including over one break.

Object B1176 is 37 mm wide and has a perforation that measures 8 x 8 mm. Striae from perforation have been obliterated by heavy smoothing or polishing on the interior edges (Figure 6-65), and heavy manufacture, handling, or use polish is present on all edges and the inferior (broken) face. One small, flattened area along one edge of the object suggests the glenoid was removed via a circum g/s1 technique, but this cannot be determined with complete certainty. The polish on this object and the presence of this cut is inconsistent with Webb's (1974) functional hypothesis, although it is possible that the flattened area is a groove formed by abrasion with a thong and that the scapula is part of a composite bow drill where the bow was drawn across the narrowest part of the scapula above the glenoid and the glenoid set against the drill.

Object B1206 is 35 mm wide and has a perforation that measures 6 x 6 mm. Circumferential striae on the interior edges of the perforation indicate use of a stone drill. The interior of the perforation is smoothed over from use or suspension. Obliquely oriented striations on a small flattened portion on the edges of the broken face indicate the glenoid was intentionally removed from a scapula via a circum g/s1 technique using the linear turn and cut method (Figure 6-66). This flattened area is likely the same as that evident on object B1176 and suggests that the bow drill hypothesis is incorrect. Manufacture, handling, or use polish is present on all edges of this object, including over some breaks. The polish and evidence of use of the groove and snap technique to remove the glenoid indicates that Webb's (1974) functional hypothesis is incorrect. It is possible these objects are ornaments that have been drilled for suspension, but their one poorly shaped, rough edge suggests this is not the case. The smoothing on the interior of their perforations suggests they may be spindle whorls or components of pump drills.

Small, square, perforated fragments of bone or turtle shell are rarely recovered from Archaic sites in the Midwest. One such artifact manufactured from a piece of softshell turtle plastron was recovered from the Carlston Annis site in Kentucky. This piece had been shaped by abrasion on its three complete sides, and the piece may have been intentionally polished and burned black (White 1990:48). The artifact was interpreted to be a net mesh gauge on the basis of parallels with similar artifacts identified ethnohistorically in Florida (White 2005:342).

One shaped, square, perforated implement (Figure 6-62b) was recovered in association with Burial No. 70 at Chiggerville (see chapter 8). This object is 40 mm long, 17 mm wide, 4 mm thick, 17 mm wide at its mid-section, and 4 mm thick at its mid-section. This object has two perforations that both exhibit rotational striae indicative of use of a stone drill and both were created by biconical drilling. The object was shaped by abrasion, but is not perfectly symmetrical in shape. This suggests that, although the object is similar in form to those identified as net mesh gauges, this is not this artifact's function. The location of the object relative to Burial No. 70 suggests that it was part of the individual's clothing (Figure 8-10).

A perforated turtle carapace was recovered from the feet of Burial No. 107 at Chiggerville (object B1258), of which 15 fragments are curated in the WPA collections. Modified turtle carapaces are common at prehistoric sites in eastern North America, but complete specimens are rare outside burial contexts. These objects are typically interpreted as bowls or containers if they are ground or scraped on their interior to remove the nuchal arches and along their margins to smooth and shape the objects (e.g., Breitburg 1982:930; Murray 1972:236; Penders 1997:83, 2002:108; Sommer 2006:13). At Schultz, the dorsal portion of the carapaces of turtle shell containers had been polished and some were engraved with geometric and curvilinear designs (Murray 1972:237). The five modified turtle shells from Windover may have been used as mortars, since one was recovered in association with a wooden pestle (Penders 1997:123).

Complete perforated turtle shells were recovered in burial contexts at Indian Knoll. According to Webb (1974:300), these objects are rattles manufactured:

> … by placing from 20 to 50 small pebbles in a terrapin carapace and placing the plastron in position… Sometimes the plastron has a central perforation about 14 mm in diameter, which, it is assumed, indicates the presence of a handle. Often the carapace is also perforated in the center with a small size hole. When both carapace and plastron are perforated, the holes are symmetrically placed, one above the other when the two portions are put in anatomical order. If a handle had been thrust completely through both portions of the terrapin shell, it would have been easy to have bound all together.

A similar turtle shell rattle was recovered from the Black Earth site (Breitburg 1982:930). Two perforated carapace fragments from the Schultz site were interpreted as bangles (Murray 1972:237). The modified turtle carapace from Chiggerville may have been a rattle, but the lack of pebbles in association renders this functional determination tentative.

A perforated deer astragulus of unknown function was recovered from Burial No. 32 at the Chiggerville site. This object is 42 mm long, 26 mm wide, 23 mm thick, 24 mm wide at the mid-section, and 22 mm thick at the mid-section. The object exhibits two separate perforations oriented at opposing angles so as to cut a perforation through one side of the astragulus. The function of this object and its perforation is unknown, but it is possible the object was ornamental in nature.

Bone Implement fragments

Bone implement fragments consist of any broken bone tool fragments that cannot be confidently assigned to any other morphological category. This category includes both formal tool fragments and expedient tool fragments exhibiting only use-wear.

Of the 36 bone implement fragments from Chiggerville, 11 are modified splinters, 4 are shaped, and 12 retain articular surfaces. Two of the shaped bone implement fragments have cylindrical or oval cross-sections and are likely bone pin fragments. Four bone implement fragments from the site are likely fragments of bi-pointed implements and may be projectile point fragments. Nine objects, including the two possible bone pins, are likely fragments of pointed implements, and three are likely fragments of spatulate tools.

The one unique bone implement fragment from the site is object B548 (Figure 6-62g). This is a distal fragment of a left human humerus that exhibits two deep hack marks on one edge that resulted in removal of a sizable chip of bone. A transverse cut is present on the superior margin of the bone, and the object is polished from handling or use on the inferior surface. The function of this artifact when complete is unknown. It is possible the hack marks are from dismemberment of the human corpse with an axe or adze.

Of the 40 bone implement fragments from Baker, 13 are modified splinters, 2 are shaped, 4 retain articular surfaces, and 5 are perforated. Of these, four are possibly fragments of pointed implements, and two of these may be bone pin fragments. One bone implement fragment is likely a broken bi-pointed implement that may be a fragment of a projectile point. Object B147 exhibits deep longitudinal cuts that may indicate this object is a portion of a piece of fishhook manufacturing debitage.

Cut Bone

Cut bone refers to any bone exhibiting cutmarks that cannot confidently be attributed to bone tool manufacture or use. These cutmarks are or may be related to butchering activities and are typically located near the epiphyseal ends of longbones where tendons were cut to separate bony elements.

A total of 13 cut bones were recovered from Chiggerville. Object B1121 is a broken deer ulna. The cuts on this object may be from use, but the distal end is broken so this cannot be determined with certainty. Object B1014 is likely a bear radius, but it may also be a pathological human femur. Object B1165 is the left humerus of a cow or bison found in the 1.5 to 2 foot level in unit 70L8. Object B801 is a large mammal rib. The remaining cut bones are deer ulnae. The one cut bone from the Baker site (object B78) is a deer phalanx.

Fishhook Production at Baker and Chiggerville

Bone tool production debitage is rare at Green River sites, with the exception of debitage from the production of fishhooks. Included in William Webb's (1950a:326-335) study of the bone tool assemblage from Carlston Annis was an excellent discussion of three fishhook manufacturing trajectories represented at these sites. Having analyzed several Green and Tennessee River shell middens, Webb was able to identify a common class of object (called a 'forked implement' by his lab analysts) as debitage remaining from fishhook production. Although Webb never truly appreciated the range of variability in fishhook manufacturing strategies at these sites, he was able to develop a typology consisting of three distinct manufacturing trajectories—deer toe bone fishhooks, bodkin fishhooks, and drilled fishhooks. These three types have been renamed but provide the core of my revised discussion of fishhook manufacturing in the Midwest and Midsouth (Moore 2008a, 2010). Elsewhere, I have interpreted the distribution of various fishhooks types in the lower Midwest and Midsouth during the Archaic as evidence for the presence of regionally distinct but interacting groups of hunter-gatherers, each characterized by a different technological style.

The Green River type fishhook manufacturing technique is by far the most common technique represented at all Green River sites, including Baker and Chiggerville. One example each of the Lauderdale and Madisonville types is represented at Baker and Chiggerville, respectively. All three of these single piece fishhook manufacturing strategies are linked by a common six-stage manufacturing sequence that involves: 1) creation of a blank, 2) initial cutting and/or drilling to make a preform, 3) continued cutting to form a sectioned preform, 4) removal from the blank forming a 'forked implement' or other piece of fishhook debitage, 5) final shaping to form a completed fishhook, and 6) discard due to breakage or loss (Table 6-50). Each of these single piece fishhook manufacturing techniques are described in detail below.

The Green River type manufacturing trajectory (Figure 6-67) begins by rounding or squaring a bone splinter or distal deer ulna to form a ground, shaped spatulate implement (or fishhook blank) (Figure 6-67k). These blanks are worked flat, oftentimes on both sides, and a longitudinal groove is cut into the bone nearly to the distal end and from both sides, likely with a flake or burin-like tool (Figure 6-67l). This cutting creates a perforation in the center of the spatulate, thus forming a perforated, unpolished spatulate implement (or fishhook sectioned preform) (Figure 6-67m). After this sectioned preform is made, the fishhook (Figure 6-67o-q) is removed from the blank by shaping the point of the prong and making incisions around the shank. This process of removing the hook from the sectioned preform results in the production of a unidirectionally forked/pronged bi-pointed implement (or Stage IV fishhook debitage) (Figure 6-67a-j, n). Final shaping of these hooks often involves rounding the proximal shank into a knob or incising a circumferential groove for hafting (Webb 1950a:329-330). In addition, perpendicular-oblique abrasion is used to create one rough, flattened side to facilitate tying of a line. According to Webb (1950a:329-330) these hooks are fairly thin and weak near the distal end, where breakage often occurs due to longitudinal splitting parallel to the bone's osteons.

Table 6-50. Stages in the Manufacture of Single-Piece Fishhooks.

Stage	**Artifact Type**	**Description**
I	Blank	A cut piece of bone, oftentimes a deer ulna, which has been initially squared or rounded on one end. Only spatulate objects exhibiting abrasion or lithic shaving striae indicative of formal shaping of a blank are included in this category. No incising or drilling is present.
II	Initial Preform	A spatulate object that shows evidence of initial but incomplete drilling, incising, or grinding.
III	Sectioned Preform	A spatulate object that has been completely drilled, incised, or ground so that a hole has been formed between what will become the fishhook and what will become the debitage.
IV	Debitage	The discarded refuse from removing the fishhook from the preform. These artifacts are often mistaken for weaving tools or awls.
V	Fishhook	A complete, undamaged hook.
VI	Fishhook	A hook that has been broken as a result of use.
VIa	Fishhook	A hook that was broken during excavation so that its initial discard as a stage V or VI hook cannot be determined.

Figure 6-67. The Green River Manufacturing Trajectory. Artifacts are from the Baker, Chiggerville, and Read Shell Midden Sites.

A total of 17 ground, shaped spatulate implements from Baker and 7 from Chiggerville are likely Stage I fishhook blanks. These objects are formed in the same manner for both the Green River manufacturing technique and the Madisonville technique, but the dominance of Green River type debitage at these sites suggests they were intended to be manufactured into hooks of this type. It is also possible that these objects represent functional tools (possibly other spatulates) that were later recycled into fishhooks. Tables 6-51 and 6-52 provide basic metric data for Stage I fishhook blanks from the two sites.

Table 6-51. Basic Metric Data for Ground, Shaped Spatulates from Baker.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	13	13	15	13	13
Missing	4	4	2	4	4
Mean	91	33	18	21	11
Median	95	37	21	22	11
Mode	95	37	21	26	6, 11, 13
Std. Deviation	15.383	10.381	6.567	4.699	4.752
Minimum	61	14	4	14	4
Maximum	110	43	23	27	22

Table 6-52. Basic Metric Data for Ground, Shaped Spatulates from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
B103	40	7	3	7	2
B141	Broken	8	4	Broken	Broken
B324	Broken	Broken	Broken	Broken	Broken
B672	53	10	8	9	7
B1062	Broken	37	19	Broken	Broken
B1085	52	20	6	19	5
B1151	26	9	4	9	4

Spatula outlines of ground, shaped spatulates are highly variable, but might be correlated with certain types of finished fishhooks with further study. Spatula outlines at Baker are pointed-triangular (n = 4), rounded (n = 3), rounded-truncate triangular (n = 4), rounded-pointed (n = 2), rounded-square (n = 1), and truncate-triangular (n = 2). Spatula outlines at Chiggerville are square (n = 1), rounded-square (n = 2), rounded-truncate triangular (n = 2), and truncate-triangular (n = 1).

Only five of the seventeen ground, shaped spatulates from Baker were sampled for microscopic use-wear analysis. Of these, three were shaped via obliquely and longitudinally oriented lithic shaving and one was shaped via longitudinally oriented lithic shaving alone. One of the five was covered in calcium carbonate and could not be adequately analyzed. Three are deer ulnae with cuts under their lateral articular processes.

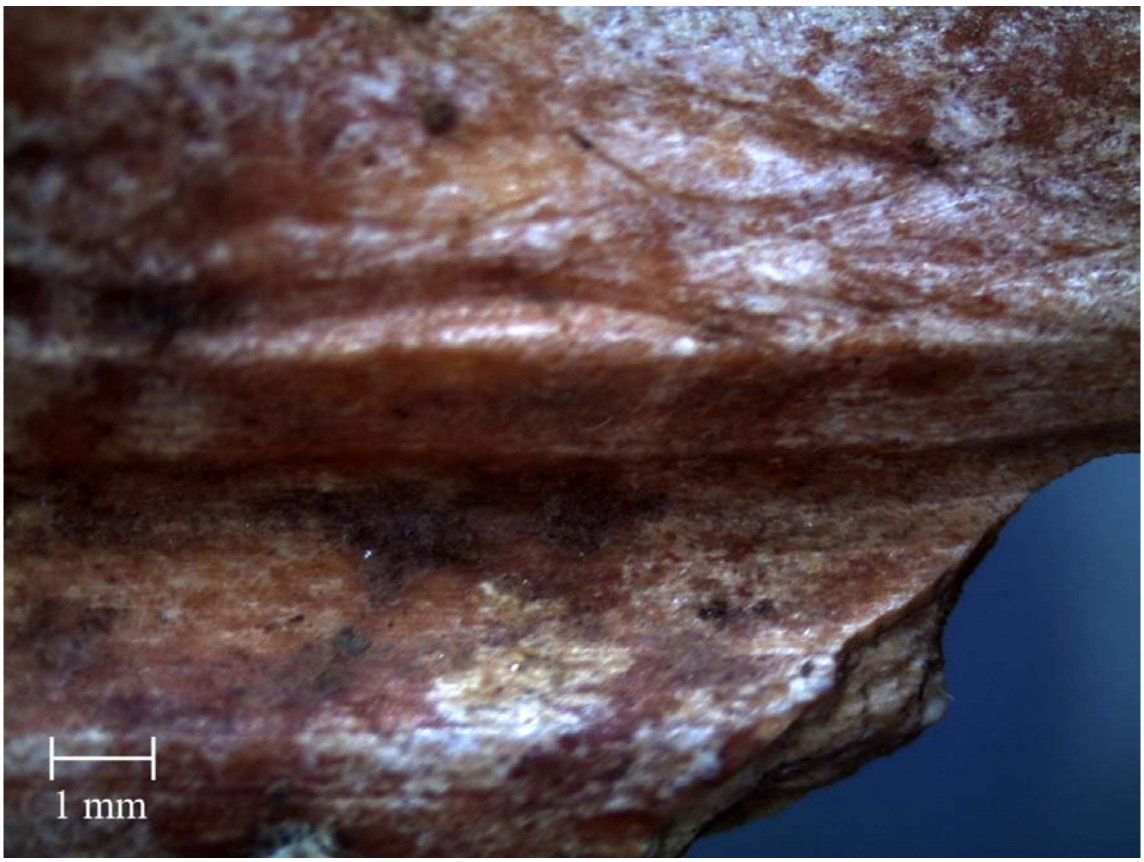


Figure 6-68. Abandoned Groove Cut into Stage II Green River Fishhook from Baker.

All seven of the ground, shaped spatulates from Chiggerville were analyzed microscopically. Of these, four were shaped via abrasion, two by longitudinally and obliquely oriented lithic shaving followed by abrasion, and one by longitudinally oriented lithic shaving followed by abrasion. One object exhibits cuts at the spatula that indicates initial shaping via a groove and snap technique. Object B141 is fairly small in size and broken at the end opposite the spatula. The spatula end exhibits some possible handling polish, so this object may be a broken pointed implement with a shaped base rather than a fishhook blank. Object B1085 exhibits curvilinear striae at the distal end that may be use related. It is possible this object was used for some unknown function then recycled into a fishhook blank. Object B1151 is a broken and abandoned Stage I fishhook blank on one end and a Stage IV unidirectionally forked/pronged bi-pointed piece of fishhook debitage on the other. This object has been counted as two implements in this study and is also included in the Stage IV discussion below.

Two perforated, unpolished spatulates from Baker are Green River Stage II fishhook initial preforms, and one perforated, unpolished spatulate from Chiggerville is a Green River Stage III fishhook sectioned preform. Stage II fishhooks are spatulates that have been initially but not completely perforated, while Stage III fishhooks have been completely perforated but the hook has yet to be removed from the spatulate. Oftentimes Stage II and Stage III fishhooks have been broken, resulting in their abandonment during production.

The two Green River Stage II fishhooks from Baker are both deer ulnae with cuts under their lateral articular processes. Object B1 is 44 mm in maximum width and 25 mm in maximum thickness. The object exhibits both obliquely and longitudinally oriented lithic shaving striations. The initial perforation on this implement is a short divet on one face. A pre-excavation break at the spatula may be from use and/or the reason this artifact was abandoned. Object B385 is 35 mm wide and 19 mm thick. This object exhibits obliquely and longitudinally oriented lithic shaving striae over much of the object, with longitudinally oriented lithic shaving concentrated toward the spatula. It is possible that striations at the proximal end are from cleaning the fresh ulna of flesh. Grooves have been cut into both faces of the spatula, but apparently did not completely penetrate before it was abandoned (Figure 6-68). A post-excavation break at the distal end precludes determining the reason this implement was discarded.

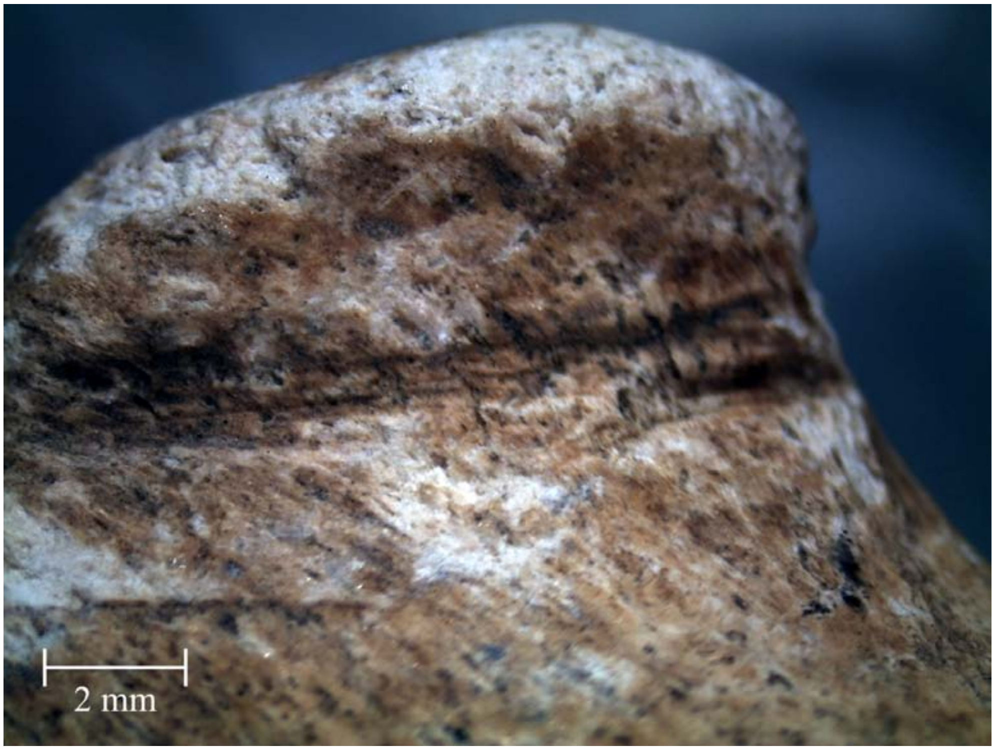


Figure 6-69. Cut under the Process of Object B1094, a Deer Ulna Stage IV Fishhook from Chiggerville

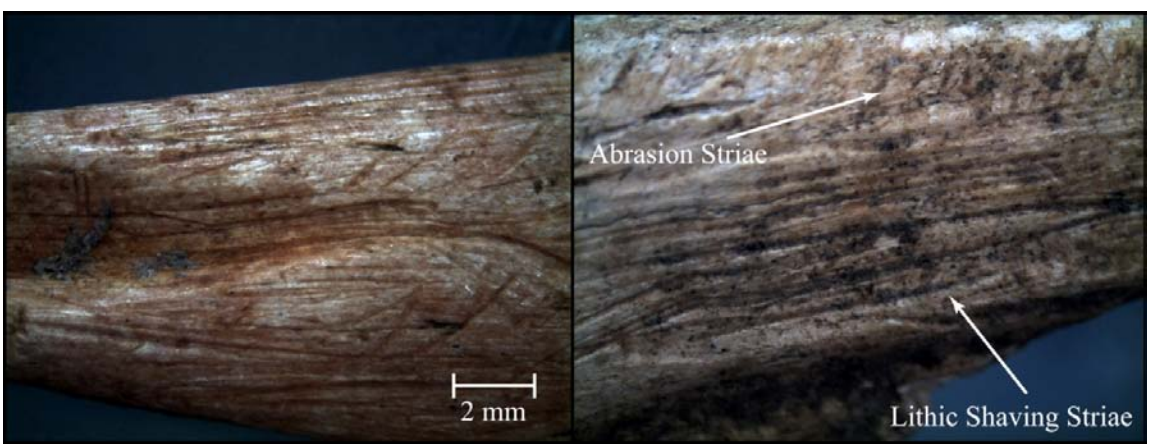


Figure 6-70. Lithic Shaving on Object B12 from Baker (left) and Lithic Shaving overlying Abrasion on Object B1094 from Chiggerville (right).

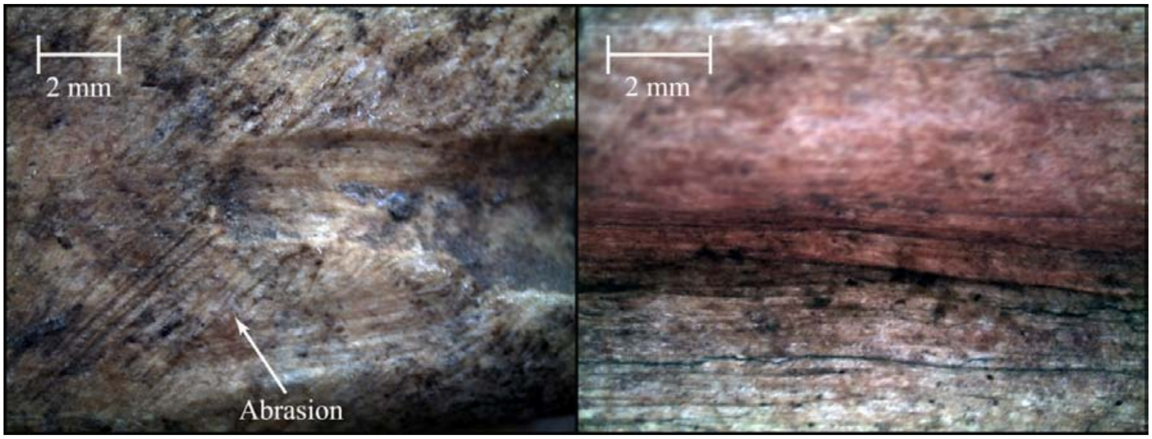


Figure 6-71. Grooving that Cuts through Abrasion Striae on Object B1198 from Chiggerville (left) and Grooving Striae on Object B80 from Baker (right).

The one Green River Stage III fishhook from Chiggerville (object B1192) is 48 mm long, 12 mm wide, 9 mm thick, 9 mm wide at the mid-section, and 3 mm thick at the mid-section. It exhibits a square-rounded spatula outline and was shaped via abrasion. Wide shallow striations are present on the interior and exterior edges of the perforation, indicating use of a stone burin-like tool to shape the perforation.

Categorized as 'forked implements' by Webb (1974), unidirectionally forked/pronged bi-pointed implements are Stage IV Green River fishhook production debitage. These objects exhibit two roughly parallel points placed toward the distal end of a deer ulna or other bone fragment. Evidence of heavy grinding and cutting between the prongs is common (Moore 2008a, 2010).

A total of 17 unidirectionally forked/pronged bi-pointed pieces of Green River Stage IV fishhook production debitage were recovered from Baker and another 47 were recovered from Chiggerville. Basic metric data for these objects are provided in Tables 6-53 and 6-54. Five of these artifacts from Baker and 23 from Chiggerville were sampled for microscopic examination. One object from Baker and three from Chiggerville are

Table 6-53. Basic Metric Data for Stage IV Fishhook Debitage from Baker.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	9	16	16	9	9
Missing	8	1	1	8	8
Mean	76	21	11	19	12
Median	76	16	5.5	22	12
Mode	58, 76	12	4	25	5
Std. Deviation	20.011	13.160	8.579	7.213	6.164
Minimum	49	6	3	5	5
Maximum	107	41	25	25	23

Table 6-54. Basic Metric Data for Stage IV Fishhook Debitage from Chiggerville.

	Max Length	Max Width	Max Thickness	Width ½	Thickness ½
Valid	22	43	46	22	22
Missing	25	4	1	25	25
Mean	66	22	11	17	9
Median	64	17	8.5	16.5	6
Mode	71	12, 15	4	13, 15, 17, 19, 23	4, 5, 6
Std. Deviation	22.950	11.013	7.289	5.588	5.836
Minimum	26	9	4	8	4
Maximum	121	43	24	27	23

manufactured from deer ulnae that exhibit cuts under their lateral articular processes (Figure 6-69).

At Baker, initial shaping of the fishhook blank was accomplished via longitudinally oriented lithic shaving (n = 3) (Figure 6-70 left), a combination of obliquely and longitudinally oriented lithic shaving (n = 1), and longitudinally oriented lithic shaving followed by abrasion (n = 1). At Chiggerville, abrasion (n = 14) was the most common technique used to shape fishhook blanks (Figure 6-71 left). Abrasion followed by longitudinally oriented lithic shaving (n = 2) (Figure 6-70 right), longitudinally oriented lithic shaving alone (n = 1), and obliquely and longitudinally oriented lithic shaving followed by abrasion (n = 1) were also employed. Five fishhooks from Baker and one from Chiggerville were manufactured from recycled pointed implements of various kinds.

Object B924 from Chiggerville is double sided, with a fishhook removed from both ends. This object has been counted as two implements herein. The articular end of object B952 was removed via a circum g/s1 technique using the linear turn and cut method. The purpose of this additional shaping is unknown.

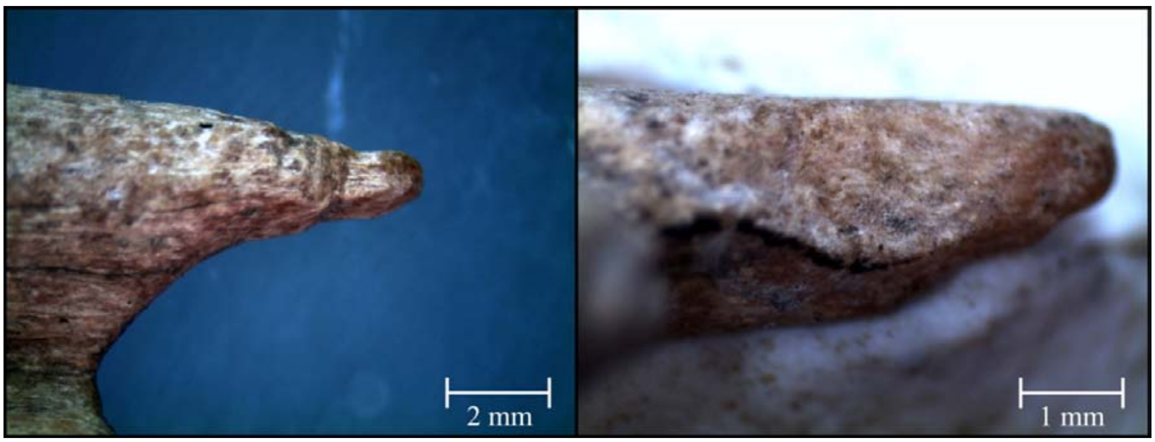


Figure 6-72. Whittling to Cut the Barb on Object B80 from Baker (left) and Object B1198 from Chiggerville (right).

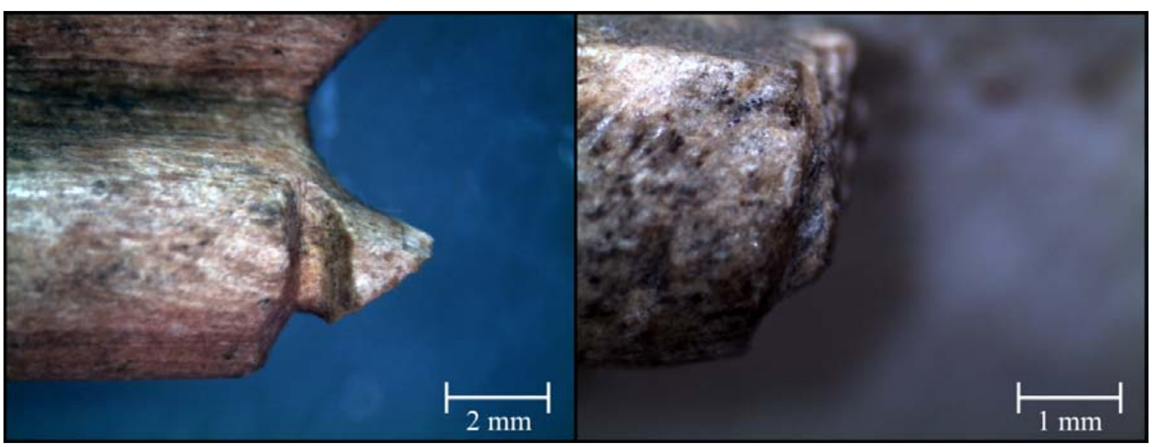


Figure 6-73. Groove and Snap Scars to Remove the Shank on Object B80 from Baker (left) and Object B1198 from Chiggerville (right).

Once the fishhook blank was initially shaped, a burin or flake was used at both sites to cut into the spatula from one or both faces (Figure 6-71). Once a perforation was created, this perforation was expanded by cutting along the interior of the spatula. The barb of the fishhook was then shaped by cutting or whittling one side of the perforated, unpolished spatula to a point (Figure 6-72). The opposite side of the perforation was grooved and snapped to remove the fishhook shank (Figure 6-73).

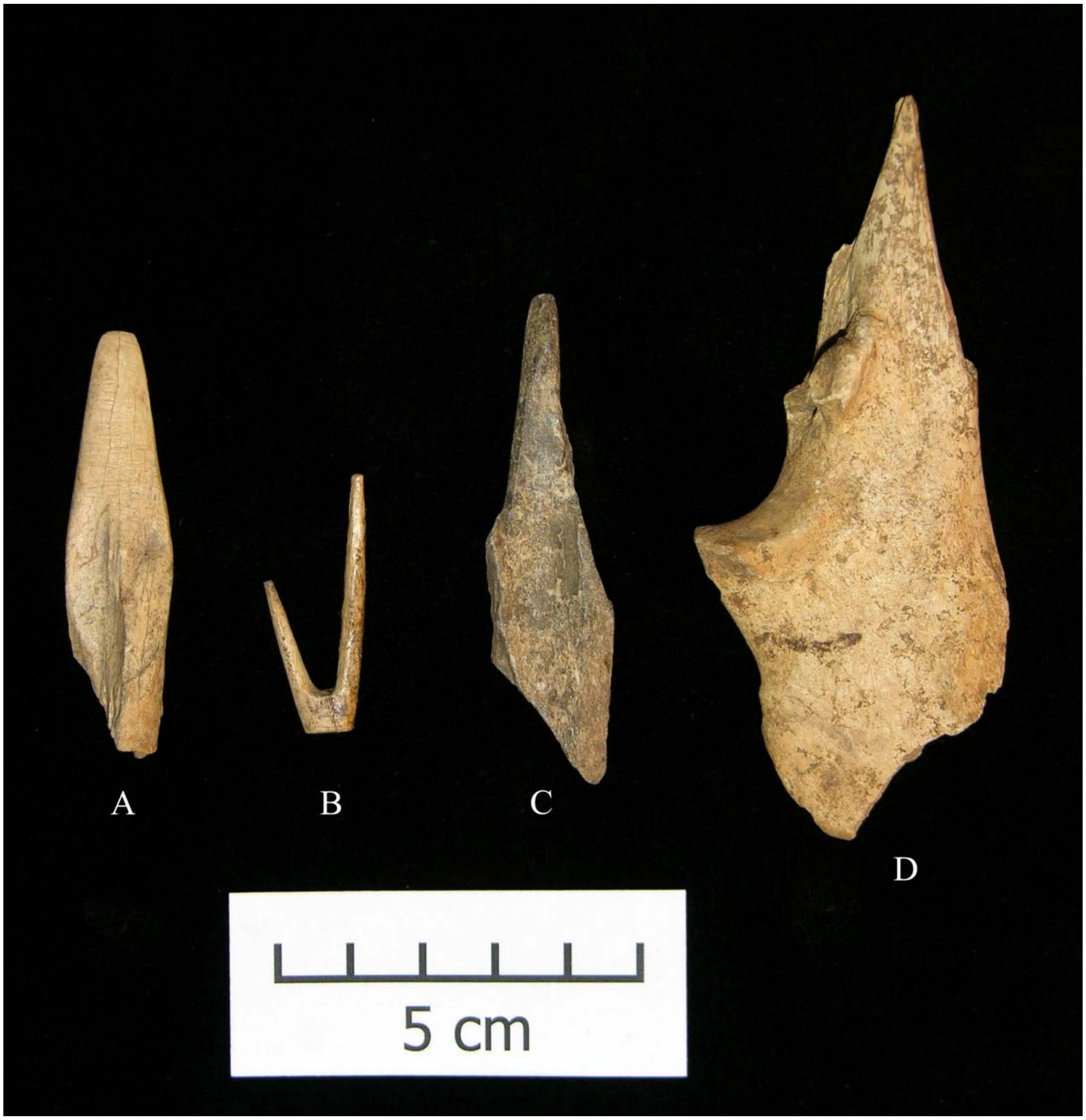


Figure 6-74. The Madisonville Fishhook Manufacturing Trajectory. Artifacts are from Chiggerville and the Read Shell Midden Sites.

Only three completed fishhooks were recovered from Chiggerville (Webb and Haag 1939:60) and none were recovered from Baker (McBride 2000). Unfortunately, the

Chiggerville fishhooks were not available at the time of this study and cannot be discussed herein.

Madisonville fishhooks (Figure 6-74) were first described by Putnam (1887) using specimens obtained by Dr. C. L. Metz from the Fort Ancient Madisonville site in southern Ohio. Like Green River hooks, these hooks are manufactured from a Stage I blank (Figure 6-74a), which typically thins toward the distal end where a hole is drilled from both sides. From this hole, grooves are cut obliquely toward both edges to form an acutely angled sectioned preform. These incisions were often made on both sides until a rough hook was removed from the blank, leaving behind a diagnostic cut piece of Stage IV production debitage (Figure 6-74c-d). This rough hook was then ground and shaped so that the tip was pointed and the shank rounded (Figure 6-74b). Oftentimes these fishhooks retain evidence of the original drill hole (Webb 1950a:330-331). Although Webb (1950a:332) recorded 62 Madisonville type fishhooks at Carlston Annis, only one piece of Stage IV debitage was recovered from the Chiggerville site and no Madisonville hooks were recovered from Baker. Based on Webb's (1950a) Carlston Annis study, it is likely that Madisonville hooks were manufactured during the Archaic, although they are prevalent on Fort Ancient sites in Ohio as well (Moore 2009a). Additional research is needed to better situate this type temporally and geographically (see also Moore 2010).

Object B139 (Figure 6-74c) from Chiggerville is a piece of Stage IV Madisonville fishhook production debitage (classified as longitudinally grooved and snapped bone tool production debitage in the morphological typology). This object is 67 mm long, 17 mm wide, 6 mm thick, 14 mm wide at the mid-section, and 6 mm thick at the mid-section. The fishhook blank represented by this object was shaped via abrasion. Linear cuts

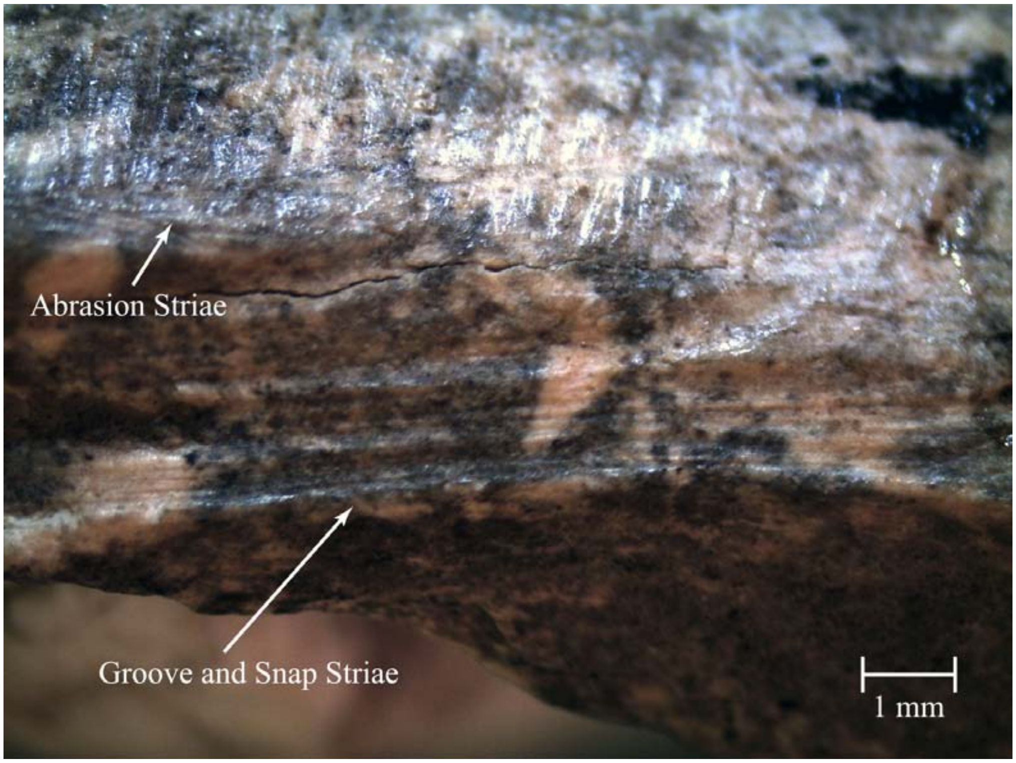


Figure 6-75. Manufacture Striae on Object B139 from Chiggerville.

Figure 6-76. The Lauderdale Fishhook Manufacturing Trajectory. Objects are from Baker and the Read Shell Midden Sites.

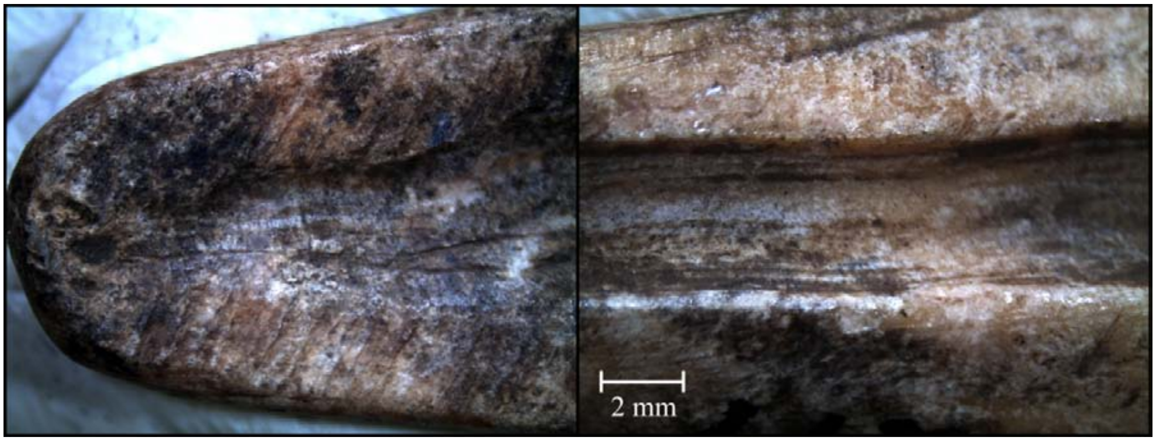


Figure 6-77. Abrasion Striae (left) and Grooving (right) on Object B297 from Baker.

running along the edges of object B139 indicate use of a thin stone tool to remove the fishhook (Figure 6-75). The cuts/grooves were created by cutting from both faces.

Lauderdale type fishhooks (Figure 6-76), named after Lauderdale County, Alabama where they were first described (Webb and DeJarnette 1942:199), are manufactured by longitudinally incising and splitting a deer phalanx to produce two fishhook blanks. These two blanks were then ground with an abrader or scraped with a lithic tool to remove the outer cortical bone of the phalanx, leaving a trianguloid loop from which the fishhook was removed. In rare cases, a flake or burin-like tool was used to cut a long rectanguloid trough on one side of the blank. Lauderdale hooks are differentiated from Green River hooks in two important ways—1) the incising and splitting of whole bones creates an extra step in the production of Lauderdale blanks and 2) abrasion or scraping is typically used to create preforms. Additional scraping and grinding made the Stage III loops cylindrical, with the thinner interior portions of the bones being shaped as the tip of the hook. Finally, the completed hooks were removed from the sectioned preform with only minor finishing required. These hooks are of a relatively standard size due to the confining nature of the raw material (deer phalanges) and are relatively strong, as the outer surface of the distal end of a deer's phalanx is fairly thick and resistant to breakage (Webb 1950a:327).

Object B297 (Figure 6-76a) is a Stage II Lauderdale fishhook initial preform manufactured by splitting a distal deer phalanx into two pieces through a longitudinal groove and snap technique. The created spatulate was then shaped by longitudinally oriented lithic shaving on the outer surface and abrasion on the inner surface (Figure 6-77 left). A stone flake or burin-like tool was then used to cut a 25 mm long and 4 mm wide rectanguloid groove through the outer cortex of the object (Figure 6-77 right). Longitudinal cuts on the interior of this groove indicate an initial attempt to finish the loop. As pointed out above, according to Webb (1950a), this method of creating a loop in the fishhook blank is rare. Object B297 is 42 mm long, 18 mm wide, 8 mm thick, 13 mm wide at the mid-section, 5 mm thick at the mid-section, and has a round spatula outline.

Manufacture of Bone Implements at Baker and Chiggerville

Examination of the bone tool assemblages from Baker and Chiggerville indicates that the majority of bone artifacts from these two sites are tools, like modified splinters and most spatulates, that were shaped from unprepared and expediently acquired bone blanks. Some objects, most notably shaped pointed implements and fishhooks, exhibit more extensive shaping from a prepared fishhook blank. Such preparation resulted in the formation of distinctive kinds of debitage. The relative lack of grooved and snapped bone tool production debitage at Baker and Chiggerville indicates that production of prepared bone tool blanks was rare at both sites. It is likely that fishhooks and most objects manufactured from bone splinters and unprepared elements were manufactured

Figure 6-78. Object B415 from Baker, a Bone Tool Production Debitage or Artifact Blank Manufactured from a Human Radius.

on site, while bone pins, bone tubes, and other shaped implements were mostly manufactured elsewhere and transported to these sites.

Aside from the fishhook production debitage discussed above, only seven pieces of circumferentially grooved and snapped and one piece of longitudinally grooved and snapped bone tool production debitage were recovered from Baker. One piece of circumferentially grooved and snapped bone tool production debitage was recovered from Chiggerville.

Of the seven pieces of circumferentially grooved and snapped bone tool production debitage at Baker, a circum g/s1 technique was employed in seven episodes on six tools. Six of these indicate use of the linear turn and cut technique. Three episodes of use of a circum g/s2 technique is evident on two objects. Represented are three large mammal longbones (Figure 6-21e), one deer tibia (Figure 6-21f), one large bird longbone, and one large bird pelvis (Figure 6-21g). Object B415 (Figure 6-78) is a human radius that has had both epiphyses removed via a circum g/s1 technique, at least one using a linear turn and cut method. What was being manufactured is uncertain, but the use of human remains to manufacture bone implements at Late Archaic sites is widespread (e.g., Herrmann 2006:96, Webb 1974:304, Webb and DeJarnette 1942:115). It is possible the human radius bone tool production debitage was being manufactured into a bone tube, bone beads, or a flute/whistle similar to that from the Bourneville Mound described by Baby (1962).

Object B150 from Baker is a deer metapodium that is cut in the center of one face, indicating an incomplete attempt to split the object via a longitudinal groove and snap technique. Longitudinally oriented striations on this object indicate shaping via a lithic shaving technique. Object B1167 (Figure 6-18a) is a fragment of a possible bear fibula that was initially shaped by obliquely oriented lithic shaving and then abraded on both faces, so heavily on one side so as to create a distinctive bevel. The end of this beveled object was then removed using a circum g/s1 technique via the linear turn and cut method. The form taken by the implement manufactured from this object is unknown since no complete object in either the Baker or Chiggerville assemblages is in any way similar to this piece of debitage. It is possible the object represents debitage from the production of a Provisional Type I fishhook like those found at Archaic sites like Frontenac Island in New York and the McKinley site in Indiana and from Fort Ancient sites in Ohio (Moore 2009a), but additional research into this possible fishhook manufacturing technique is needed to test this hypothesis.

Combining evidence of manufacturing striations found on both bone tool production debitage and finished artifacts sampled for microscopic analysis, it was found that Baker and Chiggerville differ markedly from one another in terms of the manufacturing techniques present at each. At Baker, the dominant method of bone tool manufacture was lithic shaving (n = 87), followed by abrasion (n = 12). Other manufacturing combinations include lithic shaving followed by abrasion (n = 4), abrasion followed by lithic shaving (n = 2), whittling (n = 1), and lithic shaving followed by abrasion and a second lithic shaving episode (n = 1). At Chiggerville, the dominant method of bone tool manufacture involved abrasion (n = 122), followed by lithic shaving overlain by abrasion (n = 44), lithic shaving alone (n = 35), and abrasion overlain by lithic shaving (n = 14). Minor manufacturing combinations include whittling (n = 4) and lithic shaving followed by abrasion overlain by a second lithic shaving episode (n = 3). This means that 87.9 percent of the bone artifacts from Baker were manufactured using some form of lithic shaving technique, while 82.4 percent from Chiggerville were manufactured using abrasion. Only 17.8 percent of the Baker tools exhibit abrasion striae, but 43.2 percent from Chiggerville exhibit lithic shaving striae. This suggests either that two very distinct bone tool manufacturing traditions are represented at these two sites or that use of abrasion to shape organic implements is predominantly a Late Archaic phenomenon. Whittling of bone is rare at both sites, having been employed in only 0.9 percent of cases at Baker and 1.8 percent of cases at Chiggerville. Intentional heat treatment of bone is rare at both sites, occurring just one time at Baker and three times at Chiggerville.

Table 6-55 lists bone tools by manufacturing striae at each site. Unfortunately, a Chi-square test of these data is not permissible since 33.3 percent of the cells have expected frequencies less than 5. However, when combination techniques are split to be counted as both abrasion and lithic shaving (e.g., one LS/Abrasion/LS is counted as one incidence of lithic shaving and one incidence of abrasion) and the small number of whittling episodes are removed from the sample, it is evident that significantly greater than expected frequencies of lithic shaving are present at Baker and fewer than expected at Chiggerville and significantly greater than expected frequencies of abrasion are present at Chiggerville and fewer than expected at Baker ($\chi^2 = 76.612$; $df = 1$; $p < .001$).

Table 6-55. Frequencies of Manufacture Striae Reflecting Various Bone Manufacture Techniques Employed at Baker and Chiggerville.

	Manufacture Striae						
	Lithic Shaving	Abrasion	LS/ Abrasion	Abrasion/ LS	Whittling	LS/ Abras/ LS	Total
Baker	87	12	4	2	1	1	107
Chiggerville	35	122	44	14	4	3	222

Comparison of Baker and Chiggerville Bone Tool Assemblages

Comparison of the Baker and Chiggerville bone tool assemblages indicates that the two assemblages are quite distinct from one another (Table 6-56). Several bone tool types, including many types interpreted as organic projectile points, are rare or absent at Baker but relatively common at Chiggerville. Implements that are much more common at Chiggerville include latitudinally asymmetrical, shaped bi-pointed implements; notched, shaped pointed implements; shaped pointed implements with cylindrical or oval cross-sections; beveled tipped pointed implements; incised shaped pointed implements; perforated glenoids; and worked turtle shell. Likewise, heavily modified beveled spatulates were only recovered from Baker, although a spirally fractured deer humerus was modified into a beveled spatulate at Chiggerville. This suggests that either different cultural groups are represented at these two sites or that different activities were being performed (or both). The presence of organic projectiles at Chiggerville and their absence at Baker cannot be explained by site function, however, as many stone projectiles were recovered from both sites (see chapter 7).

Table 6-56. Comparison of Bone Tool Assemblages from Baker and Chiggerville.

Trait	Site	Comparison
Notched and bi-pointed bone projectile points	Chiggerville	Relatively common
	Baker	Rare or absent
Bone pins	Chiggerville	Relatively common
	Baker	Rare
Beveled tipped pointed implements	Chiggerville	Uncommon
	Baker	Absent
Incised shaped pointed implements	Chiggerville	Uncommon
	Baker	Absent
Perforated glenoids	Chiggerville	Uncommon
	Baker	Absent
Worked turtle shell	Chiggerville	Rare
	Baker	Absent
Heavily modified beveled spatulates	Chiggerville	Absent
	Baker	Uncommon

Consistent with differences in antler tool production at the two sites (discussed above), bone tools at Baker and Chiggerville were manufactured using slightly different techniques. A lithic shaving technique was used in over 85 percent of cases at Baker, while an abrasion technique was used in over 80 percent of cases at Chiggerville. That abrasion striae were only present on 17.8 percent of artifacts at Baker and lithic shaving was present on 43.2 percent of cases at Chiggerville suggests that use of a lithic shaving technique predates use of abrasion in the Green River region. Similarly, Campana (1989) found that Natufian sites in the Levant used an earlier Upper Paleolithic method of shaping tools with chipped stone tools while later Protoneolithic groups used abrasives. However, in at least one documented case both abrasion and lithic shaving was practiced in the Early Archaic (Moore and Schmidt 2009), suggesting that time alone cannot explain the differences between these two sites. Based upon the evidence from both the bone and antler tool assemblages from the two sites, as well as upon differences in stone tool production (chapter 7) and mortuary practices (chapter 8), it is hypothesized that the populations that inhabited the Baker and Chiggerville sites were not historically linked but represent two distinct cultural groups that utilized the Green River region at different historical moments.

Modified Tooth Implements from Chiggerville

Only three modified tooth objects were recovered from the Chiggerville site and none were recovered from Baker. Of the three tooth artifacts from Chiggerville, two are necklaces made from perforated wolf or other canid teeth and associated with burials. Object B992 is a necklace consisting of four wolf carnassials, seven likely wolf canines, and two other teeth that were unavailable at the time of this study. This necklace was found under the thoracic vertebrae of Burial No. 44 (Figure 8-8). These teeth were found together in a group along with four freshwater mussel shell strips that also may be part of the same ornament.

Objects B1256 and B1257 are 27 perforated canid canine teeth found in association with Burial No. 114 (Figure 8-11). Most of these teeth were found lying immediately adjacent to one another near the individual’s neck, suggesting they were worn as a necklace at the time of burial. One was found near the feet in association with the individual's disarticulated skull.

The one non-mortuary modified tooth is object B979 from Chiggerville (Figure 6-62a). This artifact is a modified canine tooth from a bear. It measures 35 mm long, 14 mm wide, 8 mm thick, 13 mm wide at the mid-section, and 8 mm thick at the mid-section. The object has been partially drilled with a stone tool on both sides of the root as if biconical drilling was started but not completed. If the perforation is incomplete, the reason for abandoning this artifact is currently unknown. It is also possible that these two partial perforations are finished divets that were designed to hold ornamental insets. These partial perforations both measure 5 x 5 mm in diameter. Abrasion striae are present on one face and one edge, indicating some shaping was attempted. Longitudinal striae present on a worn facet at the tip of the tooth may be abrasion striae or use-wear striae from use as an unidentified tool (Figure 6-79).

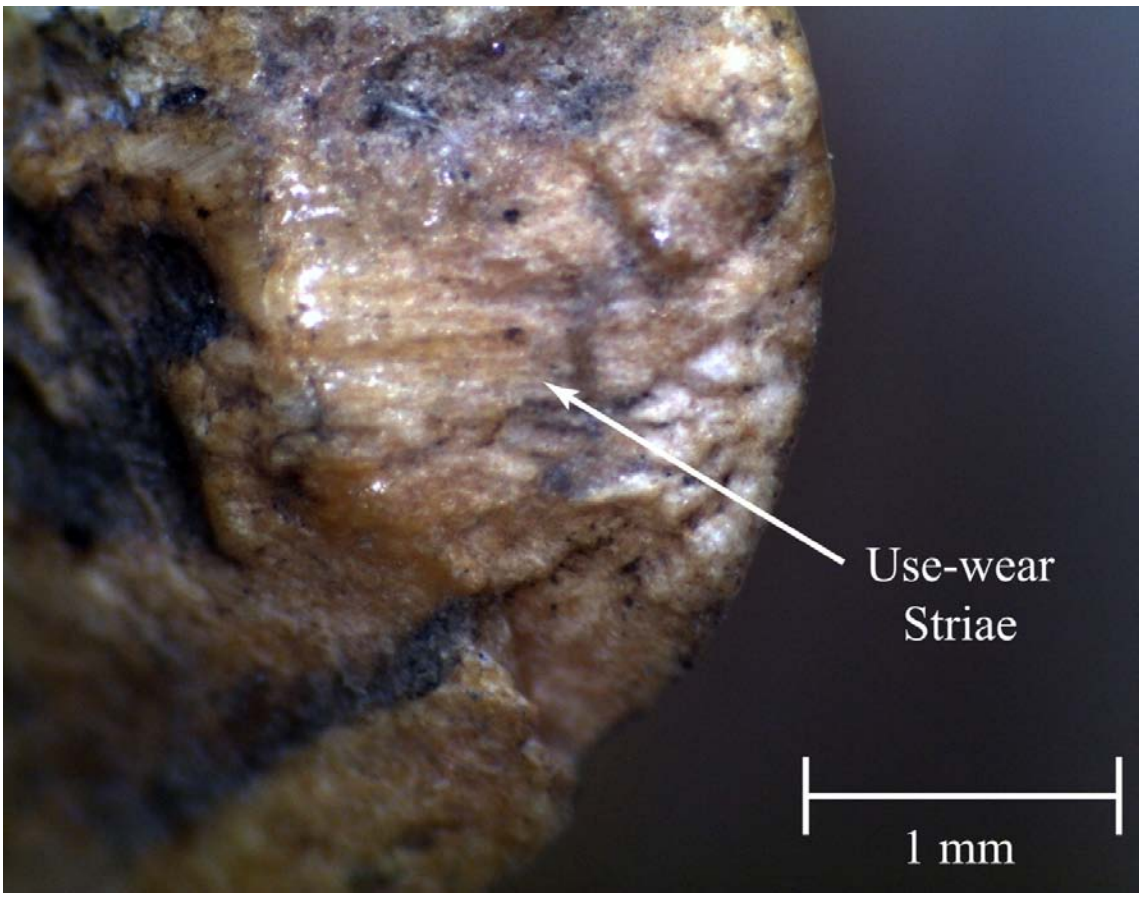


Figure 6-79. Use-wear or Abrasion Striae found on Object B979 from Chiggerville.

Curation as a Criterion for Complexity

As discussed in chapter 2, curation is considered a more complex technological strategy than an expedient one due to the increased informational needs required of groups that must anticipate raw material availability from place to place and time to time. Unfortunately, curation is a topic that has been poorly theorized with relation to bone tool technologies, and the literature on curation of stone tools (see chapter 7) is of little use given the different modes of acquisition of bone and stone. In fact, curation may not be an appropriate measure of the complexity of a bone tool assemblage at all given that stone tools are curated to facilitate the continued acquisition of game (i.e., are necessary for the food quest), whereas bone raw materials are immediately available upon successful completion of subsistence pursuits. The literature on curation of stone tools hinges on topics of mobility, subsistence strategies, and the geographic availability of stone raw materials. Since a successful subsistence strategy precedes bone raw material acquisition and geographic availability is not an issue, mobility may be the only traditional concern for hunter-gatherers deciding whether to curate their bone tools.

Some insight into curation and antler tools might be discerned from the relative proportions of finished antler tools and tool production debitage present at the two sites. Antler differs from bone in that bone is available year round, while antler is only available during certain times of the year due to the fact that deer shed their antlers seasonally. Thus, it can be hypothesized that, all else being equal, antler implements are more likely to be curated than bone due to the periodic scarcity of obtaining antler as a raw material.

The tendency to curate antler has already been demonstrated in the discussion of antler tool production debitage above. As can be seen from Table 6-16, antler Beam B sections and their attached tines were accumulated in high frequencies at both sites and, at some point, grooved and snapped to remove distal tine sections. Given the recovery of nearly equal frequencies of Tine A and Tine B sections at the two sites, the relative dearth of Tine C (distal tine artifacts) elements at Baker suggests that Middle Archaic people were manufacturing distal tine implements at both sites but curating and removing those tools from Baker. This suggests that the Baker antler assemblage is more complex than the Chiggerville assemblage, although this apparent complexity could be negated should Chiggerville be found to have been occupied by a more sedentary population that occupied the site for longer periods of time and, as a result, discarded more finished tools there.

While the Chiggerville antler assemblage can provide few insights into issues of sedentism, evidence of recycling and resharpening on antler reamed, pointed implements and other distal tine tools does suggest that these implements were curated at both sites. A total of eight reamed, pointed implements and one longitudinally asymmetrical, beveled pointed implement from Chiggerville exhibit either evidence of resharpening or repair in the form of whittled tips and repair grooves cut over longitudinal breaks. Only two reamed, pointed implements from Baker exhibit such evidence of re-use and curation. This suggests that antler projectile points at both sites were cared for and maintained. The presence of pitting on two reamed, pointed antler implements from Baker, including one tool with v-shaped cuts at its distal end, and pitting (n = 6) and chipping and blunting (n = 2) on tools from Chiggerville suggests that some antler projectiles were even recycled into awl/perforators and/or lithic flaking tools. It seems likely that the seasonal scarcity of antler and/or the need to maintain broken tools while on hunting forays are plausible explanations for this maintenance and recycling.

Janet Spector's (1993) *What this Awl Means* provides an alternate perspective on curation of organic tools by prehistoric peoples. In her hypothetical tale of Mazaokiyewin, an early 19th century Dakota woman living at the Little Rapids summer planting village, Spector (1993) illustrates how certain bone and antler tools (in Mazaokiyewin's case, an ornately carved antler and iron awl) can come to symbolize and be manipulated to communicate a person's accomplishments or aspirations. In this way, material culture becomes a meaningful component of social and political relations (Dobres 2000). It is the most heavily manipulated bone and antler tools that might be hypothesized to have the greatest potential to take on meaning and, as a result, be curated for longer periods of time.

As discussed above, the majority of bone and antler tools from both sites are minimally shaped expedient bone splinter awls, other spatulates, etc. The bone and antler assemblages at both sites might best be characterized as assemblages of expedience with little potential for curation. Table 6-57 lists those objects with the greatest degree of shaping and that are the most likely candidates for curation on the basis of their potential to communicate information.

As can be seen from Table 6-57, far more highly shaped and potentially meaningful bone and antler tools were recovered from Chiggerville (76.6 percent) than from Baker (23.4 percent). It is also these highly shaped objects that exhibit the most evidence of recycling at the two sites. At Chiggerville, two broken bone projectiles were recycled into awls, two broken bone pins were apparently recycled into basketry, weaving, or matting tools, a perforated pointed implement was recycled into a notched pointed implement, and a beveled implement exhibits evidence of recycling. At Baker, a shaped pointed implement was recycled into a fishhook and a bone pin was recycled into an unknown tool type. Four other pointed implements from Baker and one from Chiggerville were recycled into fishhooks. Additionally, one antler hooked implement (atlatl hook) from Chiggerville exhibits evidence of maintenance in the form of a resharpened beak. On the basis of recycling, re-use, and the potential for curation based on the degree of shaping involved in manufacture, the Chiggerville bone tool assemblage is more complex than the Baker assemblage.

Table 6-57. Shaped Bone and Antler Implements from Baker and Chiggerville.

Type	**Site**	**Count**
Reamed, Pointed Antler Implements	Baker Chiggerville	7 51
Hooked Antler Implements	Baker Chiggerville	0 4
Hollow/Reamed Antler Implements	Baker Chiggerville	0 6
Latitudinally Symmetrical Antler Implements	Baker Chiggerville	0 5
Shaped Pointed Bone Implements	Baker Chiggerville	36 97
Latitudinally Asymmetrical, Shaped Bi-pointed Bone Implements	Baker Chiggerville	1 14
Beveled Spatulate Bone Implements	Baker Chiggerville	7 1
Perforated, Polished Spatulate Bone Implements	Baker Chiggerville	0 1
Large Bone Tubes	Baker Chiggerville	3 1
Perforated Bone Tubes	Baker Chiggerville	1 1
Shaped, Square Unpointed, Perforated Bone Implements	Baker Chiggerville	0 1
Turtle Shell Cups/Rattles	Baker Chiggerville	0 1
Shaped Bone Implements fragments	Baker Chiggerville	2 4

As stated at the beginning of this section, curation of bone and antler tools is a poorly theorized means of assessing the relative complexity of two archaeological cultures. Nevertheless, some attempts were made to assess complexity on the basis of the degree of recycling, repair, and effort involved in the manufacture of bone and antler tools at the two sites. On these grounds, the antler assemblage at Baker was found to be more complex than the Chiggerville assemblage, but the Chiggerville bone assemblage was found to be more complex than the Baker assemblage.

Decorative Style and Complexity

As discussed in chapter 2, participation by hunter-gatherer groups in expanding networks of communication and exchange places increased importance on the role of non-verbal signaling in information exchange. Bone and antler tool assemblages containing higher frequencies of decorated tools are felt to be more likely to represent prehistoric groups involved in these communication networks. This section describes the decorated bone and antler tools from Baker and Chiggerville and assesses which assemblage is more complex on the basis of their relative frequencies.

Only one decorated object was recovered from the Chiggerville site. Object B386 (Figure 6-40n) is a perforated shaped pointed implement decorated by a series of v-shaped nocks along both margins. The object is broken, but 7 nocks remain along one edge and 5 along the other. These were created by a slicing motion with a stone tool. A similarly decorated perforated shaped pointed implement was recovered from the Carlston Annis site (Webb 1950a:297, figure 9b) and several were recovered from the Firehouse site (Moore 2007).

Six objects from Baker were found to exhibit decorations of one kind or another, although most of the designs are faint and would likely have been difficult to see when the objects were in use. Object B59 (Figure 6-63c) is the perforated bone tube (flute, whistle, or flageolet) described above. This object has two subconical divets gouged into the lateral edges on either side of the perforation. It is possible that these divets functioned to facilitate gripping the musical instrument while in use, but this potential functional explanation is entirely speculative. The divets are large enough that they would have been visible while the musical instrument was in use, and it is likely that they are decorative.

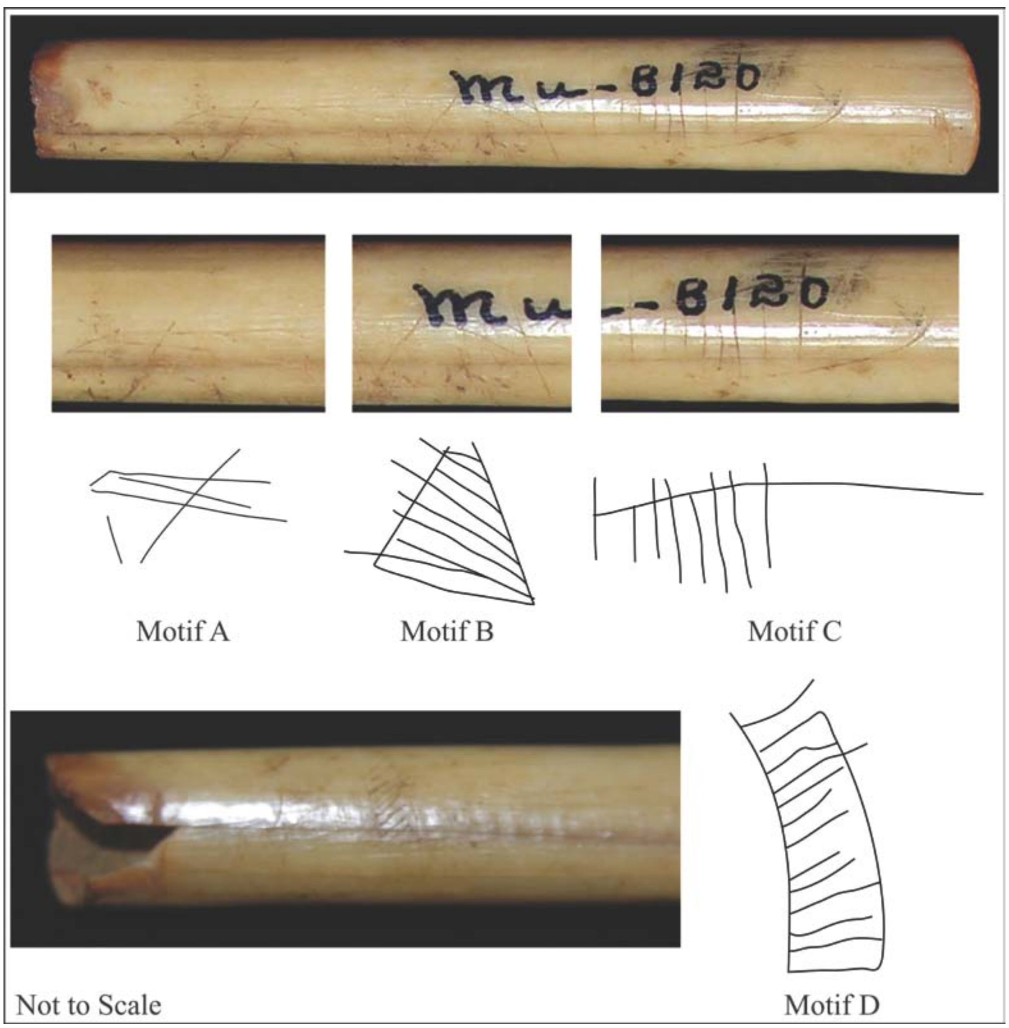


Figure 6-80. Details of Decorative Motifs on Object B120 from Baker.

Figure 6-81. Decoration on Object B148 from Baker.

Figure 6-82. Decoration on Object B202 from Baker.

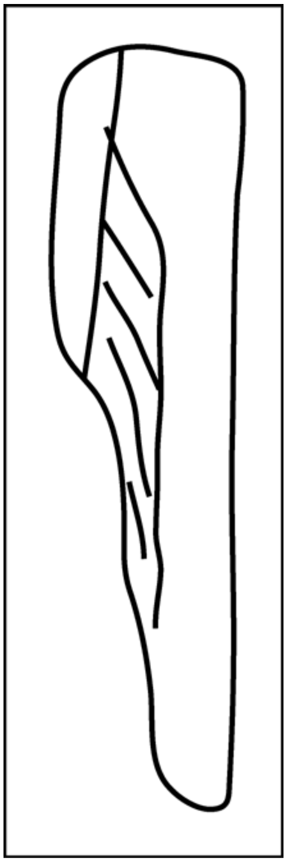


Figure 6-83. Detail of a Possible Decoration on Object B369 from Baker.

Object B120 (Figure 6-63b) is a large bone tube that exhibits several faintly incised designs on all edges (Figure 6-80). Motif A consists of two diagonal lines, one that overlies a three-sided geometric shape with one open side and an incised line inside the three sides. Motif B is an incomplete triangle filled with roughly parallel diagonal lines that extend beyond the sides of the triangle. Several transverse cuts or hacks overlying Motif B may be part of the motif, but this is not certain. Motif C is a long ‘T’ shape lying on its side and with several parallel lines extending from one side of the leg of the T. Motif D is a bent square with one open side filled, like the triangle, with a series of parallel incised lines.

Object B148 is a perforated shaped pointed implement with two zones of cross-hatching present on one face (Figure 6-81). Object B202 (Figure 6-82) is a perforated shaped pointed implement with a series of transverse-oblique cuts at its proximal end just above and overlapping the perforation. That these cuts overlap the perforation indicates that the design was incised prior to drilling. Object B369 (Figure 6-63a) is a fragment of a large bone tube. A series of incised lines located on the remaining portion of this object is possibly what remains of an incised motif (Figure 6-83). Object B518 (Figure 6-52 upper left) is the other spatulate from Baker that is a possible flensing tool. This object is manufactured from a large mammal rib and has a faintly incised cross-hatched pattern present on one face toward the working end (Figure 6-84).

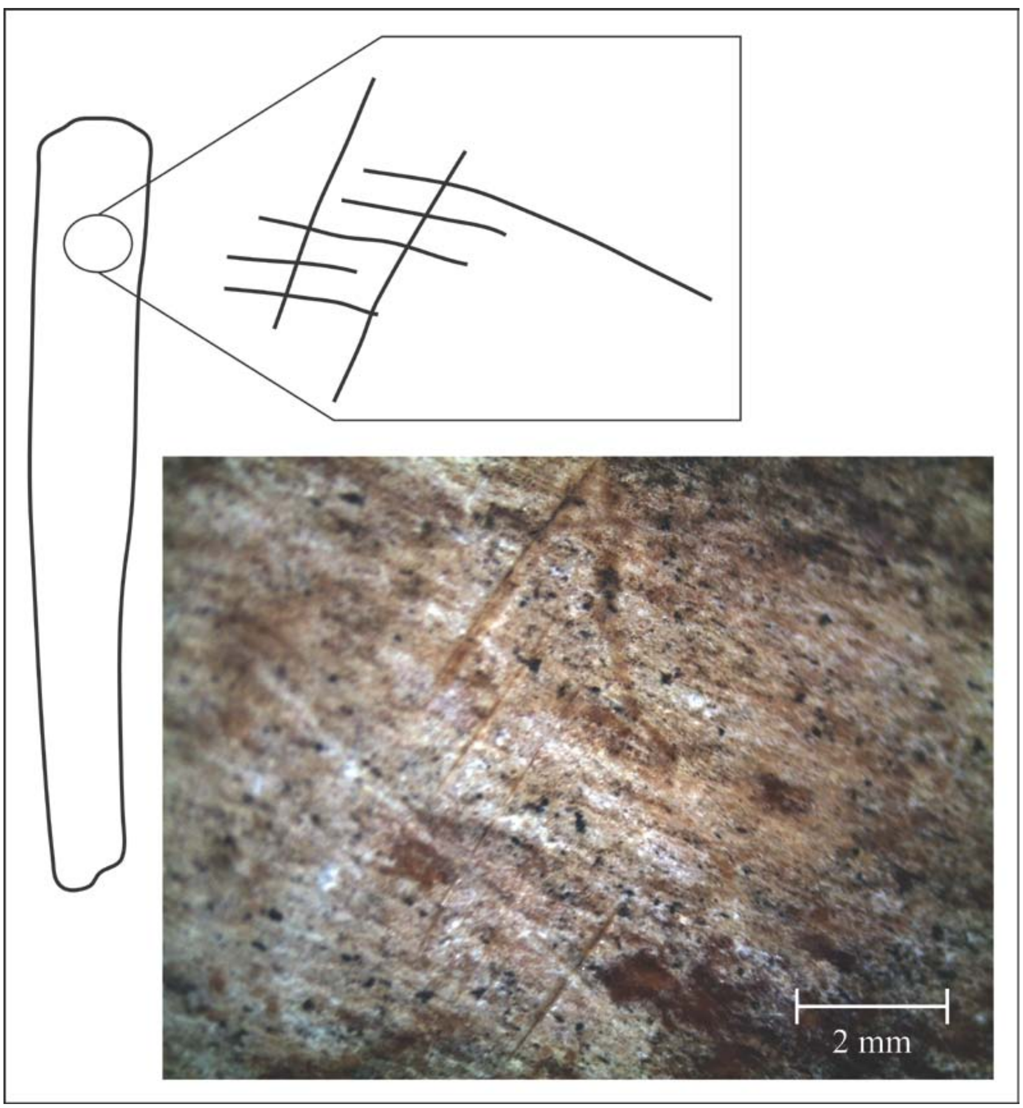


Figure 6-84. Detail of Decoration on Object B518 from Baker.

The cross-hatching patterns and geometric designs exhibited on these bone implements from Baker are almost certainly decorative, but they are so faint that they are difficult to see and, thus, do not satisfy a basic assumption of Wobst's (1977) information exchange model. That such faint designs would have been visible while the objects were in use is suspect. It is doubtful that such designs would have been effective at communicating messages to anyone but the object's user. On the basis of frequency of decorated bone implements, then, Baker exhibits the most evidence for complexity. However, the fact that Baker's decorations are faint and unlikely to communicate messages at a distance renders this measure of complexity ambiguous.

Historical Connections and Complexity at Baker and Chiggerville

This chapter has provided a detailed descriptive analysis of the bone, antler, and dental tools from the Baker and Chiggerville sites. The results of a sampled microtrace analysis have been presented and, in some cases, preliminary interpretations of potential tool functions have been provided. Manufacturing microtrace has demonstrated that distinct methods of manufacturing bone and antler implements were utilized at the two sites. At Chiggerville, antler tines were removed from beams via a slicing technique, while at Baker a more finely executed circum g/s2 technique was employed. Tine shaping also differed between the two sites, with whittling and obliquely oriented lithic shaving techniques being used at Chiggerville and a longitudinally oriented lithic shaving technique used at Baker. At Baker, bone tools were most often shaped via a lithic shaving technique, while abrasion was employed at Chiggerville. These differences in manufacturing strategies may be explainable by the temporal differences between the two sites, but it seems as likely that the two sites represent two distinct and historically unrelated cultural groups practicing two different technological traditions.

Complexity at Baker and Chiggerville was addressed through a study of decorative styles and by comparing the degree to which curation was practiced at the two sites. The relative lack of finished antler tools at Baker and several instances of recycling, re-use, and repair of antler tools at Chiggerville suggests that antler was curated by the Green River region's Middle Archaic populations. Bone tools that were highly shaped and most likely to have value to their users were also regularly recycled at both sites. Curation is apparently an ambiguous means of assessing complexity using bone and antler tool assemblages and an assessment of the complexity of the Baker and Chiggerville hunter-gatherers cannot be made from these data.

Although very few bone tools at either site exhibited any form of decoration, the Baker assemblage contained several more decorated bone implements than Chiggerville. However, the decorations found on the Baker tools are all very faint and would have been difficult or impossible to see at any distance. While the relative frequency of decorated tools at Baker seems to indicate a greater degree of complexity for this population, such a conclusion is unacceptable given that the faint decorations on the Baker tools could not be expected to communicate messages to anyone but the person using the tools. The results of this study of bone and antler tools from Baker and Chiggerville, as they pertain to the relative complexity of the sites' populations, are ambiguous and inconclusive.

Chapter Seven

Stone Tools Analysis

Unlike bone and antler implements, which are typically poorly represented at archaeological sites around the world, stone tools are notable for their ubiquity. Raw materials like chert, limestone, and granite used in the manufacture of chipped, ground, and pecked stone implements are resistant to decay. It comes as no surprise, then, that the literature pertaining to stone tools analysis and interpretation is considerably larger than the available literature on bone and antler tools. This literature, as summarized in chapter 2, is employed in this chapter to address the relative complexity of the Baker and Chiggerville sites.

The methodological and theoretical literature pertaining to stone tools is vast. Numerous researchers have different perspectives on what kinds of information can best be derived from stone tools and how this can be done. Although I present descriptive data pertaining to the entire chipped, ground, and pecked stone assemblages from the Baker and Chiggerville sites in this paper, the analytical focus is on the Large Side Notched Cluster hafted bifaces from Baker and the Saratoga Cluster hafted bifaces from Chiggerville (see Justice 1995). Specifically, I use the data from the WPA chipped stone tools to compare the technological organization evident at the two sites, address whether evidence for specialization is present in either assemblage, and briefly discuss prehistoric exchange. The ground and pecked stone tools are used to compare the relative complexity of subsistence behaviors and communication networks evident at the two sites.

To facilitate comparisons with other assemblages, the analysis of chipped, ground, and pecked stone tools presented herein is divided into several parts. After an introduction to the methods of data collection used in this study, a basic descriptive analysis of the two chipped stone assemblages recovered during the WPA excavations at Baker and Chiggerville is provided. This is followed by a presentation of descriptive data pertaining to those diagnostic hafted bifaces that are not representative of the primary component at each site and that are not included in the comparative analysis. The next section describes the Large Side Notched Cluster assemblage from Baker and the Saratoga assemblage from Chiggerville, the dominant components at each site.

After this initial presentation of data, the two WPA assemblages are compared along a number of analytical dimensions to test the relative degree to which these assemblages reflect differences in technological organization, specialization, and prehistoric exchange. These comparisons are followed by comparisons of the debitage recovered during the 2009 excavations at the sites. The debitage analysis addresses the same microscalar aspects of complexity. Finally, the WPA ground and pecked stone assemblages from the two sites are compared to address issues of complexity of subsistence practices and communication networks. A summary of each of the microscalar aspects of complexity addressed in this chapter is then provided to assess the relative complexity of Baker and Chiggerville as revealed by the stone tool assemblages.

Chipped Stone Tools

Methods

A number of metric and non-metric traits were recorded on various tool forms as part of this study. Some traits like maximum length, width, and thickness were recorded on all objects that were complete enough to allow measurement. In many cases, however, traits were recorded only for those objects that were directly relevant to answering the questions asked as part of this study. This means that many of the traits described for this section were recorded only for the Large Side Notched Cluster hafted bifaces at Baker and the Saratoga Cluster hafted bifaces at Chiggerville.

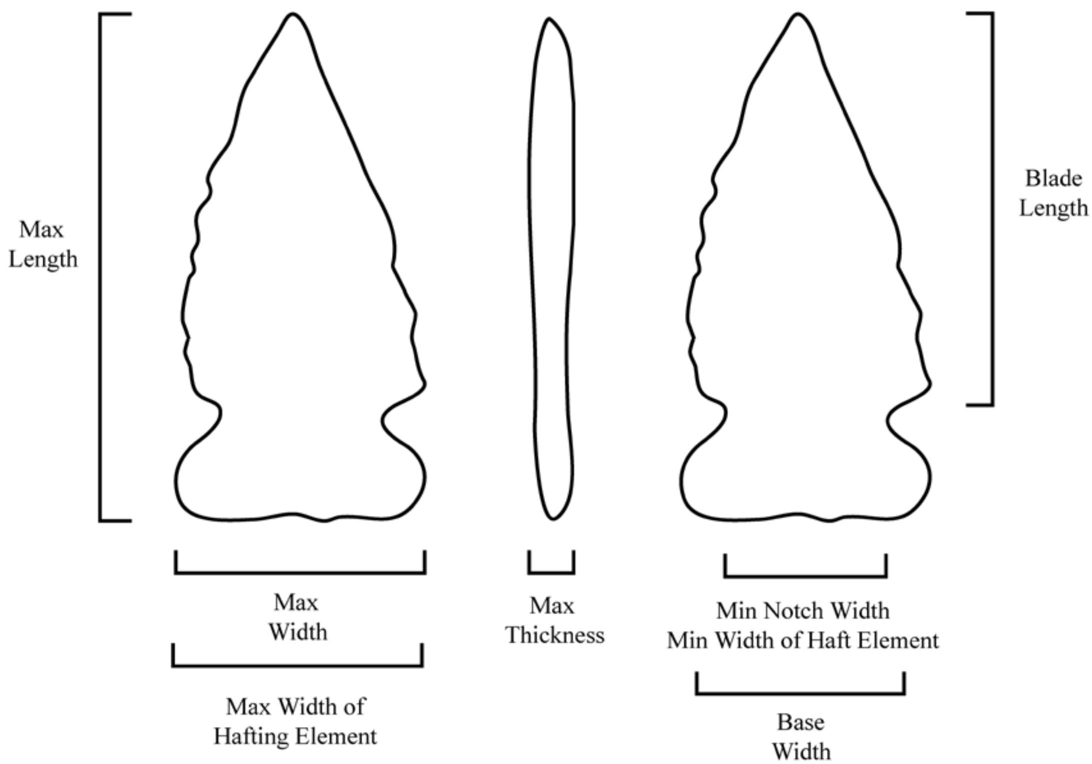


Figure 7-1. Metric Data Collected from Hafted Bifaces.

Qualitative analyses of the Chiggerville stone tools were conducted macroscopically using standard references. Chipped stone tool formal types were classified following Andrefsky (1998) and Odell (2003). Projectile points were classified following Justice (1995), with select other primary sources also consulted. Quantitative data were collected using Mitutoyo digital calipers and rounded to the nearest whole millimeter. Data were analyzed and graphs and tables constructed using the Statistical Package for the Social Sciences (SPSS) version 16.0.

The following metric traits were recorded as part of this analysis: maximum length, maximum width, maximum thickness, blade length, width and thickness at the blade mid-section, width and thickness at 1/3 of the blade length, width and thickness at 2/3 of the blade length, maximum thickness of the blade, broken biface maximum thickness, maximum width and thickness of the haft element, minimum width of the haft element, minimum width across the notches, maximum thickness of the notches, and base width. Most of these measurements are illustrated in Figure 7-1 and many of them are standard to most archaeological analyses (see Andrefsky 1998 and Cross 1990). All measurements are in millimeters unless otherwise stated. Those data that are not standard were collected to address specific research questions and are described in more detail in the comparative analyses below.

Non-metric traits collected during this study included shape of base, base form, base modifications, ear form, basal grinding, lateral haft grinding, basal thinning, base retouch, lateral haft trimming, notch grinding, barb form, blade thinning, blade imperfections, blade cross-section, blade trimming/resharpening, blade trimming/resharpening method, blade shape, point shape, and damage. Certain traits like basal thinning were collected from both faces of each hafted biface. In cases where traits were recorded on both the obverse and reverse face, the obverse face was always the face with the WPA label. In cases like ear form where non-metric traits were collected from both lateral margins, the first trait recorded (e.g., ear form1) was always recorded as the right lateral margin when the obverse side was face up and the hafting element was oriented upward. The second trait recorded (e.g., ear form2) was then recorded as the left lateral margin when the object was held in this same orientation.

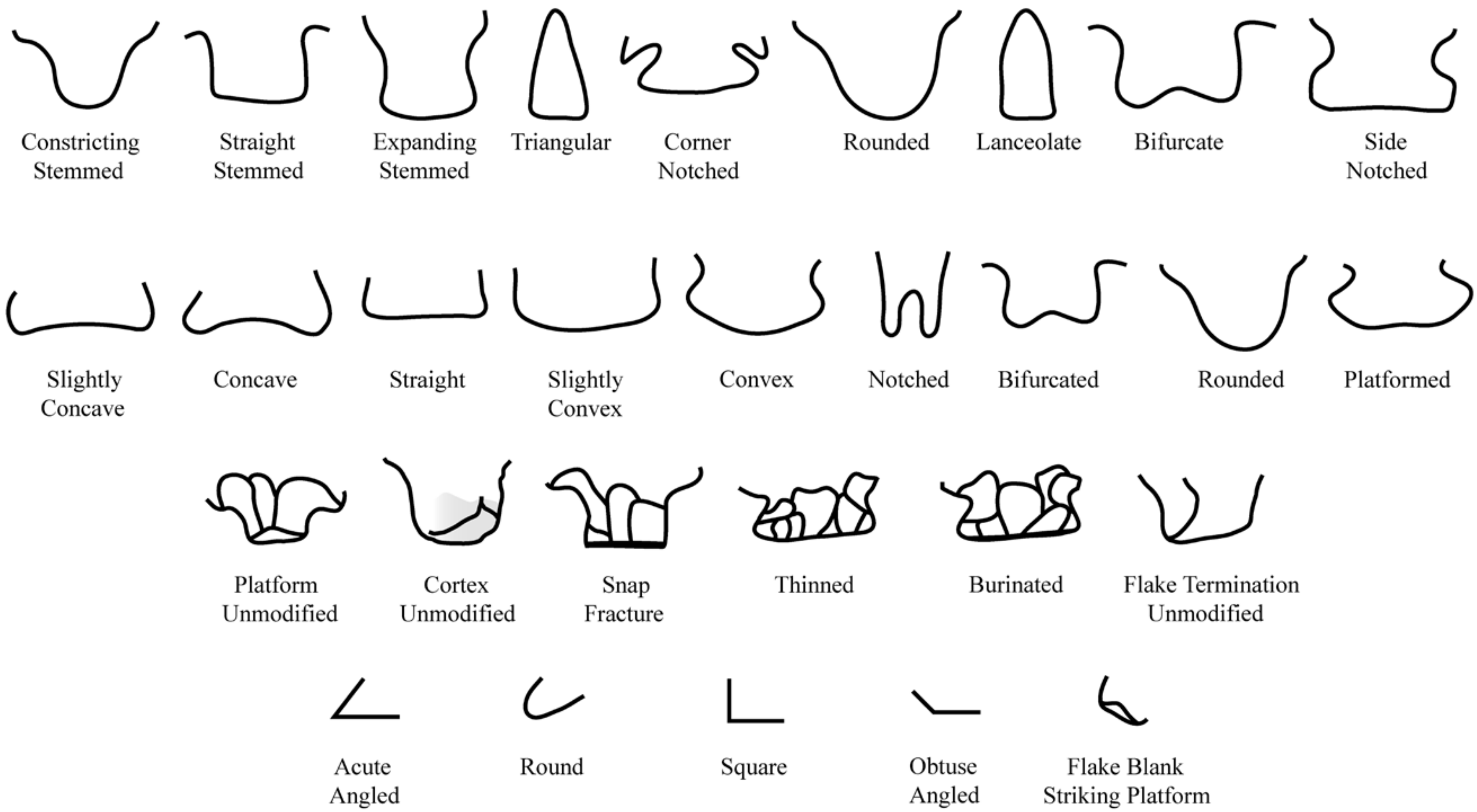


Figure 7-2. Non-metric Traits – Shape of Base, Base Form, Ear Form.

In many cases, descriptions of the non-metric traits are straightforward and standard. The different forms of shape of base, base form, and ear form traits can be derived from the illustrations in Figure 7-2. The base modifications trait is not standard and is divided into platform unmodified, cortex unmodified, snap fracture, thinning, and burinated. The majority of hafted bifaces had thinned base modifications, meaning that flakes had been removed from the base of either the bifacial preform or during the last stages of manufacture of these objects. In some cases, the bases of hafted bifaces retained the unmodified striking platform of the flake blank used to manufacture the object. In other cases, unmodified chert cortex was present at the unthinned base. A snap fractured base is similar to a platform unmodified base with the exception that the base has been intentionally broken to create a blunted base. Burinated bases have been blunted by removal of one or more flakes across the base from one or both ears.

Basal grinding, lateral haft grinding, and notch grinding were all recorded on an ordinal scale from absent, to slightly ground, to heavily ground. Heavily ground hafted biface edges are those that are thoroughly crushed and rounded so that they are smooth to the touch. In many cases, this was recorded as a relative measure, with a heavily ground edge being recorded in reference to a slightly ground or unground edge elsewhere on the hafted biface. Presumably, heavily ground edges have been intentionally ground to facilitate hafting or as a result of use. Slightly ground edges are those that are slightly crushed or smooth in some locations but not others. This trait should be interpreted with caution, since it is possible that slightly ground edges have been intentionally ground, but it is also possible that this crushing and smoothing is the result of movement within a

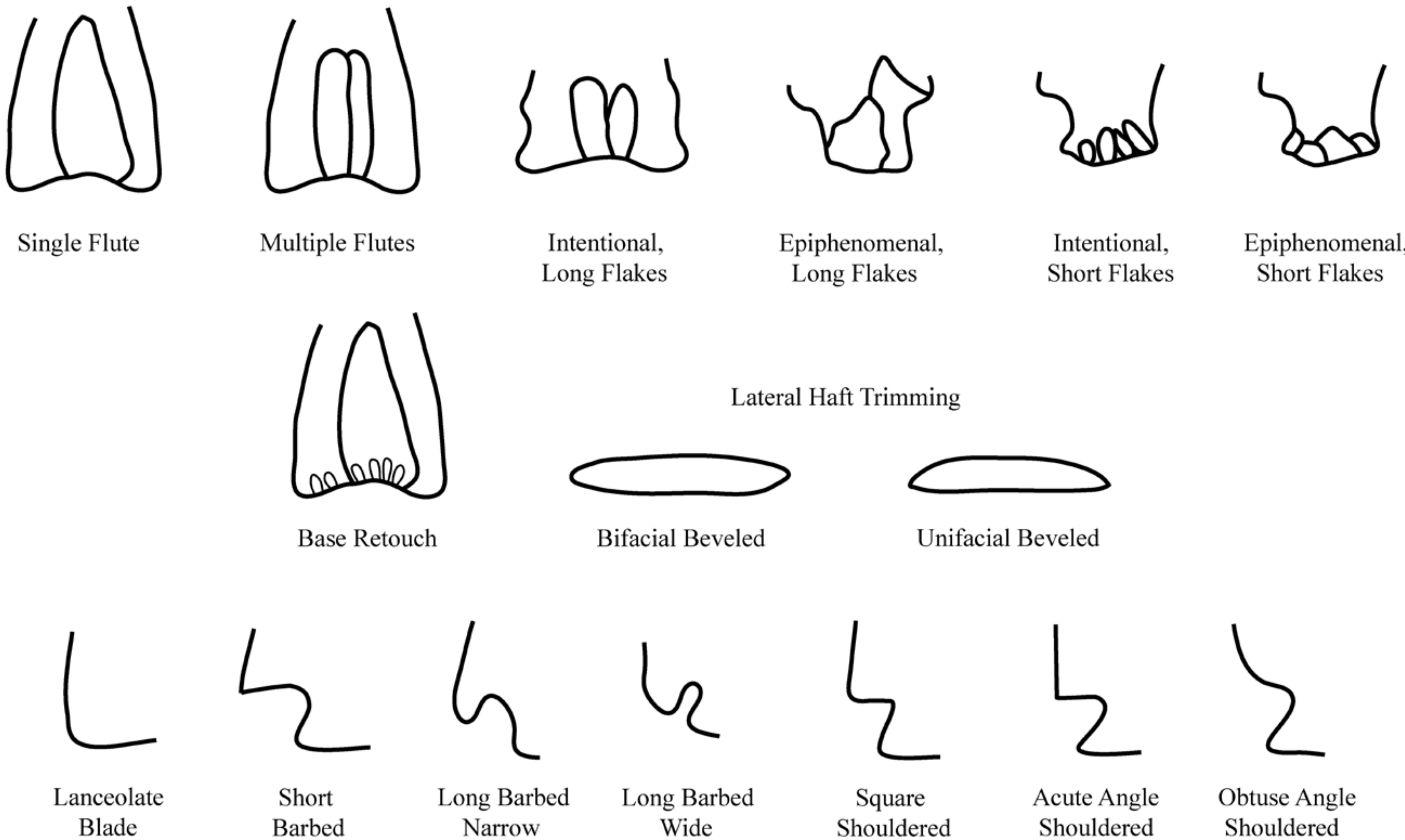


Figure 7-3. Non-metric Traits – Basal Thinning, Base Retouch, Lateral Haft Trimming, and Barb Form.

haft. This is particularly the case for objects with evidence of slightly ground lateral haft margins and/or notches.

Figure 7-3 illustrates the different kinds of basal thinning, base retouch, lateral haft trimming, and barb forms recorded by this study. Basal thinning was recorded as fluted, intentional, or epiphenomenal. Fluting refers to a special kind of basal thinning found on early Paleoamerican hafted bifaces where one or more large flakes are struck from the base and along the blade of the bifaces. Intentional basal thinning was recorded in cases where shorter flakes were struck from the base in an effort to intentionally thin the base after the bifacial preform had been thinned but prior to hafting. Epiphenomenal basal thinning was recorded in cases where the bases of hafted bifaces were thinned during the manufacture of the bifacial preform such that the flake scars of the thinning flakes originate beyond the base (the base of the hafted biface is not the striking platform). Whether intentional or epiphenomenal, the presence of either single or multiple thinning flakes was recorded. These flakes were classified as either short or long, with short basal thinning flakes traveling less than 2/3 of the hafting element and long basal thinning flakes traveling across 2/3 or more of the hafting element.

Discounting basal thinning flakes, basal retouch was recorded as present if small pressure flakes had been removed from the base to shape it after or in place of thinning. Lateral haft trimming was recorded as either bifacially or unifacially beveled using a pressure or percussion flaking technique (see Figure 7-3). Barb forms record the shape of the barb or shoulder if a barb is not present.

Figure 7-4 illustrates the different kinds of blade thinning, blade cross-sections, blade trimming/resharpening, and blade trimming/resharpening methods recorded by this

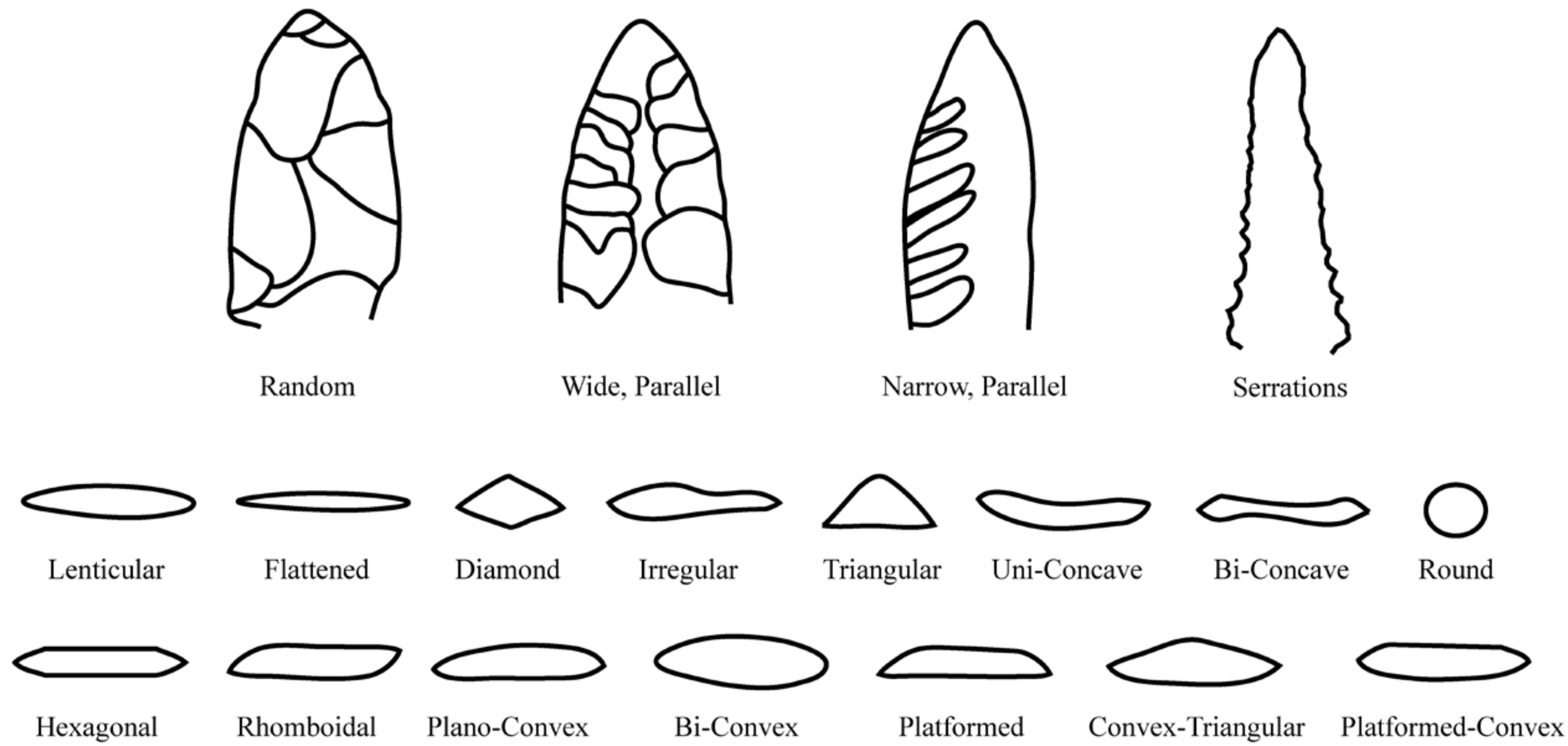


Figure 7-4. Non-metric Traits – Blade Thinning, Blade Cross-sections, Blade Trimming/Resharpening.

study. Blade thinning was recorded as either parallel or randomly distributed. Parallel blade thinning was qualitatively differentiated into wide parallel flake scars (e.g., as is typical of Clovis hafted bifaces) or narrow parallel flake scars (e.g., as is typically of Elk River Stemmed hafted bifaces) (see Justice 1995). These flake scars were then further differentiated as either shallow or deep, with the latter typically resulting in a hinge termination scar. Blade imperfections recorded during this study include hinge and step termination scars and the presence of cortex on a biface face.

Blade cross-sections are depicted in Figure 7-4 and are the direct result of the method of blade thinning and resharpening employed in the manufacture and maintenance of the bifaces for which this trait was recorded. These cross-section forms should be interpreted with caution, however, as the forms depicted in Figure 7-4 are ideal forms that do not reflect the degree of variation present within each type. For instance, a biface with a rhomboidal cross-section would typically exhibit a slight curvature to both faces rather than the flattened faces illustrated by the example.

Blade trimming/resharpening was recorded in much the same way as blade thinning, with the exception that blade trimming/resharpening refers to the removal of final blade shaping and/or blade maintenance flakes. These flakes tend to be much smaller than the flakes removed during blade thinning, although use of both pressure and percussion resharpening was recorded. As a result, the distinction between blade thinning and blade trimming/resharpening is sometimes ambiguous and subjective, meriting caution in interpreting these data. Typically, blade trimming/resharpening was recorded as pressure flaking if the flake scars were small and had small, U-shaped negative platform scars. Larger and deeper flakes removed after initial thinning was finished were recorded as percussion blade trimming/resharpening flakes. These flakes were then recorded as parallel, obliquely parallel, or randomly patterned. In cases where no pattern existed but a few isolated blade trimming/resharpening flakes were noted, these flakes were recorded as isolated. Isolated retouch usually occurred on heavily utilized edges that had not been resharpened immediately prior to discard. The blade trimming/resharpening method was recorded on the basis of blade cross-section and the overall patterning of all four edges of each biface.

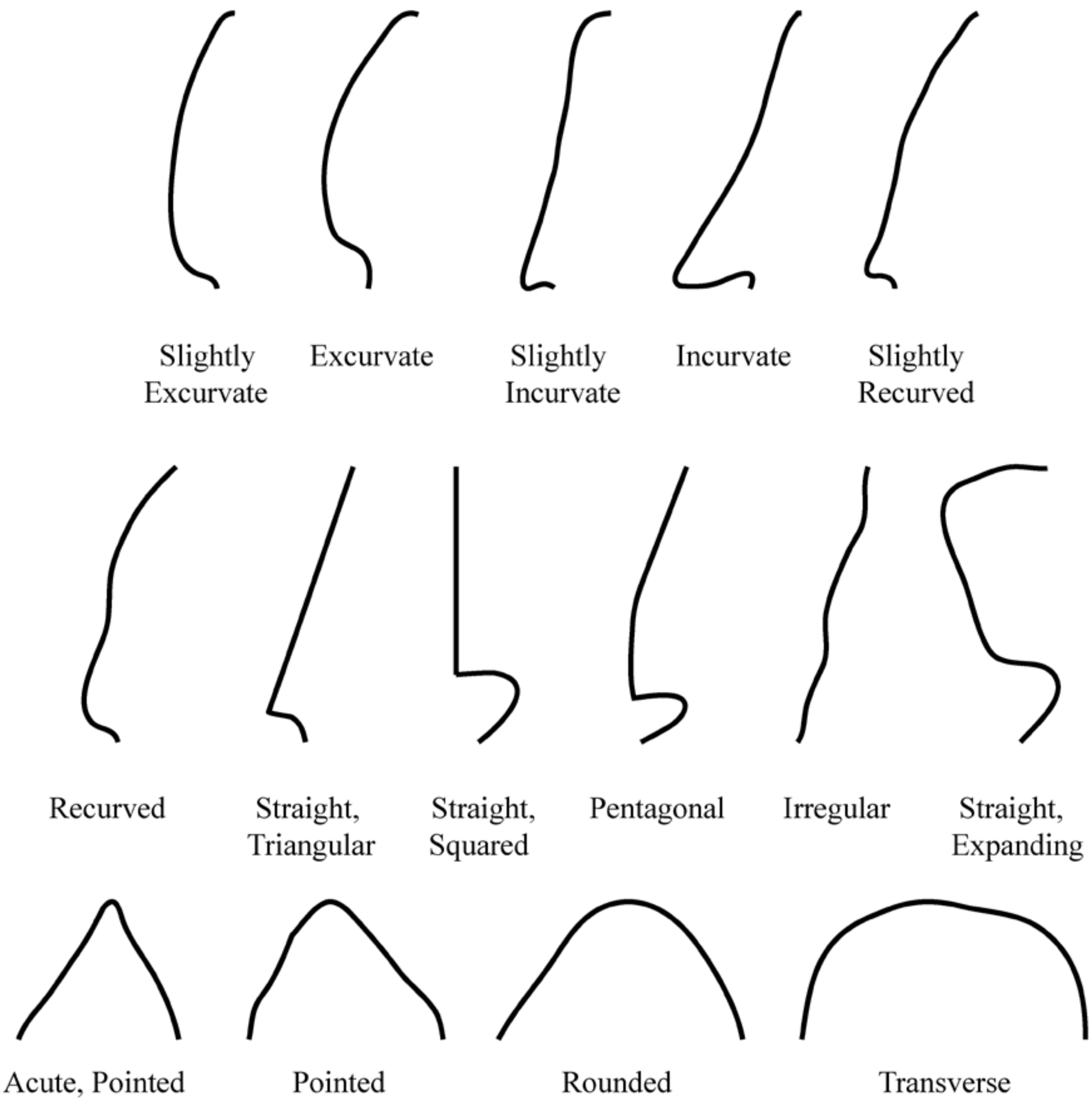


Figure 7-5. Non-metric Traits – Blade Shapes, Point Shapes.

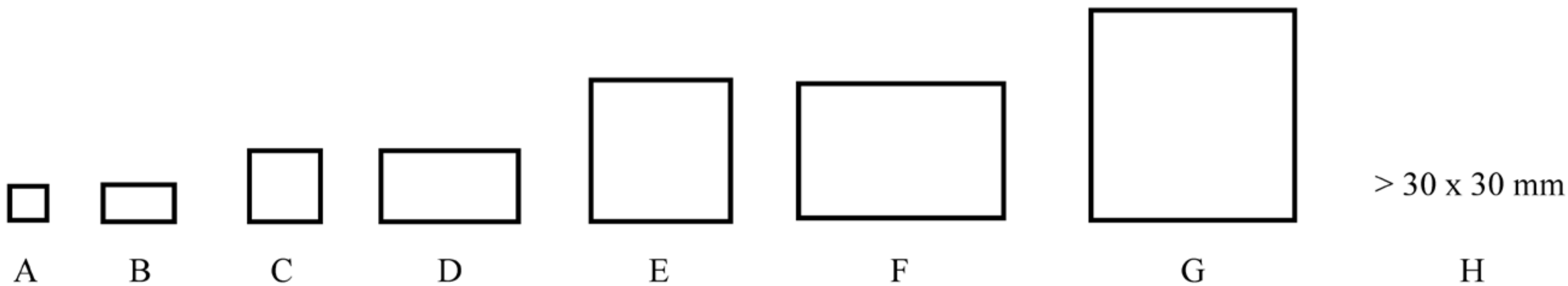


Figure 7-6. Debitage Size Classes used in this Study.

Blade shapes follow standard descriptive practice and are illustrated in Figure 7-5. Point shapes are divided into acute pointed, pointed, rounded, unifacial transverse, and bifacial transverse. The majority of hafted bifaces classified as projectile points exhibited pointed point shapes. Those with acute pointed point shapes exhibited very sharp and narrow tips that may be indicative of a microperforator function. This point shape is likely under-represented given the potential for such sharp tips to be damaged by post-depositional processes, including excavation. Hafted bifaces with rounded tips typically have broadly excurvate blades and may represent resharpened projectile points damaged by impact. Hafted bifaces with unifacial transverse point shapes are typically hafted scrapers. Objects with bifacially transverse distal ends are typically also classified as hafted scrapers, but this function does not seem reasonable given the potential for such a blade form to tear the material being scraped. It is possible these objects represent chisels, wedges, or gouges (i.e., heavy woodworking tools).

Most of the bifaces from Baker and Chiggerville and many of the hafted bifaces and other tool forms were incomplete and damaged. Hinge fracture, reverse fracture, longitudinal reverse fracture, perverse fracture, incipient fracture plane, and expansion fracture damage is typical of bifaces broken during manufacture (Johnson 1981b). Impact fracture, lateral snap fracture, and haft snap fracture damage is typical of hafted bifaces broken during use. Pot lid and crenated fracture damage is typical of secondary burning after damage. All of these damage forms follow Johnson (1979, 1981a, b). Excavation break fractures are those that occurred during excavation, as indicated by the removal of the surface patina from the broken areas. Smashing fractures are impact fractures where the impact was located in the interior of the biface and was directed perpendicular to the biface face, suggesting intentional breakage. This fracture type was not discovered until late in the analysis so some of the hafted bifaces from Chiggerville may exhibit this fracture type, thus inflating the number of 'unknown' damage in the hafted biface sample. The frequency of smashing fracture damage recorded on the bifaces from Chiggerville and the entire Baker chipped stone assemblage is accurate.

Although a few pieces of debitage were collected by the WPA during the 1930s excavations at Baker and Chiggerville, representative samples of debitage from these sites were not curated. One of the primary goals of the 2009 excavations at these sites, then, was to recover a sample of debitage from the middens to provide some insights into the organization of production represented at each. Analysis of the debitage was detailed and involved use of both stage classification and size sorting techniques. Size sorting involved a coding scheme illustrated in Figure 7-6. Debitage was classified by group (A through H) on the basis of smallest square or rectangle in which each piece of debitage could fit. Each group of debitage was then further classified on the basis of the presence or absence of cortex and striking platform forms.

All debitage exhibiting cortex was classified as decortication flakes or shatter. Primary decortication flakes are those with 100 percent cortex on their dorsal aspects. Decortication flakes with less than 100 percent cortex on their dorsal aspects were classified as secondary decortication flakes unless they exhibited very small striking platform or U-shaped striking platforms indicative of use of a pressure flaking technique, in which case they were classified as tertiary decortication flakes.

Interior flakes are those that exhibit no cortex. Primary interior flakes exhibit large striking platforms and thick bulbs of percussion and may represent reduction of a core after removal of cortex or a mistake during the manufacturing process (i.e., striking too far interior of the biface or core edge). Tertiary decortication flakes are typically very small and thin and exhibit small striking platforms. These flakes oftentimes have U-shaped striking platforms and are thought to have been removed by pressure flaking. They may represent late stage reduction flakes, maintenance and resharpening flakes, or notching and trimming flakes. Secondary interior flakes are all those flakes with no cortex that fall between primary and tertiary flakes.

When possible, both secondary decortication and secondary interior flakes were further subdivided into bipolar, biface thinning, overshot, and blade-like flakes (see Andrefsky 1998 and Odell 2003). Bipolar flakes are those created by a bipolar reduction strategy and either exhibit two striking platforms on opposing edges or are broken and have one crushed striking platform that exhibits a very narrow impact area relative to the size of the bulb of percussion. Biface thinning flakes, on the other hand, tend to have very wide striking platforms and no bulb of percussion, as these are bending flakes with an acute platform angle. Overshot flakes represent mistakes in the manufacture process. Typically these flakes break during production and consist of the distal portion of a flake with a termination consisting of the edge of a biface. These flakes form when the force of impact is too great and carries across the entire biface face, removing the opposing edge. Secondary flakes were classified as blade-like flakes if they were long relative to their widths, exhibited approximately 90 degree striking platform angles, and exhibited long, narrow flake scars on their dorsal margins. In some cases, these flakes may be true blades struck from blade cores, but the subjective length standard used in this classification does not permit identification of true blades at this time.

Broken flakes that could not be classified as primary, secondary, or tertiary were classified as decortication or interior flake fragments depending on whether cortex was present. Debitage was classified as shatter if it consisted of angular pieces of chert with no striking platform, bulb of percussion, or other flake characteristics indicative of directionality and intentional removal. Burned debitage consisted of fragments that were heavily pot lidded and crenated from contact with extreme heat to the extent that they were otherwise unclassifiable.

Descriptions of Tool Types

A total of 922 chipped stone objects are listed in the WPA catalogue from Baker and another 1485 are listed from Chiggerville. Of these, 909 objects from Baker and 1455 from Chiggerville were available for study. Table 7-1 summarizes these artifacts by type.

Adzes and adze/gouges were recovered only at the Chiggerville site. These objects are bifacial chipped stone tools with relatively thick cross-sections and narrow widths. They narrow to a point at their proximal ends and are widest at their bifacially transverse bit ends, where they exhibit macroscopic evidence of heavy use-wear and/or manufacture polish. Object #683 is broken but has a maximum width of 30 mm and maximum thickness of 14 mm. This object is manufactured from an unidentified white fossiliferous chert, has a platformed blade cross-section, and was broken by a lateral snap fracture that is oriented at an angle to the perpendicular axis of the tool, suggesting the break occurred as part of a twisting motion. Object #1228 is 53 mm long, 30 mm wide, and 16 mm thick, with a base width of 23 mm. The object is manufactured from an unidentified reddish tan chert and has an irregular blade cross-section. Object #1283 is

44 mm long, 29 mm wide, 13 mm thick, with a base width of 20 mm. It is manufactured from Ste Genevieve chert and has an irregular blade cross-section.

Table 7-1. Artifacts by Type at Baker and Chiggerville.

	Baker		Chiggerville	
	Frequency	Percent	Frequency	Percent
adze	0	0.0	3	0.2
adze/gouge	0	0.0	1	0.1
biface	237	26.1	255	17.5
core - bifacial	3	0.3	22	1.5
core - amorphous	4	0.4	31	2.1
core - pyramidal	1	0.1	0	0.0
core - expended	0	0.0	6	0.4
bifacial endscraper	0	0.0	21	1.4
cobble	0	0.0	18	1.2
debitage	34	3.7	69	4.7
drawknife	0	0.0	1	0.1
drill	46	5.1	123	8.5
endscraper	84	9.2	41	2.8
flake tool	143	15.7	102	7.0
graver	1	0.1	0	0.0
hafted drill	6	0.7	24	1.6
hafted endscraper	12	1.3	46	3.2
hafted knife	1	0.1	1	0.1
hafted microperforator	1	0.1	1	0.1
hafted scraper	57	6.3	130	8.9
knife	37	4.1	11	0.8
knife/ spokeshave	0	0.0	1	0.1
microdrill	0	0.0	3	0.2
pièce esquillée	1	0.1	0	0.0
projectile point	231	25.4	527	36.2
sidescraper	8	0.9	16	1.1
spokeshave	1	0.1	0	0.0
uniface	1	0.1	2	0.1
Total	909	100.0	1455	100.0

Object #250 has a slightly different form than the adzes and has been classified as an adze/gouge. This object exhibits heavy grinding at its narrow end, indicating that this is the hafting element. The distal end narrows and has the appearance of a short hafting element (e.g., like a Sykes/White Springs projectile point), but this is likely related to the tool's function. The adze/gouge is 57 mm long, 28 mm wide, 8 mm thick, and has a base width of 10 mm. It is manufactured from Ste Genevieve chert and has a platformed blade cross-section.

The term biface was used to describe any relatively symmetrical, bifacially chipped stone tool with no hafting element that could not be appropriately placed in any other formal tool category. Table 7-2 provides summary statistics for the bifaces at the two sites. The majority of bifaces at both sites were broken, either during manufacture, use, or during excavation. Of those that were not, most exhibited excurvate or slightly excurvate blade margins. Points shapes at Baker included acute pointed (n = 2), pointed (n = 37), rounded (n = 49), unifacial transverse (n = 4), bifacial transverse (n = 12), and unpointed (n = 4). Point shapes at Chiggerville included acute pointed (n = 1), pointed (n = 49), rounded (n = 45), unifacial transverse (n = 2), bifacial transverse (n = 2), and unpointed (n = 4). Table 7-3 depicts the frequency of different forms of damage observed in both assemblages.

A total of 21 bifacial endscrapers were recovered at Chiggerville. These objects are bifacially flaked tools with one steeply beveled edge located perpendicular to the long axis of the tool. Summary statistics are provided in Table 7-4. Of the 20 complete or nearly complete bifacial endscrapers, 19 exhibit unifacially transverse distal ends and one

Table 7-2. Summary Statistics for Bifaces at Baker and Chiggerville.

		Max Length	Max Width	Max Thick	Broken Biface Max Thick	Base Width
Baker	Valid	60	68	76	190	88
	Missing	177	169	161	47	149
	Mean	55	33	11	9	25
	Median	54.5	32	9.5	8	25
	Mode	57	25, 29	7	8	27
	Std. Dev	10.924	7.486	4.768	2.735	6.482
	Minimum	33	15	5	4	8
	Maximum	83	57	35	22	40
Chiggerville	Valid	51	95	100	209	89
	Missing	204	160	155	46	166
	Mean	58	29	11	10	22
	Median	58	29	10	9	23
	Mode	70	29	9	9	23
	Std. Dev	15.053	6.69	2.827	2.321	6.654
	Minimum	30	18	6	5	8
	Maximum	102	46	24	24	42

Table 7-3. Types of Damage Observed on Bifaces at Baker and Chiggerville.

	Baker	Chiggerville
Reverse Fracture	0	2
Longitudinal Reverse Fracture	9	2
Perverse Fracture	5	8
Impact Fracture	0	4
Lateral Snap Fracture	39	58
Incipient Fracture Plane	1	5
Crenated Fracture	57	87
Pot Lid	27	55
Smashing Fracture	8	41
Excavation Break	19	12
Unknown	128	64

is bifacially transverse. Damage includes one with unifacial breakage indicative of impact fracture and three are pot lidded.

Cores are chert raw material from which at least one flake has been removed. Considerably more cores were recovered from Chiggerville (n = 59) than from Baker (n = 8), which, along with the recovery of 18 unmodified chert cobbles at the site, suggests that more raw material was being transported to and/or curated at Chiggerville than at Baker. Summary statistics for the cores at Chiggerville are listed by type in Table 7-5. Three of the amorphous cores from Baker were complete and could be measured. Cat #299 is 63 mm long, 50 mm wide, and 24 mm thick. Cat #407 is 58 mm long, 54 mm wide, and 49 mm thick. Cat #430 is 44 mm long, 30 mm wide, and 26 mm thick. One bifacial core (Cat #392) at Baker is 92 mm long, 58 mm long, and 25 mm thick. Cat #699 is 45 mm long, 42 mm wide, and 21 mm thick. Cat #749 is 82 mm wide, 44 mm wide, and 41 mm thick. The one pyramidal core (Cat #502) at Baker is 64 mm long, 63 mm wide, and 40 mm thick. This object is interesting because it suggests the use of a blade reduction strategy at this site.

Table 7-4. Summary Statistics for Bifacial Endscrapers from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	20	21	21
Missing	1	0	0
Mean	49	26	10
Median	50	25	9
Mode	41	25	8
Std. Dev	11.140	5.406	2.406
Minimum	33	20	8
Maximum	75	46	17

Drills are relatively small bifaces with very narrow tips and a width to thickness ratio that approaches one. Hafted drills and hafted microperforators are drills or awls manufactured on classifiable projectile point bases. Microdrills are small drills usually manufactured on flakes. Summary statistics for drills from the two sites are provided in Table 7-6. Hafted drills and hafted microperforators are described with the other diagnostic hafted artifacts below. Microdrills were recovered only from Chiggerville.

Table 7-5. Summary Statistics for Different Core Types at Chiggerville.

		Max Length	Max Width	Max Thickness
Amorphous Cores	Valid	22	23	25
	Missing	9	8	6
	Mean	68	48	29
	Median	69	46	26
	Mode	50, 69, 70, 72	38	22
	Std. Dev	13.654	10.891	9.596
	Minimum	42	37	19
	Maximum	97	73	54
Bifacial Cores	Valid	12	12	16
	Missing	10	10	6
	Mean	71	46	21
	Median	67.5	45	20
	Mode	54	36, 45, 52	15, 24
	Std. Dev	20.028	9.808	5.875
	Minimum	47	32	13
	Maximum	105	65	36
Expended Cores	Valid	5	5	5
	Missing	1	1	1
	Mean	41	31	15
	Median	39	30	16
	Mode	39	N/A	16
	Std. Dev	5.215	5.119	1.517
	Minimum	35	25	13
	Maximum	49	39	17

Cat #311 is 27 mm long, 19 mm wide, and 5 mm thick. Cat #809 is 40 mm long, 21 mm wide, and 5 mm thick. Cat #867 is 29 mm long, 14 mm wide, and 4 mm thick.

Drills at both sites exhibit a wide range of base shapes (Table 7-7) and blade cross-sections (Table 7-8). Damage on drills at Baker includes lateral snap fractures (n = 22), incipient fracture planes (n = 1), crenated fractures (n = 14), pot lidding (n = 3), excavation breaks (n = 1), and unknown damage (n = 15). Damage on drills at Chiggerville includes impact fractures (n = 5), lateral snap fractures (n = 51), crenated fractures (n = 13), pot lidding (n = 11), excavation breaks (n = 1), and unknown damage

Table 7-6. Summary Statistics for Drills from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	8	16	17
	Missing	38	30	29
	Mean	57	21	7
	Median	54	22	6
	Mode	N/A	18	6
	Std. Dev	19.448	5.779	1.478
	Minimum	33	10	5
	Maximum	87	32	11
Chiggerville	Valid	43	64	71
	Missing	80	59	52
	Mean	55	18	8
	Median	53	17.5	8
	Mode	52, 59	17, 20	7
	Std. Dev	10.593	5.234	1.690
	Minimum	35	10	6
	Maximum	83	38	17

Table 7-7. Base Shapes of Drills from Baker and Chiggerville.

	Baker	Chiggerville
Constricting Stemmed	1	8
Straight Stemmed	1	4
Straight Stemmed/Winged	0	1
Expanding Stemmed	7	18
Expanding Stemmed/Winged	1	0
Lanceolate	1	6
Rounded	0	2
Triangular	2	15
Winged	2	7
T-Shaped	6	3
Asymmetrical	3	6

(n = 31). Most of this damage can be attributed to use as drills (lateral snap fractures) or projectiles (impact fractures) or post-discard burning (crenated fractures and pot lidding).

Endscrapers are unifacially flaked tools with one steep-beveled edge perpendicular to the longest axis of the tool. Sidescrapers are unifacially flaked tools with one or more steep-beveled edge along the longest axes but no edge perpendicular to the long axis (tools with both edges unifacially beveled are classified as endscrapers). Hafted endscrapers meet the criteria for endscrapers but exhibit a hafting element. Hafted scrapers are bifacially worked hafted endscrapers thought to be manufactured from recycled projectile points (Jefferies 1990). These latter objects are described with the other temporally diagnostic hafted bifaces below. Summary statistics for endscrapers are provided in Table 7-9, and summary statistics for sidescrapers are provided in Table 7-10.

Table 7-8. Blade Cross-sections of Drills from Baker and Chiggerville.

	Baker	Chiggerville
Lenticular	4	17
Diamond	7	18
Irregular	12	33
Triangular	0	9
Hexagonal	1	0
Rhomboidal	5	5
Plano-Convex	0	3
Bi-Convex	1	8
Platformed	1	0
Convex Triangular	6	24
Platformed-Convex	1	0

Hafted endscrapers are unifacial endscrapers with either a minimally modified or fully bifacial hafting element. In some cases these hafting elements are well formed and have characteristics similar to those exhibited by temporally diagnostic hafted bifaces. At Baker, six hafted endscrapers are broken or exhibit hafting elements with no diagnostic properties, but five other hafted endscrapers have straight or expanding stemmed hafting elements similar to Saratoga Cluster hafted bifaces and one hafted endscraper has a side notched hafting element similar to Large Side Notched Cluster hafted bifaces. At Chiggerville, one hafted endscraper is broken and cannot be classified, while 45 others have hafting elements similar to Saratoga Cluster hafted bifaces. The large number of these hafted endscraper forms at Chiggerville suggests that these objects are a formal Late Archaic artifact type and are herein classified as Chiggerville hafted endscrapers (Figure 7-7).

Table 7-9. Summary Statistics for Endscrapers from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	39	49	52
	Missing	45	35	32
	Mean	50	31	10
	Median	49	31	10
	Mode	41	33	10
	Std. Dev	12.402	6.170	3.308
	Minimum	23	19	5
	Maximum	78	46	23
Chiggerville	Valid	33	35	37
	Missing	8	6	4
	Mean	53	29	10
	Median	50	28	10
	Mode	64	25, 28, 30, 34, 37	7
	Std. Dev	12.422	4.549	3.594
	Minimum	29	21	4
	Maximum	87	37	17

Unlike the ubiquitous hafted scrapers manufactured from recycled Saratoga points and included in that cluster, Chiggerville hafted endscrapers are manufactured on large flakes struck from a core. Hafting elements of Chiggerville hafted endscrapers range from primarily unifacially retouched to bifacially shaped in a manner consistent with Saratoga stems. Additional modification is typically restricted to unifacial beveling of the functional end. In some cases, however, these tools are fully bifacially shaped. The distinguishing characteristic, then, is that they were produced as part of a core reduction strategy, not the bifacial reduction strategy that characterizes the Saratoga cluster hafted scrapers.

Table 7-10. Summary Statistics for Sidescrapers from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	4	4	4
	Missing	4	4	4
	Mean	85	28	14
	Median	84	28.5	14.5
	Mode	N/A	N/A	16
	Std. Dev	16.693	2.160	2.449
	Minimum	66	25	11
	Maximum	106	30	16
Chiggerville	Valid	11	11	14
	Missing	5	5	2
	Mean	62	30	10
	Median	66	30	9
	Mode	72	34	6
	Std. Dev	13.445	5.241	3.800
	Minimum	40	17	6
	Maximum	82	34	17

Figure 7-7. Chiggerville Hafted Endscrapers from the Chiggerville Site.

Table 7-11. Summary Statistics for Chiggerville Hafted Endscrapers from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness	Max Thickness of Blade	Max Width of Haft Element	Min Width of Haft Element	Max Thickness of Haft Element
Baker	Valid	4	4	4	4	Not Collected	Not Collected	Not Collected
	Missing	1	1	1	1	Not Collected	Not Collected	Not Collected
	Mean	43	31	10	10	Not Collected	Not Collected	Not Collected
	Median	42	30.5	9	9	Not Collected	Not Collected	Not Collected
	Mode	42	29	N/A	N/A	Not Collected	Not Collected	Not Collected
	Std. Dev	2.708	2.062	2.646	2.646	Not Collected	Not Collected	Not Collected
	Minimum	41	29	7	7	Not Collected	Not Collected	Not Collected
	Maximum	47	33	13	13	Not Collected	Not Collected	Not Collected
Chiggerville	Valid	41	42	45	45	39	45	44
	Missing	4	3	0	0	6	0	1
	Mean	44	29	10	10	20	16	8
	Median	44	29	10	10	20	17	8
	Mode	43, 48	27	10	10	21	17	7, 9
	Std. Dev	9.245	3.795	2.524	2.510	2.832	3.143	2.443
	Minimum	28	21	4	4	13	8	4
	Maximum	67	41	15	15	27	24	15

Summary statistics for Chiggerville hafted endscrapers from the two sites are provided in Table 7-11 and summary statistics for unidentified hafted endscrapers from Baker are provided in Table 7-12. More data is provided for Chiggerville hafted endscrapers from the Chiggerville site because this assemblage is considered the type assemblage for this artifact type. The side notched hafted endscraper from Baker is 39 mm long, 29 mm wide, 5 mm thick, has a maximum blade thickness of 5 mm, a maximum haft element width of 26 mm, a minimum haft element width of 19 mm, a minimum notch width of 19 mm, a maximum haft element thickness of 5 mm, and a maximum notch thickness of 5 mm. The point shape on this undamaged object is unifacial transverse. It is notable that five of the unidentified hafted endscrapers from Baker exhibit one or two side notches.

Table 7-12. Summary Statistics for Unidentified Hafted Endscrapers from Baker.

	Max Length	Max Width	Max Thickness	Max Thickness of Blade
Valid	6	6	6	6
Missing	0	0	0	0
Mean	42	32	7	7
Median	38	31	7	6.5
Mode	29	38	7	N/A
Std. Dev	16.525	5.060	2.280	2.317
Minimum	27	26	4	4
Maximum	69	38	10	10

Base shapes exhibited by the Chiggerville hafted endscrapers from Chiggerville include constricting stemmed (n = 3), constricting stemmed/straight stemmed (n = 1), constricting stemmed/expanding stemmed (n = 4), straight stemmed (n = 3), expanding stemmed (n = 18), rounded (n = 3), and asymmetrical (n = 12). Of the 44 Chiggerville hafted endscrapers with unbroken distal ends, 43 are unifacial transverse and 1 is bifacial transverse. Damage on Chiggerville hafted endscrapers from Chiggerville includes one crenated fracture, one pot lid fracture, two excavation breaks, and five cases of unknown damage.

Flake tools consist of informal tools with macroscopic evidence of use or retouching along at least one edge. As macroscopic identification of utilization wear is notoriously difficult and oftentimes confused with wear from trampling, handling, backing, and other forms of modification and post-deposition wear (Young and Bamforth 1990), this category of 'tool' should be interpreted with caution. Summary statistics for flake tools are presented in Table 7-13.

Table 7-13. Summary Statistics for Flake Tools from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	52	65	83
	Missing	91	78	60
	Mean	51	32	9
	Median	50.5	30	8
	Mode	37, 64, 72	25, 30	5
	Std. Dev	15.492	10.676	3.361
	Minimum	21	14	3
	Maximum	93	66	18
Chiggerville	Valid	59	70	76
	Missing	43	32	26
	Mean	58	33	10
	Median	53	31.5	8
	Mode	49	34	8
	Std. Dev	18.934	9.688	4.120
	Minimum	31	16	3
	Maximum	131	62	27

A graver is a small retouched flake with one or more acutely pointed spurs presumably used either to engrave some softer material or as a microperforator. One graver was recovered from Baker, but gravers are likely under-represented at both sites due to recovery bias. The Baker graver is 32 mm long, 24 mm wide, and 6 mm thick.

As utilized herein, the term knife refers to chipped stone objects that are bifacially worked along one unthinned edge. Hafted knives, on the other hand are distinct from knives in that hafted knives are bifaces consisting of one straight and one markedly excurvate blade margin. Additionally, one object from Chiggerville is a knife with one steeply beveled incurvate edge indicative of use as a spokeshave. Summary statistics for the Baker and Chiggerville knives are provided in Table 7-14. The knife/spokeshave from Chiggerville is 67 mm long, 34 mm wide, and 10 mm thick. A broken spokeshave from Baker is 33 mm wide and 8 mm thick.

Table 7-14. Summary Statistics for Knives from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	12	14	16
	Missing	25	23	21
	Mean	67	32	12
	Median	61	32.5	11.5
	Mode	N/A	32	7
	Std. Dev	21.621	6.239	5.56
	Minimum	40	19	5
	Maximum	118	44	25
Chiggerville	Valid	3	4	6
	Missing	8	7	5
	Mean	69	33	14
	Median	67	29	14
	Mode	N/A	N/A	N/A
	Std. Dev	5.686	11.871	5.357
	Minimum	64	23	7
	Maximum	75	50	20

A single pièce esquillée was identified in the WPA assemblage from Baker. These objects likely represent bipolar cores, although it is possible they functioned as wedges used to split wood, bone, or antler (Flenniken 1981). The pièce esquillée from Baker is 25 mm long, 20 mm wide, and 6 mm thick.

Two artifacts from Chiggerville and one from Baker were unifacially worked formal tools that could not be included in any of the other categories described above. The function of these objects is unknown. The object from Baker was heavily damaged during excavation such that no metric data could be collected. Cat #910 from Chiggerville is 73 mm long, 39 mm wide, and 25 mm thick. Cat #1046 is 78 mm long, 52 mm wide, and 27 mm thick.

The term projectile point was used for all bifaces with a distinct hafting element and that could not be classified as a hafted knife, hafted drill, hafted scraper, hafted endscraper, or hafted microperforator. The single drawknife consists of an Elk River Stemmed hafted biface with a high degree of use-wear polish and flake scar attrition evident across both faces. Although broken, this wear was sufficient to classify the hafted biface as a drawknife on the basis of comparison with complete drawknives illustrated and discussed by Webb (1974:264).

In addition to the flaked stone tools described above, a total of 69 pieces of debitage (flakes and shatter) are included in the WPA collection from Chiggerville and 34 pieces from Baker. Most of these items were misclassified as some kind of tool type by the WPA, which is likely the reason they were retained in the collections.

Diagnostic Hafted Bifaces belonging to Minor Components at Each Site

As discussed in chapters 4 and 5, most of the hafted bifaces from Baker belong to the Middle Archaic Large Side Notched Cluster and most from Chiggerville belong to the Late Archaic Saratoga Cluster. However, small numbers of points dating from other time periods and some points dating to the primary component but stylistically more similar to point types that are more common outside the middle Green River region are present at both sites. This section provides descriptive data for each of these point types and provides a tentative explanation for the presence of non-Saratoga Late Archaic points at Chiggerville. Table 7-15 lists all broken or otherwise unidentifiable projectile points from both sites by morphofunctional type. This table includes six unique projectile points classified as Provisional Type I.

Table 7-15. Unidentifiable Hafted Bifaces from Baker and Chiggerville.

	Hafted Drill	Hafted Knife	Hafted Scraper	Projectile Point
Baker	1	1	7	77
Chiggerville	2	1	10	136

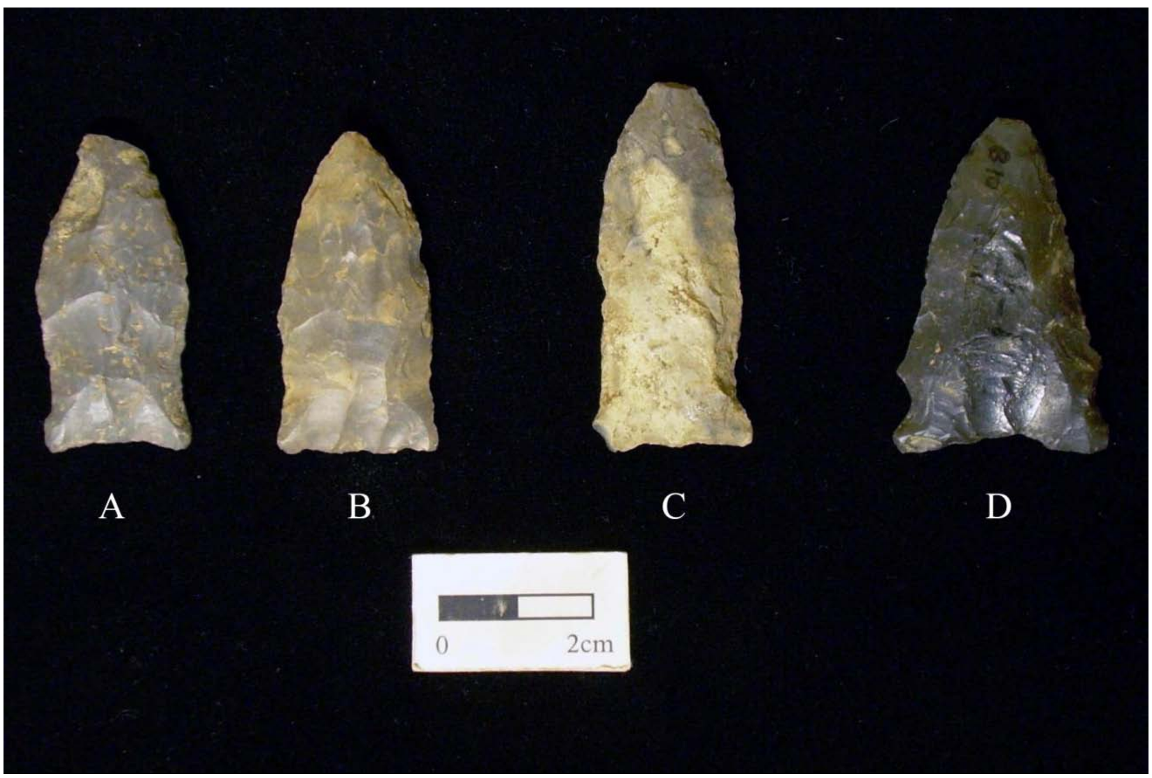


Figure 7-8. Dalton Cluster Projectile Points from Chiggerville.

Diagnostic Paleoindian artifacts are rare at most Green River shell midden sites but do occur in low frequencies at several (Moore 2009b). Four Dalton Cluster projectile points were recovered from Chiggerville and one fragment of a Clovis projectile point was recovered from Baker. The Dalton Cluster points from Chiggerville consist of three Dalton points (Figure 7-8a-c) and one Greenbrier variety (Figure 7-8d). Two of the three Dalton Cluster points are broken and one is complete. All three are lanceolate in form. The complete Dalton point (Cat. #395, Figure 7-8b) is 42 mm long, 21 mm wide, and 8 mm thick. Cat #4 is a Dalton point that is 20 mm wide and 8 mm thick. This point exhibits an impact fracture and pot-lidding. Cat #179 is 8 mm thick and exhibits unknown damage. Cat #176 is a complete side notched Greenbrier point that is 43 mm long, 26 mm wide, and 9 mm thick. The Clovis point from Baker (Cat #320) is a basal fragment of a Clovis point that broke as a result of a haft snap fracture.

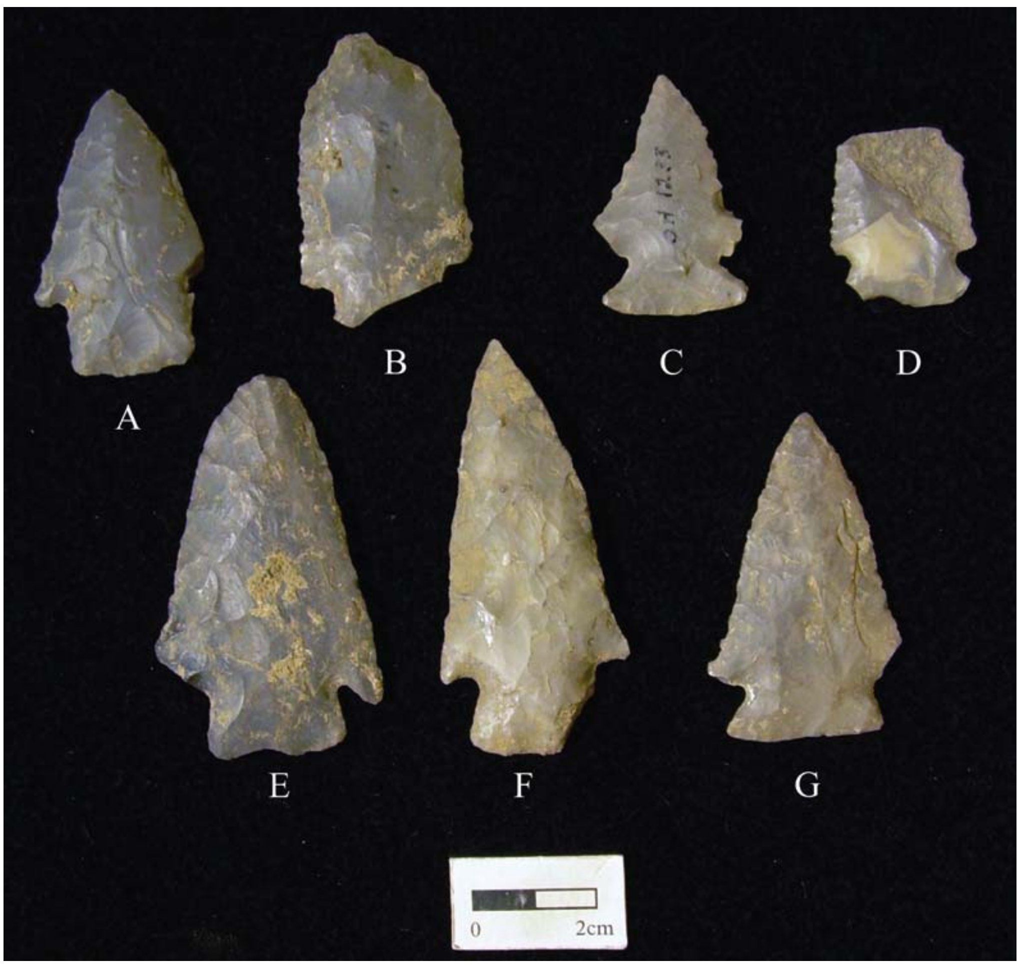


Figure 7-9. Kirk Corner Notched and Hardin Barbed Cluster Hafted Bifaces from Chiggerville.

Figure 7-10. Thebes Cluster Hafted Bifaces from Chiggerville.

Figure 7-11. MacCorkle Cluster Hafted Bifaces from Chiggerville.

Several Early Archaic hafted biface types were recovered from both Chiggerville and Baker (Table 7-16). Both Kirk Cluster (Figure 7-9b-g) and Thebes Cluster (Figure 7-10) points are represented at both sites. One Hardin Barbed Cluster (Figure 7-9a) and two MacCorkle Cluster (Figure 7-11) points were recovered from Chiggerville. Basic metric data for these points can be found in Appendices 2 and 3. Summary statistics for the Kirk Corner Notched projectile points from each site are provided in Table 7-17.

Table 7-16. Early Archaic Hafted Bifaces from Baker and Chiggerville.

	Cluster	Type	Hafted Drill	Hafted Scraper	Projectile Point
Baker	Kirk Corner Notched	Kirk Corner Notched	0	2	10
		UID	0	0	1
	Thebes	Lost Lake	0	0	1
		Thebes	0	0	5
Chiggerville	Hardin Barbed	Hardin Barbed	0	0	1
	Kirk Corner Notched	Charleston Corner Notched	0	0	3
		Kirk Corner Notched	1	1	12
		Pine Tree Corner Notched	0	0	4
		UID	0	0	2
	Rice Lobed	MacCorkle	0	0	2
	Thebes	Calf Creek	0	0	2
		Lost Lake	0	0	2
		Thebes	0	0	2
		UID	0	0	1

Table 7-18 lists the Middle Archaic hafted bifaces from Baker and Chiggerville by type, with the exception of the Large Side Notched Cluster hafted bifaces from Baker. Even considering that the Large Side Notched points from Baker are not included in this table, the Chiggerville Middle Archaic assemblage is much more diverse than the Baker assemblage. All of the Middle Archaic point types that are not present at Baker are early

Middle Archaic types that are represented by only single specimens at Chiggerville. Given the early dates on side notched points at Baker and the lack of evidence for any major occupations by Eva (Figure 7-12a), Stanly Stemmed (Figure 7-12b), Kirk Stemmed (Figure 7-12c), or White Springs (Figure 7-12d-e) groups in the middle Green River region (Jefferies et al. 2007:51), it is reasonable to conclude that these early Middle Archaic points do not represent distinct occupations at either site. It is possible these objects were obtained by Large Side Notched Cluster manufacturing groups through trade or that they represent 'heirloom' artifacts brought to the site by either Middle or Late Archaic individuals. Summary statistics for the Godar/Raddatz projectile points from Chiggerville (Figure 7-13a-e, g, h) are provided in Table 7-19. The Faulkner point is depicted in Figure 7-13f.

Table 7-17. Summary Statistics for Kirk Corner Notched Projectile Points from Baker and Chiggerville.

		Max Length	Max Width	Max Thickness
Baker	Valid	2	3	5
	Missing	8	7	5
	Mean	47	23	7
	Median	47	23	7
	Mode	N/A	N/A	7
	Std. Deviation	1.414	1.528	0.548
	Minimum	46	22	6
	Maximum	48	25	7
Chiggerville	Valid	2	5	9
	Missing	10	7	3
	Mean	57	25	7
	Median	57	25	7
	Mode	N/A	23, 25	6, 8
	Std. Deviation	12.728	2.864	1.093
	Minimum	48	23	6
	Maximum	66	30	9

Figure 7-12. Early Middle Archaic Hafted Bifaces from Chiggerville.

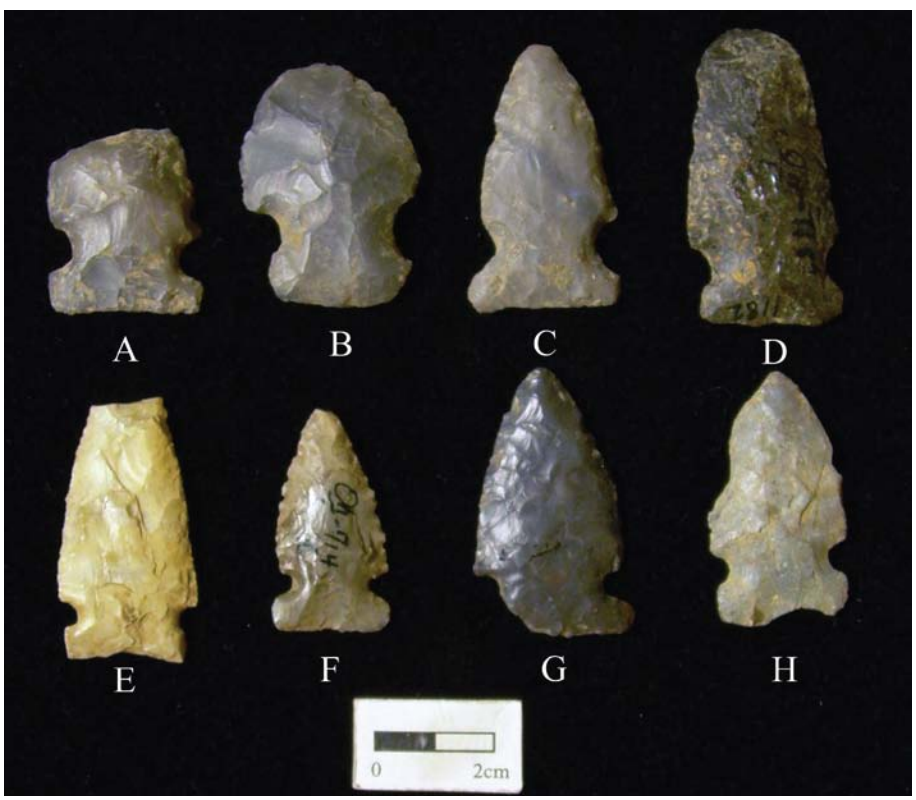


Figure 7-13. Large Side Notched Cluster Hafted Bifaces from Chiggerville.

Table 7-18. Middle Archaic Hafted Bifaces from Baker and Chiggerville, not including Large Side Notched Cluster Points from Baker.

	Cluster	Type	Hafted Drill	Hafted Scraper	Projectile Point
Baker	Kirk Stemmed	Kirk Stemmed	0	0	2
Chiggerville	Eva	Eva	0	0	1
	Kirk Stemmed	Kirk Stemmed	0	0	1
	Large Side Notched	Faulkner	0	0	1
		Godar/Raddatz	1	3	11
	Stanly Stemmed	Stanly Stemmed	0	0	1
	White Springs	Sykes	0	1	0
		White Springs	0	0	1

Table 7-19. Summary Statistics for Godar/Raddatz Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	6	4	9
Missing	5	7	2
Mean	46	24	7
Median	44.5	23	8
Mode	42, 45	23	8
Std. Deviation	5.241	1.000	1.014
Minimum	42	23	6
Maximum	56	25	9

As can be seen from Table 7-20, the diversity in projectile point forms present at both sites increases markedly during the Late Archaic, although the total percentage of points at Baker dating from the Late Archaic is low. Some of this diversity can be explained by the fact that Late Archaic points consist of a large variety of stemmed point types characterized by considerable intra-assemblage diversity. Ambiguous Late Archaic stemmed forms were placed within the Late Archaic Stemmed Cluster (Figure 7-14b-d), although they may have been produced by peoples who also produced Saratoga or other point types. Additionally, the Karnak (Figure 7-14a) and Motley Cluster (Figure 7-15e-i) hafted bifaces should be interpreted with caution. The hafted bifaces assigned to these types conform to the range of variation discussed by Justice (1995) but are not ideal representatives of these types. The other hafted bifaces listed here are representative of the types to which they have been assigned and can be considered 'real' examples of these types.

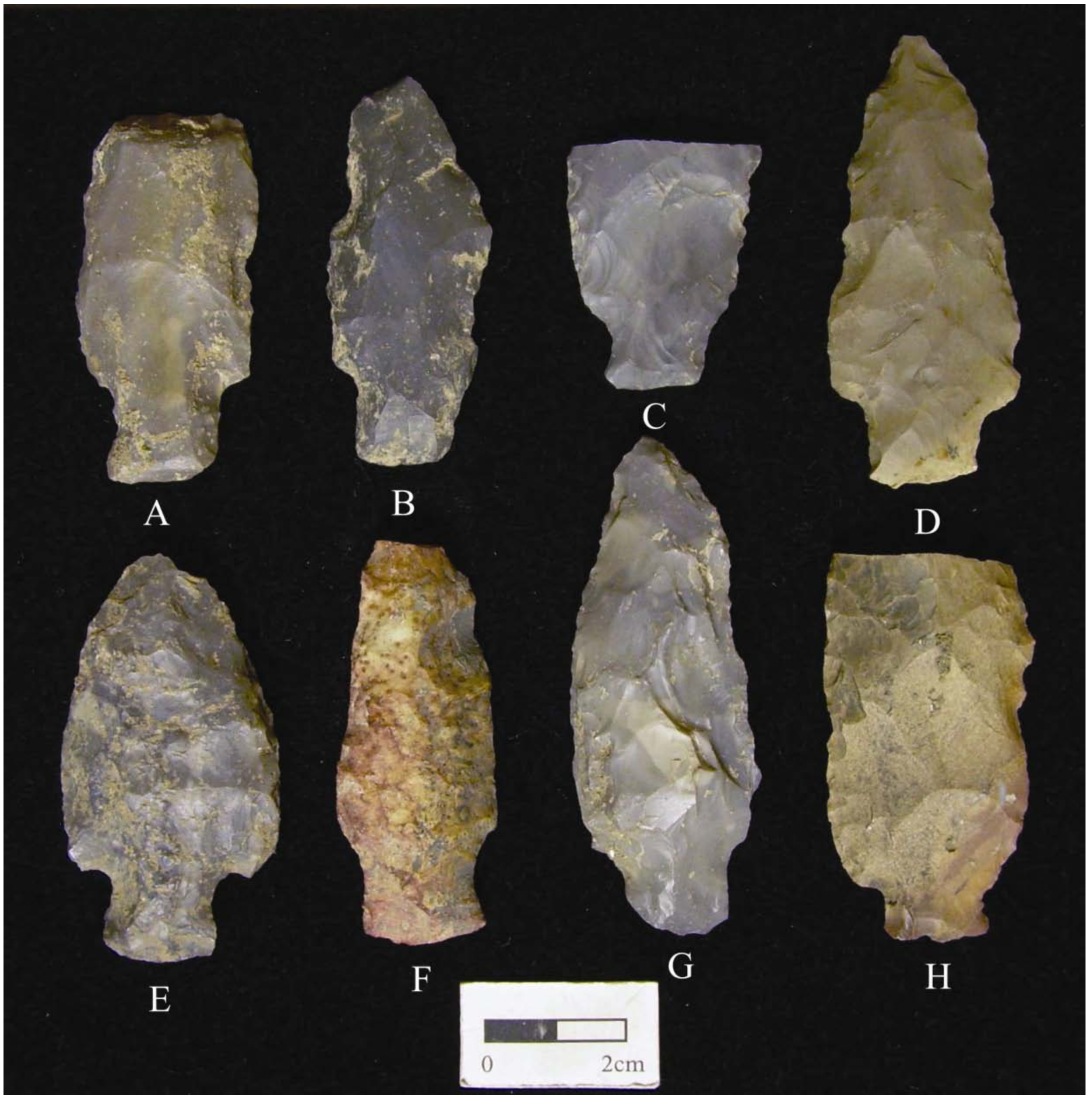


Figure 7-14. Late Archaic Stemmed Hafted Bifaces from Chiggerville.

The diversity of the Late Archaic assemblages, particularly at Chiggerville, is remarkable considering that most of these clusters are considered diagnostic of other regions. For instance, the two dominant clusters other than Saratoga are Ledbetter (Figure 7-16) and Benton (Figure 7-17) points, which are considered diagnostic of the

Tennessee River region to the south (Justice 1995), where, during the Middle Archaic, they are sometimes found in caches of oversized bifaces that include Turkey-tail forms (Johnson and Brookes 1989, Meeks 1999). A cache of Benton points associated with Burial No. 612 at Indian Knoll was AMS dated to 4570 +/-75 B.P., justifying the Late Archaic age for Benton points in the middle Green River region (Herrmann 2007). Evidence that distinct Benton Cluster manufacturing groups were present in the Green River region comes from the Parrish Village site in Hopkins County, Kentucky, where a significant number of Benton and Elk River Stemmed points were recovered (e.g., Webb 1951:428). Hensley-Martin (1986:147) identified a dozen Ledbetter points at the Read Shell Midden and Maggard and Pollack (2006:58) identified three Pickwick points at Highland Creek, indicating that this cluster is also present at more than one Green River site. Summary Statistics for Elk River Stemmed and Ledbetter projectile points from Chiggerville are provided in Tables 7-21 and 7-22.

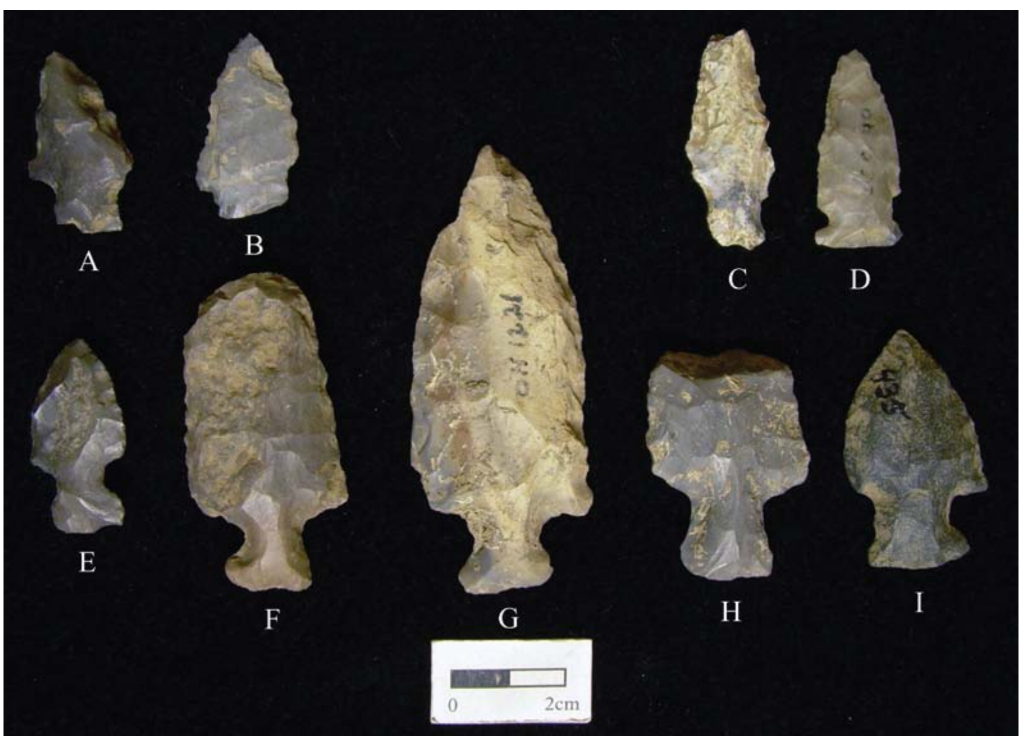


Figure 7-15. Riverton and Motley Hafted Bifaces from Chiggerville.

Table 7-20. Late Archaic Hafted Bifaces from Baker and Chiggerville, not including Saratoga Cluster Points from Chiggerville.

	Cluster	Type	Drawknife	Hafted Drill	Hafted Microperforator	Hafted Scraper	Projectile Point
Baker	Benton	Benton Stemmed	0	0	0	0	1
	Late Archaic Stemmed	Karnak	0	0	0	0	1
		Jakie Stemmed	0	0	0	0	2
		UID	0	0	0	0	1
	Matanzas	Matanzas Side Notched	0	0	0	0	1
	Saratoga	Saratoga Expanding Stemmed	0	0	0	0	2
	Turkey-tail	UID	0	1	0	0	0
	Susquehanna	Perkiomen	0	0	0	0	1
Chiggerville	Benton	Benton Stemmed	0	0	0	3	7
		Elk River Stemmed	1	0	0	0	22
		UID	0	0	0	0	1
	Brewerton	Brewerton Corner Notched	0	0	0	3	1
	Etley	Etley	0	0	0	1	10
	Late Archaic Stemmed	Karnak	0	0	0	1	1
		McWhinney	0	0	0	2	20
		UID	0	1	1	12	30
	Ledbetter	Ledbetter	0	0	0	0	16
		Pickwick	0	0	0	0	6
		UID	0	2	0	0	4
	Matanzas	Matanzas Side Notched	0	1	0	2	11
	Merom	Riverton	0	0	0	0	4
	Motley	Motley	0	0	0	2	6
	Terminal Archaic Barbed	Buck Creek Barbed	0	0	0	0	4
		Wade	0	0	0	2	4
		UID	0	0	0	1	2
	Turkey-tail	UID	0	0	0	0	2
	Wadlow	Wadlow	0	0	0	0	1

Figure 7-16. Ledbetter Cluster Hafted Bifaces from Chiggerville.

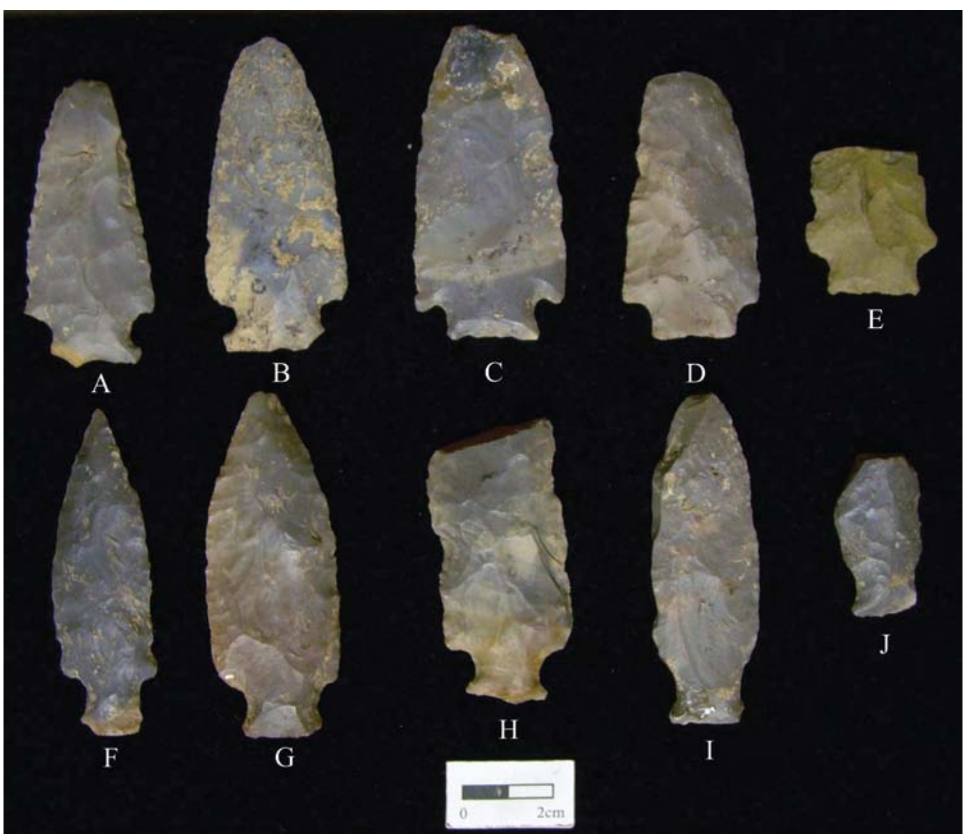


Figure 7-17. Benton Cluster Hafted Bifaces from Chiggerville.

Table 7-21. Summary Statistics for Elk River Stemmed Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	8	15	18
Missing	14	7	4
Mean	67	24	9
Median	62	24	8
Mode	62	22, 24, 27	8
Std. Deviation	13.969	2.356	1.685
Minimum	51	20	6
Maximum	95	28	13

Table 7-22. Summary Statistics for Ledbetter Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	8	14	15
Missing	8	2	1
Mean	64	33	10
Median	61	33	10
Mode	57	33	10
Std. Deviation	15.854	4.053	1.163
Minimum	43	25	8
Maximum	89	40	12

The Etley (Figure 7-18), Wadlow, Brewerton (Figure 7-19a-c), and McWhinney (Figure 7-14e-h) types are all typically found concentrated north of the Ohio River (Justice 1995). Etley and Wadlow points were both manufactured by Titterington phase groups in Illinois (Cook 1976). Klippel (1969) was consulted when classifying the Etley points from Chiggerville since many are heavily reworked and maintained points in the latter stages of wear. Matanzas (Figure 7-19d-i), Brewerton, and McWhinney hafted bifaces were the dominant types at the Robert Dudgeon site in Taylor County, Kentucky (Duffield 1966), indicating that groups manufacturing these points were present in the region, and an Etley point was identified at the Highland Creek site (Maggard and

Figure 7-18. Etley Hafted Bifaces from Chiggerville.

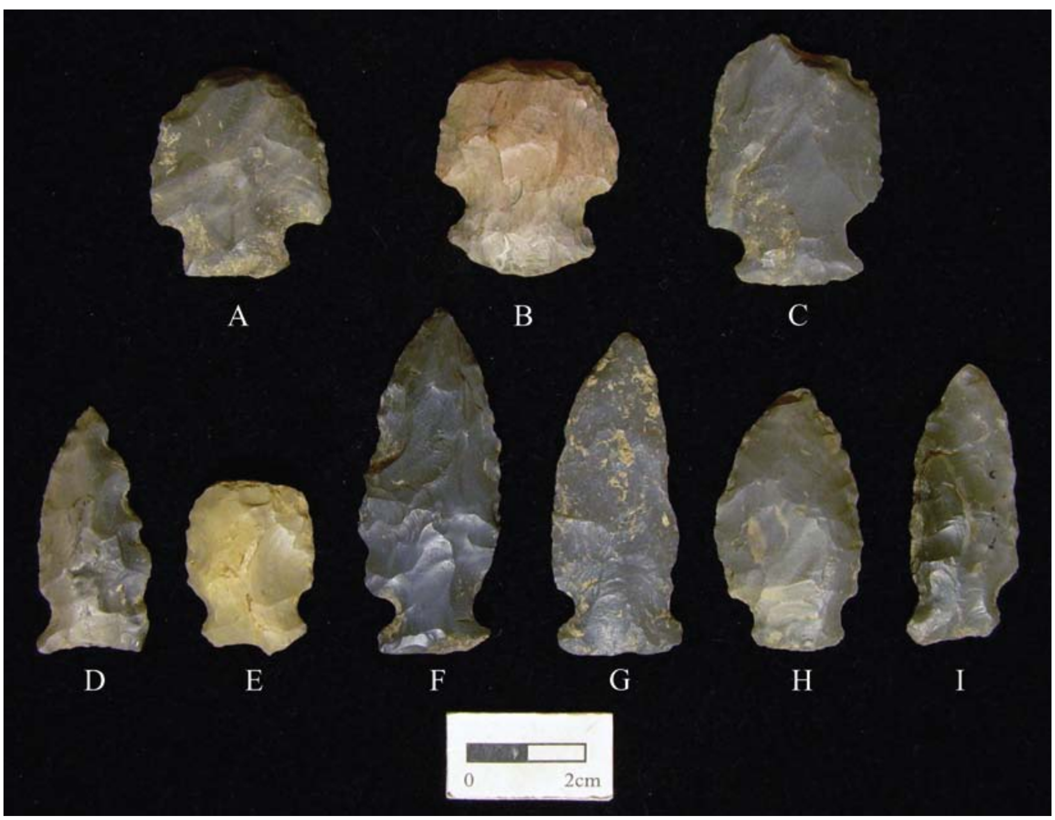


Figure 7-19. Brewerton and Matanzas Hafted Bifaces from Chiggerville.

Table 7-23. Summary Statistics for Etley Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	6	9	10
Missing	4	1	0
Mean	65	28	8
Median	65.5	27	8.5
Mode	N/A	N/A	9
Std. Deviation	8.589	4.702	0.699
Minimum	55	22	7
Maximum	77	36	9

Table 7-24. Summary Statistics for McWhinney Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	5	10	11
Missing	15	10	9
Mean	68	24	10
Median	66	22.5	10
Mode	N/A	21	10
Std. Deviation	9.762	4.055	1.342
Minimum	58	19	8
Maximum	83	31	12

Table 7-25. Summary Statistics for Matanzas Side Notched Projectile Points from Chiggerville.

	Max Length	Max Width	Max Thickness
Valid	6	8	9
Missing	5	3	2
Mean	44	23	8
Median	41.5	23	8
Mode	N/A	24	7, 8
Std. Deviation	8.167	2.268	1.364
Minimum	36	18	6
Maximum	58	25	10

Pollack 2006:58). Summary statistics for Etley, McWhinney, and Matanzas Side Notched points from Chiggerville are provided in Tables 7-23 through 7-25.

The Jakie Stemmed and Perkiomen points identified at Baker are unique in that these points are typically found in regions to the west and east, respectively (Justice 1995). Jakie Stemmed points are expanding stemmed forms with basal concavities typically found in Missouri (Chapman 1975), while Perkiomen points are more common in Pennsylvania and elsewhere in the northeast (Ritchie 1971, Witthoft 1953). How these points came to be present at Baker is unknown.

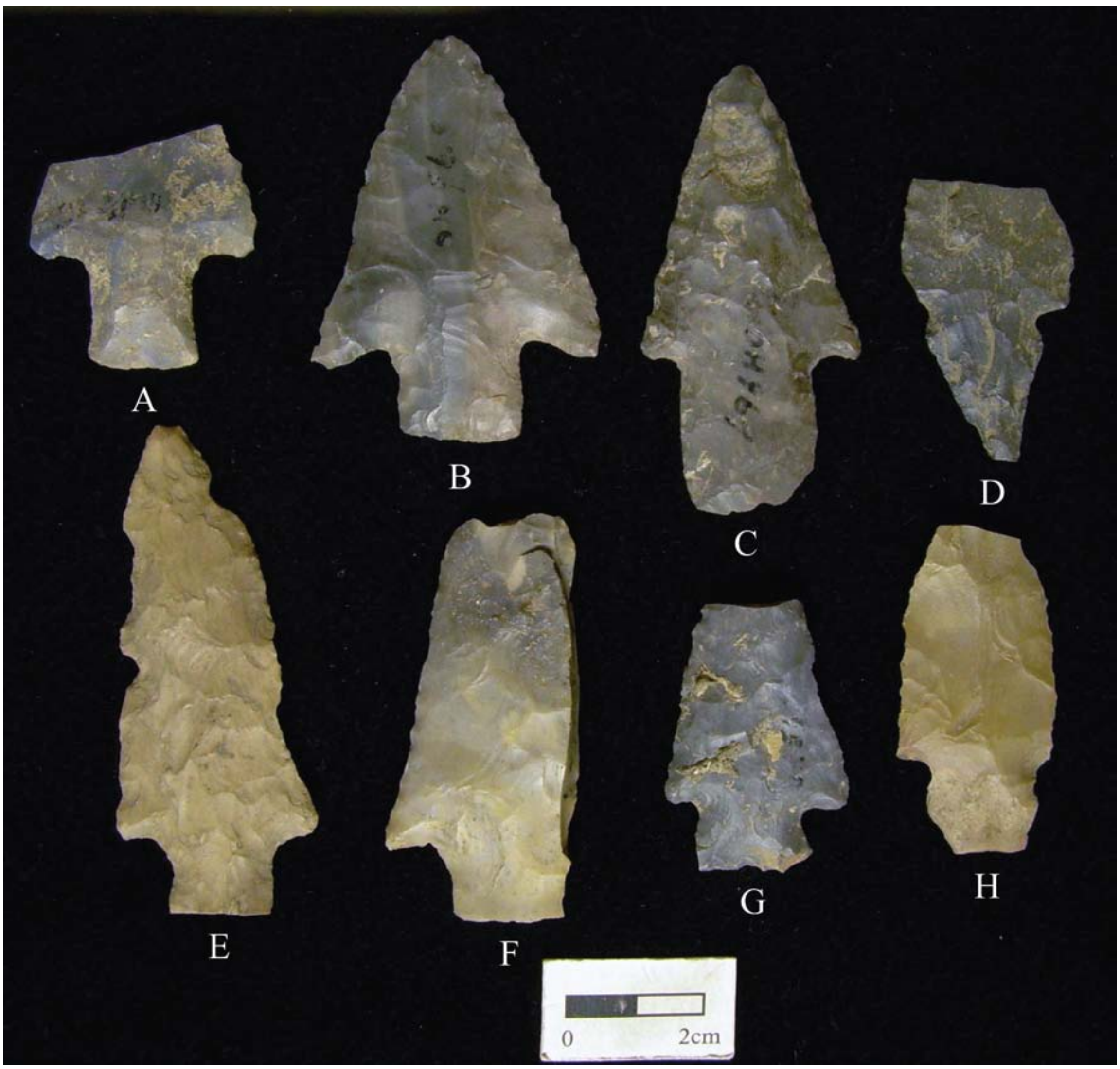


Figure 7-20. Terminal Archaic Hafted Bifaces from Chiggerville.

The Riverton (Figure 7-15a-d) and Terminal Archaic Barbed Cluster points at Chiggerville are typically dated to after the Saratoga occupation at this site (Justice 1995) so likely post-date the main Late Archaic occupation. This relative date for these groups in the Green River is partly confirmed by the recovery of nine Riverton points from the shell free midden at Carlston Annis (Marquardt 2005:370). The Terminal Archaic Barbed Cluster points include both the Buck Creek Barbed (Figure 7-20a-c) and Wade (Figure 7-20e-g) types, which are typically found to the north and south of the Green River region, respectively (Justice 1995). Additional research is required to more fully understand the nature of Terminal Archaic use of the Green River shell middens. It is possible the Turkey-tail points (Figure 7-20d, h) from Chiggerville date to the Terminal Archaic as well (Justice 1995).

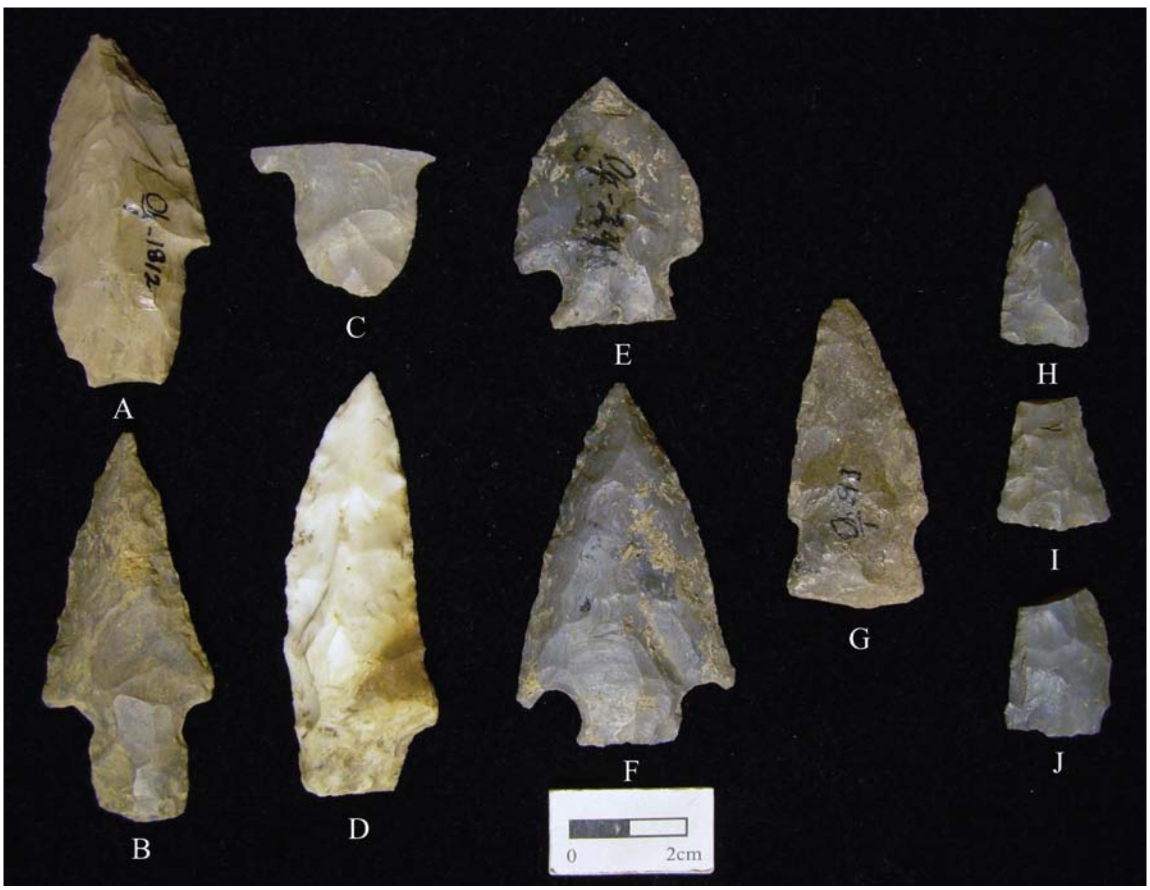


Figure 7-21. Woodland Hafted Bifaces from Chiggerville.

Occupation of Baker and Chiggerville during the Woodland period was apparently sporadic and short term (Table 7-26). Only a single Snyders Cluster projectile point was recovered from Baker. A few Early Woodland Dickson Cluster points represent a brief Early Woodland occupation at Chiggerville. Similarly, Adena Stemmed (Figure 7-21c) and Cypress Stemmed (Figure 7-21a, b) points were found in contexts post-dating the Late Archaic Saratoga occupation at sites in the Carrier Mills Archaeological District in Illinois (May1982), suggesting the Chiggerville's Late Archaic and Early Woodland occupants may be temporally related to one another. The Dickson Contracting Stemmed (Figure 7-21d) point is manufactured from a milky white chert that may be Burlington chert, which would suggest it was brought or traded into the region from Illinois or Missouri. The Lowe (Figure 7-21g) and Snyders (Figure 7-21e, f) points indicate brief use of both sites during the Middle Woodland period.

Table 7-26. Woodland Hafted Bifaces from Baker and Chiggerville.

<table>
<tr><th></th><th>Cluster</th><th>Type</th><th>Projectile Point</th></tr>
<tr><td>Baker</td><td>Snyders</td><td>UID</td><td>1</td></tr>
<tr><td rowspan="7">Chiggerville</td><td rowspan="5">Dickson</td><td>Adena Stemmed</td><td>1</td></tr>
<tr><td>Cypress Stemmed</td><td>2</td></tr>
<tr><td>Dickson Contracting Stemmed</td><td>1</td></tr>
<tr><td>UID</td><td>2</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Lowe</td><td>Lowe Flared Base</td><td>1</td></tr>
<tr><td>Snyders</td><td>UID</td><td>2</td></tr>
</table>

No Late Prehistoric points were recovered from Baker, but the Chiggerville assemblage contains four triangular projectile points (Table 7-27; Figure 7-21h-i). This should come as no surprise given the large numbers of Late Prehistoric shell-tempered sherds recovered from the site (see chapter 5), and it is possible that more triangular points would have been recovered had modern recovery methods been employed by the WPA. Like the ceramics from the site, the Late Prehistoric points from Chiggerville were concentrated in plowzone contexts. Two were recovered from the half foot level,

Table 7-27. Late Prehistoric Hafted Bifaces from Chiggerville.

Cluster	Type	Projectile Point
LW/MS Triangular	Hamilton Incurvate	1
	Madison	3
	UID	1

one from the one foot level, one from the two foot level, and one from a general context at the site. The nature of the Late Prehistoric utilization of Chiggerville is unknown.

Large Side Notched Cluster Points from Baker and Saratoga Cluster Points from Chiggerville

The Large Side Notched Cluster, as defined by Justice (1995), includes several projectile point types with deep rounded to square notches and broad, rectanguloid hafting elements. The points in this cluster range in age from the Early Archaic (e.g., Big Sandy points) to the Late Archaic-Early Woodland transition (e.g., Osceola points). However, the majority of the Large Side Notched point types mentioned by Justice (1995) and found elsewhere in the literature are considered diagnostic of the Middle Archaic period.

Figure 7-22. Godar/Raddatz Hafted Bifaces from Baker.

Large Side Notched points from the Baker site (Figure 7-22) are listed by type and morphofunctional category in Table 7-28. The majority of the Large Side Notched hafted bifaces have been classified as belonging to the Godar/Raddatz type. Justice (1995:67-69) uses the Raddatz type, named after the Raddatz Rockshelter site in Wisconsin, to classify points similar to those from Baker and includes the Godar type name as a morphological correlate of the Raddatz type. The name Godar/Raddatz has been used herein to remain consistent in the use of Justice's (1995) typological system while acknowledging the widespread preference for the Godar type name in Kentucky and Illinois. These points are considered morphological correlates of the Midsouthern Big Sandy II type (Justice 1995).

Table 7-28. Large Side Notched Cluster Hafted Bifaces from Baker.

Type	Hafted Drill	Hafted Microperforator	Hafted Scraper	Projectile Point
Godar/Raddatz	4	1	48	118
UID	0	0	0	6

The Godar hafted biface type consists of very well made, thin projectile points manufactured on large flakes using a combination of a well executed blade thinning technique and pressure retouch (Cook 1976:145). Like other Large Side Notched points, Godar hafted bifaces exhibit large, rectanguloid bases and squared notches. When the notches have not been squared by retouch, "the notches commonly end in punched, true-notch flake scars" (May 1982:1360). Other characteristics of these points that are typically included in type descriptions (e.g., blade shape and barb form) are treated herein as variables rather than as diagnostic characteristics. Summaries and discussions of these variables are treated below.

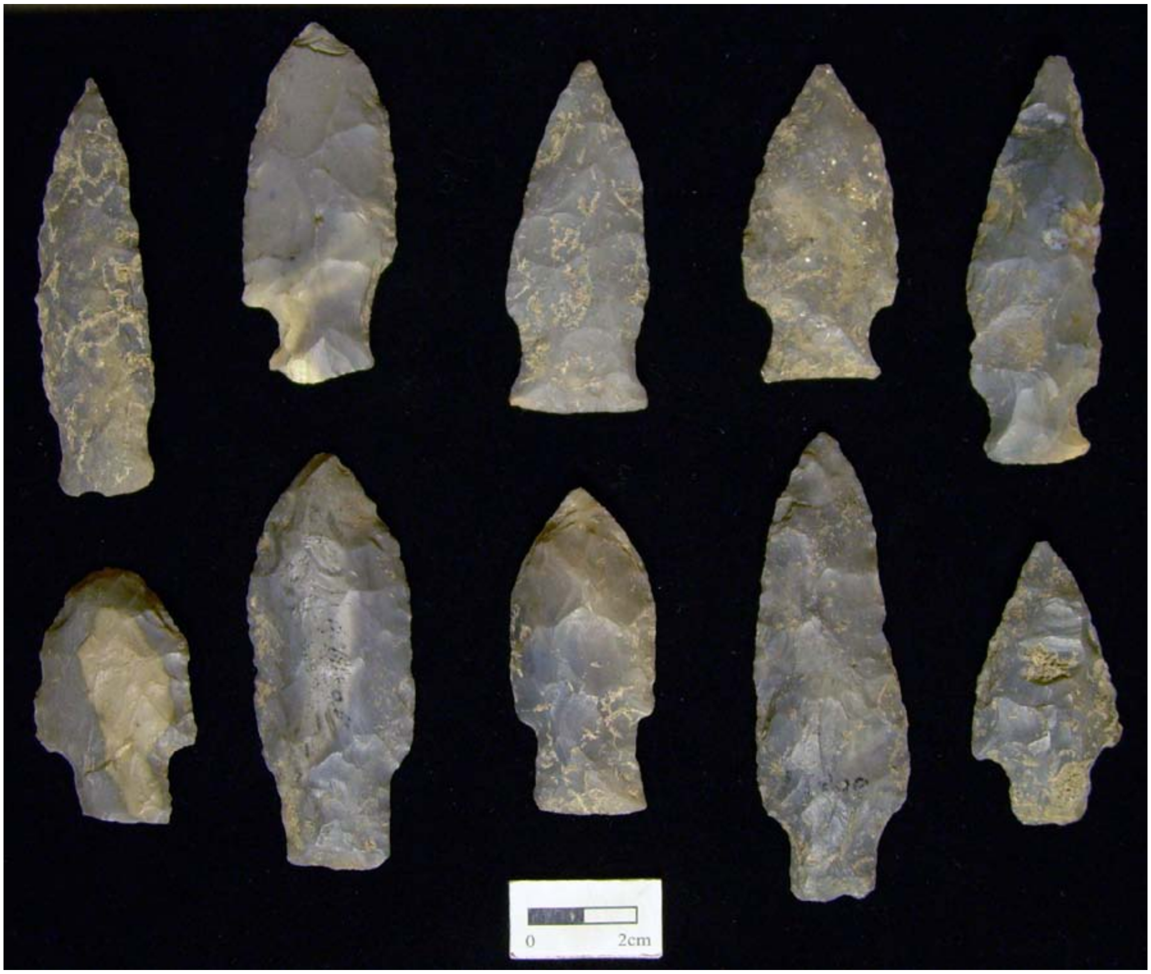


Figure 7-23. Saratoga Cluster Hafted Bifaces from Chiggerville.

Saratoga Cluster points from Chiggerville (Figure 7-23) are listed by type and morphofunctional category in Table 7-29. As defined by Justice (1995), these points include a wide range of Late Archaic to Early Woodland straight to expanding stemmed forms in the greater lower Ohio River valley region. For this reason, it is perhaps more appropriate to adopt the term ‘Oak Grove’ for Late Archaic Saratoga Cluster points occurring in western Kentucky. This type was named by Jack Schock based on specimens recovered from the Late Archaic Site 15Ch307 in Christian County (Schock et al. 1977). Morphologically, Saratoga Cluster points at Chiggerville are indistinguishable from those at Site 15Ch307 and also resemble Saratogas, as originally defined by

Table 7-29. Saratoga Cluster Hafted Bifaces from Chiggerville.

Type	Hafted Drill	Hafted Scraper	Projectile Point
Saratoga Expanding Stemmed	12	49	127
Saratoga Straight Stemmed	4	31	30
UID	0	6	17

Winter's (1967) in the Wabash River valley of Illinois and as described by May (1982) at Carrier Mills.

Rather than arbitrarily dividing Large Side Notched and Saratoga Cluster hafted bifaces into morphological types that may or may not have true functional connotations, bifaces assigned to these clusters are treated below as single groups and all shape characteristics treated as variables. This method of analysis is preferable to standard analyses, which first divides hafted bifaces into one or more types across clusters and then into several morphofunctional categories (e.g., hafted scrapers, projectile points, etc.) in that it eliminates one potentially biased step in the classification process. Additionally, this technique allows hafted biface 'types' to be treated as hypothetical variants rather than structuring variables. This analytical technique is particularly preferable in this analysis in that different morphofunctional categories are treated as part of a single biface life cycle rather than as distinct artifact types. Of course, it would be best to include Large Side Notched and Saratoga Cluster biface preforms in this kind of 'life cycle' study, but the lack of a standard typology for assigning specific bifaces to particular point clusters precludes including these objects at the present time. Summary statistics relating to the metric variables collected from Large Side Notched and Saratoga Cluster points from the two sites are provided in Tables 7-30 and 7-31. Raw metric data

Table 7-30. Summary Statistics for Large Side Notched Cluster Hafted Bifaces from Baker.

	Max Length	Blade Length	Max Length - Blade Length	Max Width	Max Thickness	Max Thick of Blade	Width Blade Midsection	Thick Blade Midsection	Base Width
Valid	65	62	52	79	99	101	61	62	104
Missing	112	115	125	98	78	76	116	115	73
Mean	35	23	12	27	7	7	23	7	25
Median	36	23	12	27	7	7	24	7	25
Mode	22	23	12, 13	29	7	7	24, 26	7	24
Std. Dev.	9.679	10.241	1.991	2.380	0.908	0.926	3.653	0.954	3.274
Minimum	18	5	8	22	5	5	13	5	14
Maximum	54	42	16	33	9	9	30	9	34

	Width 1/3 Blade Length	Thickness 1/3 Blade Length	Width 2/3 Blade Length	Thickness 2/3 Blade Length	Max Width of Haft Element	Min Width of Haft Element	Min Notch Width	Max Thickness of Haft Element	Max Thickness of Notches
Valid	61	62	62	62	110	132	133	136	138
Missing	116	115	115	115	67	45	44	41	39
Mean	21	6	25	7	27	18	18	6	6
Median	22	6	25.5	7	27	18	18	6	6
Mode	17, 25	6	26	7	29	18	18	6	6
Std. Dev.	4.524	1.007	3.237	1.080	2.866	1.891	1.910	0.885	0.883
Minimum	11	4	14	5	18	12	12	4	4
Maximum	29	9	31	9	36	24	24	9	9

Table 7-31. Summary Statistics for Saratoga Cluster Hafted Bifaces from Chiggerville.

	Max Length	Blade Length	Max Length -Blade Length	Max Width	Max Thickness	Max Thickness of Blade	Width Blade Midsection	Thick Blade Midsection	Base Width
Valid	137	136	125	221	233	229	135	135	182
Missing	139	140	151	55	43	47	141	141	94
Mean	48	33	16	26	9	9	23	9	18
Median	47	31	16	25	9	9	23	8	18.5
Mode	49	28	17	25	9	9	22, 23, 25	8	19
Std. Dev.	13.261	14.233	2.521	3.461	1.528	1.542	3.905	1.558	2.625
Minimum	21	8	10	17	6	6	11	6	11
Maximum	87	75	24	35	17	17	32	17	26

	Width 1/3 Blade Length	Thickness 1/3 Blade Length	Width 2/3 Blade Length	Thickness 2/3 Blade Length	Max Width of Haft Element	Min Width of Haft Element	Max Thickness of Haft Element
Valid	134	135	134	135	196	235	246
Missing	142	141	142	141	80	41	30
Mean	20	8	24	9	20	17	8
Median	21	8	24	9	20	17	8
Mode	22	8	24	8	19	18	8
Std. Dev.	4.516	1.565	3.668	1.738	2.036	1.889	1.308
Minimum	10	5	14	6	15	13	6
Maximum	30	16	33	17	26	24	15

are provided in Appendices 4 and 5, and non-metric trait frequencies are provided in Appendices 6 and 7.

Comparison of the Two WPA Assemblages

This section compares the relative complexity of the Baker and Chiggerville lithic assemblages by evaluating aspects of technological organization and specialization. The primary means of assessing the relative complexity of these assemblages is through comparison of metric and non-metric data pertaining to the dominant form of hafted bifaces found at the two sites – Large Side Notched Cluster points at Baker and Saratoga Cluster points at Chiggerville. Additional insights into these microscalar aspects of complexity are derived from some of the other tool types described above.

The means for assessing the relative complexity of technological organization used in this study is through an evaluation of the degree to which hafted bifaces at the two sites were curated. Curation can be indirectly analyzed by examining the degree to which hafted bifaces of a certain type were recycled into a variety of tool forms and through metric analysis of blade reuse through rejuvenation.

As can be seen from Tables 7-28 and 7-29, both Large Side Notched Cluster points from Baker and Saratoga Cluster points from Chiggerville were recycled into hafted drills and hafted scrapers, and one hafted biface from Baker was manufactured into a hafted microperforator. If the frequency of recycled tool forms at one site was significantly greater than the frequency of recycled tool forms at the other, then the assemblage exhibiting the higher frequency of recycled tool forms might be said to represent a more highly curated assemblage. However, a Chi-square test indicates that frequency of various tool forms does not differ significantly from expected ($\chi^2 = 6.017$; *df*

= 3; p = .111). The same result was obtained when the single hafted microperforator was eliminated from the sample (χ^2 = 4.460; *df* = 2; p = .108). Based on the diversity of recycled tool forms, neither site can be said to be relatively more complex.

Since recycling and rejuvenation of hafted bifaces are processes that are more likely to affect the shape and size of artifact blades than hafting elements, it was decided that comparisons between hafting element size and blade size would best reflect curation behavior related to these activities. Variables selected for this portion of the analysis include maximum length, blade length, maximum length minus blade length (i.e., length of hafting element), width of blade mid-section, width of 1/3 blade length, width of 2/3 blade length, and maximum width of hafting element. As can be seen from Tables 7-32 and 7-33, all but one of these variables are normally distributed; however, examination of a histogram of the haft element widths of the Chiggerville hafted bifaces indicates that this variable is very close to normally distributed and is treated as such herein (Figure 7-24).

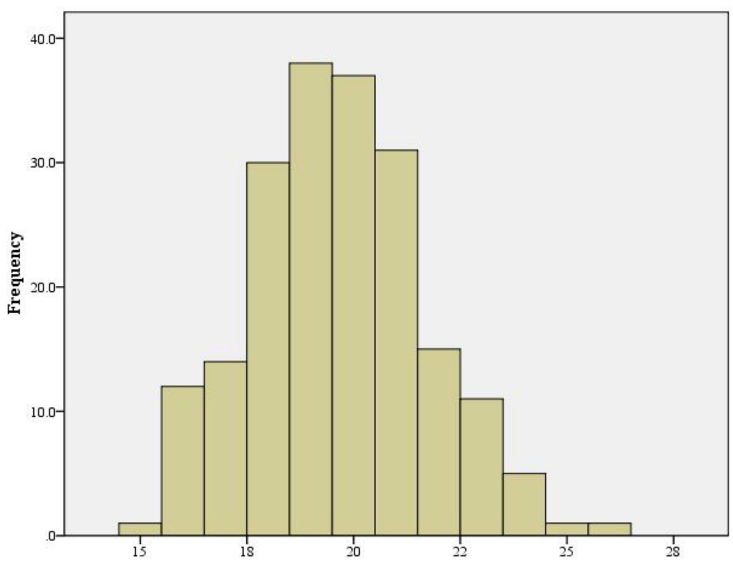


Figure 7-24. Histogram of Maximum Width of Haft Element of Saratoga Cluster Hafted Bifaces from Chiggerville.

Table 7-32. One-Sample Kolmogorov-Smirnov Test for Baker Hafted Bifaces.

		Max Length	Blade Length	Max Length -Blade Length	Width Blade Midsection	Width 1/3 Blade Length	Width 2/3 Blade Length	Max Width of Haft Element
N		65	62	52	61	61	62	110
Normal Parameters[a]	Mean	35.492	23.242	12.269	23.230	20.656	24.823	26.700
	Std. Dev	9.679	10.241	1.991	3.653	4.524	3.237	2.866
Most Extreme Differences	Absolute	0.088	0.067	0.111	0.141	0.125	0.142	0.089
	Positive	0.071	0.067	0.111	0.069	0.118	0.066	0.084
	Negative	-0.088	-0.056	-0.085	-0.141	-0.125	-0.142	-0.089
Kolmogorov-Smirnov Z		0.708	0.529	0.804	1.100	0.976	1.118	0.932
Asymp. Sig. (2-tailed)		0.698	0.942	0.538	0.177	0.296	0.164	0.350
a. Test distribution is Normal.								

Table 7-33. One-Sample Kolmogorov-Smirnov Test for Chiggerville Hafted Bifaces.

		Max Length	Blade Length	Max Length -Blade Length	Width Blade Midsection	Width 1/3 Blade Length	Width 2/3 Blade Length	Max Width of Haft Element
N		137	136	125	135	134	134	196
Normal Parameters[a]	Mean	48.401	32.699	16.000	22.830	20.261	24.231	19.653
	Std. Deviation	13.261	14.233	2.521	3.905	4.516	3.668	2.036
Most Extreme Differences	Absolute	0.080	0.093	0.102	0.075	0.072	0.085	0.110
	Positive	0.080	0.093	0.102	0.060	0.072	0.077	0.110
	Negative	-0.044	-0.041	-0.102	-0.075	-0.072	-0.085	-0.083
Kolmogorov-Smirnov Z		0.934	1.080	1.143	0.874	0.839	0.983	1.547
Asymp. Sig. (2-tailed)		0.348	0.194	0.147	0.429	0.483	0.288	0.017
a. Test distribution is Normal.								

Table 7-34. T-Test for Equality of Means for Select Metric Variables.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Max Length	Equal variances assumed	6.199	.014	-7.008	200	.000	-12.909	1.842	-16.541	-9.277
	Equal variances not assumed			-7.820	166.578	.000	-12.909	1.651	-16.168	-9.650
Blade Length	Equal variances assumed	6.948	.009	-4.703	196	.000	-9.457	2.011	-13.422	-5.491
	Equal variances not assumed			-5.302	159.759	.000	-9.457	1.784	-12.979	-5.934
Max Length - Blade Length	Equal variances assumed	3.402	.067	-9.504	175	.000	-3.731	.393	-4.505	-2.956
	Equal variances not assumed			-10.465	119.774	.000	-3.731	.357	-4.437	-3.025
Width Blade Midsection	Equal variances assumed	0.004	.948	.677	194	.499	.400	.591	-.765	1.565
	Equal variances not assumed			.694	123.228	.489	.400	.576	-.740	1.540
Width 1/3 Blade Length	Equal variances assumed	0.224	.636	.565	193	.572	.395	.698	-.982	1.771
	Equal variances not assumed			.565	116.009	.573	.395	.698	-.989	1.778

Table 7-34 (continued)

Width 2/3 Blade Length	Equal variances assumed	0.653	.420	1.088	194	.278	.591	.543	-.481	1.663
	Equal variances not assumed			1.139	133.440	.257	.591	.519	-.435	1.618
Max Width of Haft Element	Equal variances assumed	12.734	.000	24.988	304	.000	7.047	.282	6.492	7.602
	Equal variances not assumed			22.767	171.806	.000	7.047	.310	6.436	7.658

To correct for this, two sets of ratios were developed. Based upon the assumption that curation behavior is more likely to influence blade forms than hafting element forms, lengths and widths of these two groups of hafted bifaces were standardized using a ratio based upon hafting element widths and lengths (i.e., maximum length minus blade length). T-tests for equality of means of these ratios from the two sites indicate that the means of all but two ratios are statistically significant (Tables 7-35 and 7-36). These data indicate that Large Side Notched Cluster hafted bifaces from Baker are shorter and have shorter blade lengths relative to hafting element lengths than Saratoga Cluster hafted bifaces from Chiggerville but that these differences are not statistically significant. Blades of the Baker points are also narrower relative to hafting elements widths than the hafted biface blades at Chiggerville, and these differences are significant. Taken together, these results suggest that the hafted bifaces from Baker are more heavily recycled than those from Chiggerville, indicating greater complexity in technological organization. Statistics for width to length ratios are provided for descriptive purposes but have no bearing on the question of complexity.

The next variable analyzed to assess complexity of technological organization was chert type. Of the 25 chert-bearing deposits identified by Gatus (2005) in the middle Green River region, 11 chert types were identified in large enough quantities to have potentially been utilized by prehistoric groups. Given this variability of chert types available in the region, procurement of a single type of chert is suggestive of a logistical procurement strategy while procurement of a variety of chert types is suggestive of an embedded strategy. As can be seen in Table 7-37, the main chert type present at both sites is Ste Genevieve chert (these data do not include diagnostic hafted bifaces other than

Table 7-35. Descriptive Statistics for Ratios from Baker and Chiggerville.

	Site	N	Mean	Std. Deviation	Std. Error Mean
MaxLength/ HLength	Baker	52	2.8827	1.02117	.14161
	Chiggerville	125	3.1037	1.01703	.09097
BladeLength/ HLength	Baker	52	1.8827	1.02117	.14161
	Chiggerville	125	2.1036	1.01510	.09079
WidthMid/ HLength	Baker	51	1.8893	.39181	.05486
	Chiggerville	124	1.4533	.35171	.03158
Width13/ HLength	Baker	51	1.6646	.44064	.06170
	Chiggerville	123	1.2789	.33666	.03036
Width23/ HLength	Baker	52	2.0354	.36027	.04996
	Chiggerville	123	1.5494	.36523	.03293
MaxLength/ HWidth	Baker	59	1.3515	.41827	.05445
	Chiggerville	114	2.5096	.79862	.07480
BladeLength/ HWidth	Baker	47	.8521	.43803	.06389
	Chiggerville	105	1.7088	.80374	.07844
WidthMid/ HWidth	Baker	46	.8831	.16108	.02375
	Chiggerville	104	1.1777	.22460	.02202
Width1/3/ HWidth	Baker	46	.7779	.19497	.02875
	Chiggerville	103	1.0516	.24740	.02438
Width2/3/ HWidth	Baker	47	.9468	.13900	.02027
	Chiggerville	103	1.2515	.21419	.02110

Saratoga Cluster points at Chiggerville and Large Side Notched Cluster points at Baker). A Chi-square test indicates that the frequency of various chert types observed at the two sites differs significantly from expected (χ^2 = 13.862; *df* = 5; p = .017). The greatest differences between observed and expected values occurred within the fossiliferous chert type, with Baker yielding more examples of this type than expected and Chiggerville fewer than expected. Although not statistically significant based on the standardized residuals, fewer than expected artifacts from Baker and more than expected from Chiggerville were manufactured from Ste Genevieve chert, indicating that the inhabitants of Baker were obtaining cherts from a wider variety of sources (Table 7-37). These

Table 7-36. T-Test for Equality of Means for Ratios.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MaxLength/ HLength	Equal variances assumed	.016	.900	-1.315	175	.190	-.22092	.16803	-.55254	.11070
	Equal variances not assumed			-1.313	95.112	.192	-.22092	.16831	-.55506	.11321
BladeLength/ HLength	Equal variances assumed	.019	.892	-1.316	175	.190	-.22082	.16780	-.55200	.11035
	Equal variances not assumed			-1.313	94.949	.192	-.22082	.16822	-.55478	.11313
WidthMid/ HLength	Equal variances assumed	1.870	.173	7.205	173	.000	.43598	.06051	.31655	.55541
	Equal variances not assumed			6.887	84.845	.000	.43598	.06331	.31011	.56185
Width13/ HLength	Equal variances assumed	7.337	.007	6.261	172	.000	.38571	.06161	.26411	.50732
	Equal variances not assumed			5.609	75.324	.000	.38571	.06876	.24874	.52269
Width23/ HLength	Equal variances assumed	.411	.522	8.077	173	.000	.48601	.06017	.36724	.60477

Table 7-36 (continued)

	Equal variances not assumed			8.122	97.267	.000	.48601	.05984	.36725	.60476
MaxLength/ HWidth	Equal variances assumed	13.553	.000	-10.414	171	.000	-1.15809	.11121	-1.37761	-.93858
	Equal variances not assumed			-12.517	170.960	.000	-1.15809	.09252	-1.34072	-.97546
BladeLength/ HWidth	Equal variances assumed	10.549	.001	-6.857	150	.000	-.85666	.12493	-1.10350	-.60981
	Equal variances not assumed			-8.468	144.232	.000	-.85666	.10117	-1.05662	-.65669
WidthMid/ HWidth	Equal variances assumed	4.365	.038	-8.026	148	.000	-.29468	.03672	-.36723	-.22212
	Equal variances not assumed			-9.098	117.661	.000	-.29468	.03239	-.35882	-.23053
Width13/ HWidth	Equal variances assumed	1.410	.237	-6.636	147	.000	-.27372	.04125	-.35524	-.19221
	Equal variances not assumed			-7.262	108.284	.000	-.27372	.03769	-.34843	-.19902
Width23/ HWidth	Equal variances assumed	6.026	.015	-8.922	148	.000	-.30462	.03414	-.37209	-.23715
	Equal variances not assumed			-10.409	130.561	.000	-.30462	.02927	-.36251	-.24672

Table 7-37. Chert Types Identified at Baker and Chiggerville.

		Chert Variability						
		Fort Payne	St Louis/ Ste Genevieve	Ste Genevieve	Fossiliferous	Burned	Other	Total
Baker	Count	1	22	765	13	10	65	876
	Expected Count	2.5	23.7	776.2	6.8	8.5	58.3	876.0
	Std. Residual	-1.0	-.3	-.4	2.4	.5	.9	
Chiggerville	Count	5	34	1071	3	10	73	1196
	Expected Count	3.5	32.3	1059.8	9.2	11.5	79.7	1196.0
	Std. Residual	.8	.3	.3	-2.1	-.5	-.7	
Total	Count	6	56	1836	16	20	138	2072
	Expected Count	6.0	56.0	1836.0	16.0	20.0	138.0	2072.0

differences, although not definitive, do suggest that the inhabitants of Baker were practicing a more embedded form of lithic procurement, while the inhabitants of Chiggerville were practicing a more logistically organized strategy. Such a pattern of embedded procurement was identified among the Large Side Notched Cluster producing groups at the Black Earth site in southern Illinois (Morrow and Jefferies 1989) and provides evidence that a more complex form of technological organization was being practiced by the inhabitants of the Chiggerville site.

Testing for craft specialization among hunter-gatherer groups is somewhat more complex than testing for greater or less curation. According to Cross (1990), craft specialization is expected in situations characterized by greater numbers of steps in production, a spatial or temporal separation of production stages, increased storage of production stages, uniformity in the products and by-products of tool manufacture, increased distances to raw materials, increased time spent in production, and an increased number of items produced. The first three of these criteria require data from many sites within a settlement system so cannot be assessed with these data; however, it is telling that many of the Green River sites excavated by the WPA yielded caches of bifaces and other tools that may support a model of lithic craft specialization among these groups (e.g., Webb 1974). No caches of chipped stone tools were identified at Baker, but two caches were recovered at Chiggerville (Feature Nos. 33 and 42). These features were likely the remnants of flintknapping activity areas rather than evidence of 'storage of production stages', however, given that most of the objects in both caches were cores, flake tools, and amorphous cores and not bifaces. Preference for Ste Genevieve chert by the inhabitants of Chiggerville and the possibility that a logistical procurement strategy was practiced by inhabitants of this site also may support the specialization hypothesis. The criteria of increased time spent in production and an increased number of items produced cannot be evaluated with these data, and none of the aforementioned data are definitive enough to evaluate the relative complexity of the Baker and Chiggerville groups.

The uniformity in the products and by-products of tool manufacture criterion can be evaluated by examining variability in biface and hafted biface thicknesses to evaluate the degree to which hafted bifaces from the two sites were manufactured from standard-size preforms. As can be seen from Table 7-2, both broken and unbroken bifaces from Chiggerville tend to be thicker with a smaller standard deviation than those from Baker. However, Tables 7-30 and 7-31 indicate that, while finished Saratoga Cluster hafted bifaces from Chiggerville are thicker than Large Side Notched Cluster hafted bifaces from Baker, the Baker hafted bifaces are much less variable with regard to thickness. Unfortunately, One-Sample Kolmogorov-Smirnov tests run on biface and hafted bifaces thickness variables indicate that all thickness distributions are right-skewed. As a result, T-tests cannot be performed to determine the significance of these differences.

In statistical terms, then, analyses of thickness variables are ambiguous with regard to the presence of specialization at the two sites. Qualitatively, the smaller standard deviations for Large Side Notched Cluster points indicate that these hafted bifaces are much more uniform in thicknesses than Saratoga points; however, this uniformity is likely due to a technological constraint. Large Side Notched Cluster points at Baker appear to have been manufactured from large flakes struck from cores, while Saratoga points were manufactured from bifacial cores. These differences alone could explain the differences in variability among thickness variables. In either case, no evaluation of the relative complexity of the two groups can be derived from these variables.

The variability in hafting element forms noted among Saratoga and other Late Archaic stemmed points at Chiggerville is similar to the situation identified by Cross (1990, 1993) among Susquehanna Tradition groups, where craft specialists appear to have been producing standard biface preforms that were then hafted by numerous individuals within the groups into a variety of different forms. If the various stemmed point types identified at Chiggerville were all manufactured by the same group or groups, then this variability may indicate specialization. However, when just examining variability in hafting element non-metric traits, Large Side Notched Cluster points are found to have more variants with more than expected examples (Tables 7-38 through 7-41). This variability in technological choices made by the manufacturers of Large Side Notched Cluster points also is evident in blade thinning form techniques (Table 7-42), suggesting that the Baker site inhabitants had more technological options. Unfortunately, Chi-square tests of Tables 7-38, 7-39, and 7-42 are not permissible since 20 percent or greater of the cells in each of these tables have expected frequencies less than 5. Following Cross (1990, 1993), the greater degree of variability in blade thinning techniques present at Baker and the greater degree of variability in stemmed point forms at Chiggerville suggests that craft specialization was not practiced in the manufacture of hafted bifaces at Baker but may have been practiced at Chiggerville. Additional data is required to more fully test this hypothesis, but if the specialization hypothesis is

Table 7-38. Variability in Ear Forms at Baker and Chiggerville.

		Ear Form Combined					
		Acute Angled	Round	Square	Obtuse Angled	Flake Blank Striking Platform	Total
Baker	Count	7	78	36	139	1	261
	Expected Count	49.6	59.9	19.9	130.1	1.5	261.0
Chiggerville	Count	128	85	18	215	3	449
	Expected Count	85.4	103.1	34.1	223.9	2.5	449.0
Total	Count	135	163	54	354	4	710
	Expected Count	135.0	163.0	54.0	354.0	4.0	710.0

confirmed then the technological organization practiced by the inhabitants of Chiggerville is more complex.

Comparison of the 2009 Assemblages

Given the WPA recovery biases described in chapters 4 and 5, evaluation of the relative complexity of the Baker and Chiggerville assemblages based upon frequencies of tool and core types and debitage frequencies is restricted to the assemblages recovered during the 2009 excavations at the sites. Table 7-43 summarizes the tool types recovered from all contexts. Not included in this table are diagnostic Early Archaic hafted bifaces recovered from both sites. Bipolar core frequencies include those cores that were classified as 'probably bipolar'.

As discussed in chapter 2, a technological organization can be considered more complex if a higher frequency of curated tools is present. As can be seen in Table 7-43, Chiggerville yielded more curated tool forms like bifaces and formal unifacial tools and fewer flake tools and other expedient tool forms than Baker. Discrepancies in excavation volumes are negated by the fact that the relative frequencies of tool types rather than

Table 7-39. Variability in Base Forms at Baker and Chiggerville.

		Base Form									
		Slightly Concave	Concave	Straight	Slightly Convex	Convex	Bifurcated	Platformed	Straight Angled	Irregular	Total
Baker	Count	21	54	19	5	3	1	2	1	31	137
	Expected Count	12.8	20.5	20.8	32.9	19.0	0.4	1.5	7.3	21.9	137.0
Chiggerville	Count	14	2	38	85	49	0	2	19	29	238
	Expected Count	22.2	35.5	36.2	57.1	33.0	0.6	2.5	12.7	38.1	238.0
Total	Count	35	56	57	90	52	1	4	20	60	375
	Expected Count	35.0	56.0	57.0	90.0	52.0	1.0	4.0	20.0	60.0	375.0

Table 7-40. Variability in Basal Thinning Techniques at Baker and Chiggerville ($\chi^2 = 97.403$; $df = 4$; $p < .001$).

		Basal Thinning Combined					
		Intentional, Single Flake, Short	Intentional, Single Flake, Long	Intentional, Multiple Flakes, Short	Intentional, Multiple Flakes, Long	None	Total
Baker	Count	9	54	53	52	116	284
	Expected Count	12.5	35.8	45.0	23.6	167.1	284.0
	Std. Residual	-1.0	3.0	1.2	5.8	-4.0	
Chiggerville	Count	25	43	69	12	337	486
	Expected Count	21.5	61.2	77.0	40.4	285.9	486.0
	Std. Residual	.8	-2.3	-.9	-4.5	3.0	
Total	Count	34	97	122	64	453	770
	Expected Count	34.0	97.0	122.0	64.0	453.0	770.0

Table 7-41. Variability in Lateral Haft Trimming Techniques at Baker and Chiggerville (χ^2 = 247.189; *df* = 5; p < .001).

		Lateral Haft Trimming Combined						
		Bifacially Beveled, Pressure	Unifacially Beveled, Pressure	Bifacially Beveled, Percussion	Unifacially Beveled, Percussion	Bifacially Beveled - Pressure/Percussion	None	Total
Baker	Count	173	79	0	2	2	15	271
	Expected Count	117.4	46.2	37.2	12.9	51.6	5.7	271.0
	Std. Residual	5.1	4.8	-6.1	-3.0	-6.9	3.9	
Chiggerville	Count	155	50	104	34	142	1	486
	Expected Count	210.6	82.8	66.8	23.1	92.4	10.3	486.0
	Std. Residual	-3.8	-3.6	4.6	2.3	5.2	-2.9	
Total	Count	328	129	104	36	144	16	757
	Expected Count	328.0	129.0	104.0	36.0	144.0	16.0	757.0

Table 7-42. Variability in Blade Thinning Techniques at Baker and Chiggerville.

		Blade Thinning Obverse/Reverse Combined					
		Random, Shallow	Random, Deep	Wide, Parallel, Shallow	Narrow, Parallel, Shallow	Unmodified	Total
Baker	Count	186	17	0	1	25	229
	Expected Count	180.0	36.5	1.6	0.7	10.2	229.0
Chiggerville	Count	362	94	5	1	6	468
	Expected Count	368.0	74.5	3.4	1.3	20.8	468.0
Total	Count	548	111	5	2	31	697
	Expected Count	548.0	111.0	5.0	2.0	31.0	697.0

absolute frequencies are being compared (i.e., given the larger volume of material excavated at Chiggerville, a higher frequency of both curated and expedient forms is expected). A Chi-square test indicates that this difference is significant (χ^2 = 3.985; *df* = 1; p = .046) (Table 7-44). A Fisher's Exact Test was not relevant given the high sample size and the Continuity Correction was unnecessary given the high minimum expected count (Thomas 1986:298). The overall distribution of curated and expedient tool forms recovered from the two sites, therefore, indicates that the inhabitants of Chiggerville were characterized by a more highly curated and, therefore, more complex technological organization.

A second test of technological organization involves the frequency of different types of cores at the two sites. A higher absolute frequency of cores may indicate stockpiling of raw material and could reduce the need to curate tools in regions characterized by a lack of raw material (Odell 1998, Parry and Kelly 1987). However, the frequency of amorphous and bifacial cores at the two sites is equal indicating that, if

Table 7-43. Tool Forms Recovered during the 2009 Excavations at Baker and Chiggerville.

Curated Tools							
	Bifaces	Hafted Bifaces	Drills	Scrapers	Knives		**Total**
Baker	37	23	1	0	1		62
Chiggerville	42	21	7	7	1		78
Expedient Tools							
	Flake Tools	Gravers	Microdrills/ Perforators	Spokeshave	Uniface		**Total**
Baker	27	2	2	0	1		32
Chiggerville	17	2	0	1	1		21
Other							
	Cores				UID Chipped Stone Tool	Pièce Esquillée	**Total**
	Amorphous	Bifacial	Bipolar	Expended			
Baker	10	0	17	1	1	1	30
Chiggerville	9	1	0	0	1	1	12

Table 7-44. Comparison of Curated to Expedient Forms from 2009 Excavations at Baker and Chiggerville.

		Tool Type		
		Curated	Expedient	Total
Baker	Count	62	32	94
	Expected Count	68.2	25.8	94.0
	Std. Residual	-.7	1.2	
Chiggerville	Count	78	21	99
	Expected Count	71.8	27.2	99.0
	Std. Residual	.7	-1.2	
Total	Count	140	53	193
	Expected Count	140.0	53.0	193.0

stockpiling was practiced, this strategy was equally influential at both sites. The presence of bipolar cores at Baker alone suggests that the need to conserve raw material was felt more heavily by these groups, indicating that either these groups were less mobile and, therefore, had more limited access to high quality raw materials (Parry and Kelly 1987) or that these groups practiced an embedded procurement strategy and the future availability of raw material was uncertain. Given the evidence for an embedded strategy cited above, the latter hypothesis is considered the most likely. If this is the case, then the more logistically organized raw procurement strategy practiced by the inhabitants of Chiggerville is more complex than the embedded strategy evident at Baker.

Analysis of the debitage from the 2009 excavations at Baker and Chiggerville can provide insights into technological organization and specialization at the two sites. As discussed above, debitage was analyzed by size sorting each flake or piece of shatter into eight size classes. Debitage in each of these size classes was then classified on the basis

Table 7-45. Debitage from Baker and Chiggerville.

Site	Flake Type	Flake Variety	Subvariety	Size								
				A	B	C	D	E	F	G	H	Total
Baker	Decortication	UID Burned	N/A	1	0	2	5	6	2	2	1	19
		Flake Fragments	N/A	1	0	7	6	17	5	2	2	40
		Primary	Bipolar	0	0	0	0	0	0	1	0	1
			N/A	0	0	0	3	8	3	2	5	21
		Secondary	Biface Thinning	0	0	0	0	1	0	0	0	1
			Bipolar	0	0	0	0	0	1	1	0	2
			N/A	0	0	3	14	41	10	22	13	103
		Tertiary	N/A	1	1	6	9	4	0	0	0	21
		Shatter	N/A	6	9	14	23	43	9	7	8	119
	Interior	UID Burned	N/A	31	11	22	33	24	2	1	2	126
		Flake Fragments	N/A	152	71	160	122	110	18	10	1	644
		Primary	Bipolar	0	0	0	0	0	0	0	1	1
			N/A	0	0	0	0	3	0	1	2	6
		Secondary	Biface Thinning	0	0	0	1	16	7	7	5	36
			Bipolar	0	0	0	0	2	2	1	0	5
			Blade-like	0	0	0	0	0	0	0	3	3
			N/A	0	0	10	52	115	42	15	6	240
		Tertiary	N/A	140	58	165	95	30	3	0	0	491
		Shatter	N/A	153	78	96	95	74	13	5	5	519
Chiggerville	Decortication	UID Burned	N/A	0	0	11	20	17	2	4	1	55
		Flake Fragments	N/A	0	0	3	9	9	1	3	2	27
		Primary	N/A	0	0	1	1	4	3	4	1	14
		Secondary	Biface Thinning	0	0	0	0	1	0	2	2	5
			N/A	0	0	3	11	14	8	7	7	50

Table 7-45 (continued)

Chiggerville	Decortication	Tertiary	N/A	0	0	3	1	0	0	0	0	4
		Shatter	N/A	0	2	25	42	41	6	6	7	129
	Interior	UID Burned	N/A	0	1	56	85	70	5	4	1	222
		Flake Fragments	N/A	0	2	130	130	96	9	4	1	372
		Primary	N/A	0	0	0	0	0	1	1	1	3
		Secondary	Biface Thinning	0	0	0	6	29	3	2	2	42
			N/A	0	0	37	83	130	14	9	9	282
		Tertiary	N/A	1	1	128	103	34	1	0	0	268
		Shatter	N/A	0	1	36	53	32	6	1	0	129

of presence and amount of cortex and striking platform characteristics. The results of this classification are provided in Table 7-45. Since debitage found in surface contexts is more likely to be biased toward larger pieces, surface collected materials are not included in this table or in the analyses described below. All materials recovered from ¼" and ½" mesh screens and flotation samples are included.

Technological organization can be tested using these debitage data by examining the relative frequencies of flake size classes and subvarieties. The presence of large quantities of smaller flakes in an assemblage suggests maintenance and rejuvenation of bifaces and tools characteristic of curation practices (Collins 1975). Curation is also indicated by the presence of bipolar and blade-like flakes, which indicate the use of core reduction strategies geared toward conservation of raw material.

As can be seen in Table 7-46, the two sites differ markedly in terms of the size classes represented at each. Baker exhibits higher than expected frequencies of very small flakes (Sizes A and B), lower than expected frequencies of medium sized flakes (Sizes C, D, and E), and higher than expected frequencies of larger flakes (Sizes F, G, and H). Chiggerville, on the other hand, exhibits drastically lower than expected frequencies of very small flakes, higher than expected frequencies of medium sized flakes, and lower than expected frequencies of larger flakes. A Chi-square test indicates that these differences are statistically significant ($\chi^2 = 596.606$; $df = 7$; $p < .001$), but the standardized residuals indicate that the differences between expected and observed frequencies of larger flakes are not statistically significant.

The large quantities of very small flakes at Baker indicate that the inhabitants of this site were heavily trimming, maintaining, and rejuvenating their tools, supporting the hypothesis that the Baker assemblage is a heavily curated assemblage. This is supported by the presence of bipolar (n = 9) and blade-like (n = 3) flakes at the site. This conclusion is further supported by the presence of 17 bipolar cores at Baker and the recovery of one pyramidal core at the site by the WPA. On the basis of the curation criterion, then, technological organization at Baker must be considered more complex than that exhibited at Chiggerville.

Table 7-46. Debitage Size Classes at Baker and Chiggerville.

		Size								
		A	B	C	D	E	F	G	H	Total
Baker	Count	485	228	485	458	494	117	77	54	2398
	Expected Count	291.4	140.9	550.3	600.7	582.1	105.5	74.3	52.8	2398.0
	Std. Residual	11.3	7.3	-2.8	-5.8	-3.7	1.1	.3	.2	
Chiggerville	Count	1	7	433	544	477	59	47	34	1602
	Expected Count	194.6	94.1	367.7	401.3	388.9	70.5	49.7	35.2	1602.0
	Std. Residual	-13.9	-9.0	3.4	7.1	4.5	-1.4	-.4	-.2	
Total	Count	486	235	918	1002	971	176	124	88	4000
	Expected Count	486.0	235.0	918.0	1002.0	971.0	176.0	124.0	88.0	4000.0

The overall distribution of size classes at the two sites provides insight into the potential for these sites to reflect specialization as well. The fact that Baker yielded flakes of all sizes and higher than expected frequencies of both smaller and larger flakes suggests that the site's inhabitants were practicing a variety of core and biface reduction strategies concomitant with a variety of activities. That Chiggerville exhibits higher than expected frequencies of medium sized flakes and a high frequency (n = 47) of biface thinning flakes suggests that lithic reduction was restricted to primary and secondary

Table 7-47. Flake Variety at Baker and Chiggerville (χ^2 = 77.438; *df* = 4; p < .001).

		Flake Variety					
		Flake Fragments	Primary	Secondary	Tertiary	Shatter	Total
Baker	Count	684	29	390	512	638	2253
	Expected Count	681.9	29.0	484.2	493.7	564.2	2253.0
	Std. Residual	.1	.0	-4.3	.8	3.1	
Chiggerville	Count	399	17	379	272	258	1325
	Expected Count	401.1	17.0	284.8	290.3	331.8	1325.0
	Std. Residual	-.1	.0	5.6	-1.1	-4.1	
Total	Count	1083	46	769	784	896	3578
	Expected Count	1083.0	46.0	769.0	784.0	896.0	3578.0

trimming (e.g., Collins 1975). This isolation of a single stage of reduction at Chiggerville is consistent with the increased steps in production and spatial and temporal separation of production stages criteria for evidence for specialization (Cross 1990).

Inferences pertaining to specialization based upon the size class data are further confirmed by the relative frequencies of flake varieties (Table 7-47). Primary flakes and shatter are typically associated with early stage reduction, secondary flakes with primary trimming, and tertiary flakes with secondary trimming, maintenance, and rejuvenation. Excluding burned flakes since these represent post-depositional modifications rather than stone tool manufacture, Baker yielded significantly fewer than expected secondary flakes and more than expected tertiary flakes, although the latter difference is not significant based on the standardized residuals. At Chiggerville, secondary flakes are represented in significantly higher than expected numbers, while tertiary flakes are represented in lower than expected frequencies (not significant based on standardized residuals) (Table 7-47), consistent with the hypothesis that this assemblage represents a single stage in a spatially and temporally segmented reduction strategy. Both sets of data, then, suggest the increased complexity of the Chiggerville assemblage. Interestingly, significantly more than expected decortication flakes are present at Chiggerville (Table 7-48), a contradiction that may be resolved with a detailed analysis of chert types.

Table 7-48. Flake Types at Baker and Chiggerville ($\chi^2 = 12.423$; $df = 1$; $p < .001$).

		Flake Type		
		Decortication	Interior	Total
Baker	Count	327	2071	2398
	Expected Count	366.3	2031.7	2398.0
	Std. Residual	-2.1	.9	
Chiggerville	Count	284	1318	1602
	Expected Count	244.7	1357.3	1602.0
	Std. Residual	2.5	-1.1	
Total	Count	611	3389	4000
	Expected Count	611.0	3389.0	4000.0

Ground and Pecked Stone Tools

Description of Tool Types

Ground and pecked stone tools as a class include objects manufactured from a variety of igneous, metamorphic, and sedimentary rock types and include intentionally shaped forms like pestles and axes as well as objects shaped as a result of use (e.g., hammerstones). In theory, ground and pecked stone tools should be differentiated on the basis of manufacturing techniques; however, the use of chipping to shape some ground and pecked stone tools makes strict adherence to this method of classification difficult. For purposes of this study, morphofunctional classes that are typically assigned to the ground and pecked stone category are included in that category herein regardless of the use of a chipping technique. Individual artifact classes are described below and data pertaining to raw material type and weights of complete specimens provided. Raw material was classified on the basis of macroscopic inspection and, thus, should be treated with caution. When possible, broken edges were examined microscopically, but clean broken edges were not always present. In most cases, classifications follow Adams (2002).

A total of 92 objects from the WPA excavations at the Baker site and another 388 from Chiggerville initially were grouped with the ground and pecked stone. Of these, 4 objects from Baker (classified by the WPA as 3 pestles and an axe) and 25 from Chiggerville (classified by the WPA as 14 pestles, 3 hammerstones, 3 grinding stones, 2 mortars, 1 atlatl weight, 1 gorget, and 1 stone) were missing at the time of this analysis and could not be analyzed by the author (Figure 7-26l is a missing bar atlatl weight). Another 8 objects from Baker were determined to be FCR and 13 to be unmodified stones, while 6 objects from Chiggerville are FCR, 39 are unmodified stones (Figure 7-26i, k), and Cat. #1853 was found to refit to Cat. #1621. This brings the total number of ground and pecked stone implements from Baker to 67 and the total from Chiggerville to 317 (Table 7-49).

The presence of atlatl weights at Green River shell midden sites has been the subject of much archaeological debate since Moore's (2002) first classification of these objects as net spacers. In a series of reports begun in Webb and Haag (1939), Webb (1957) provides the most comprehensive examination of eastern North American atlatl weights found in archaeological contexts. According to Webb (1957) a number of

Table 7-49. Ground and Pecked Stone Tools from Baker and Chiggerville.

	Baker	Chiggerville
Atlatl Weight	5	8
Axe	6	15
Bead	0	3
Billet	0	1
Celt	0	1
Debitage	0	2
Hammerstone	5	19
Hoe	1	1
Mano/Hammerstone	2	5
Nutting Stone	1	1
Pestle	23	218
Pitted Stone	2	6
Stone Vessel	0	1
Abrader	2	0
Pigment Stone	1	0
UID Ground/Pecked Stone Object	0	1
Ground/Pecked Stone Fragment	19	35
Total	67	317

artifact types, including gorgets and bannerstones, functioned as weights that increased the velocity of projectiles launched with an atlatl. More recent studies indicate that atlatl weights may actually decrease the efficacy of the atlatl. Howard's (1974) experimental studies demonstrated that thrust was decreased when an atlatl weight was attached to an atlatl, and Cole (1972) argued that the weight decreased impact pressure of the atlatl dart by increasing the energy expended in using the atlatl. Alternatively, Cole (1972) suggested that atlatl weights were attached to the darts themselves, thus increasing impact pressure and the stability of the spear while in flight. Peets (1960), on the other hand, argued that atlatl weights served to balance atlatls against the heavy foreshafts with stone points attached, and Palter (1976) argued that small weights served to augment the flexibility of flexible shaft atlatls while larger weights had social or magical functions.

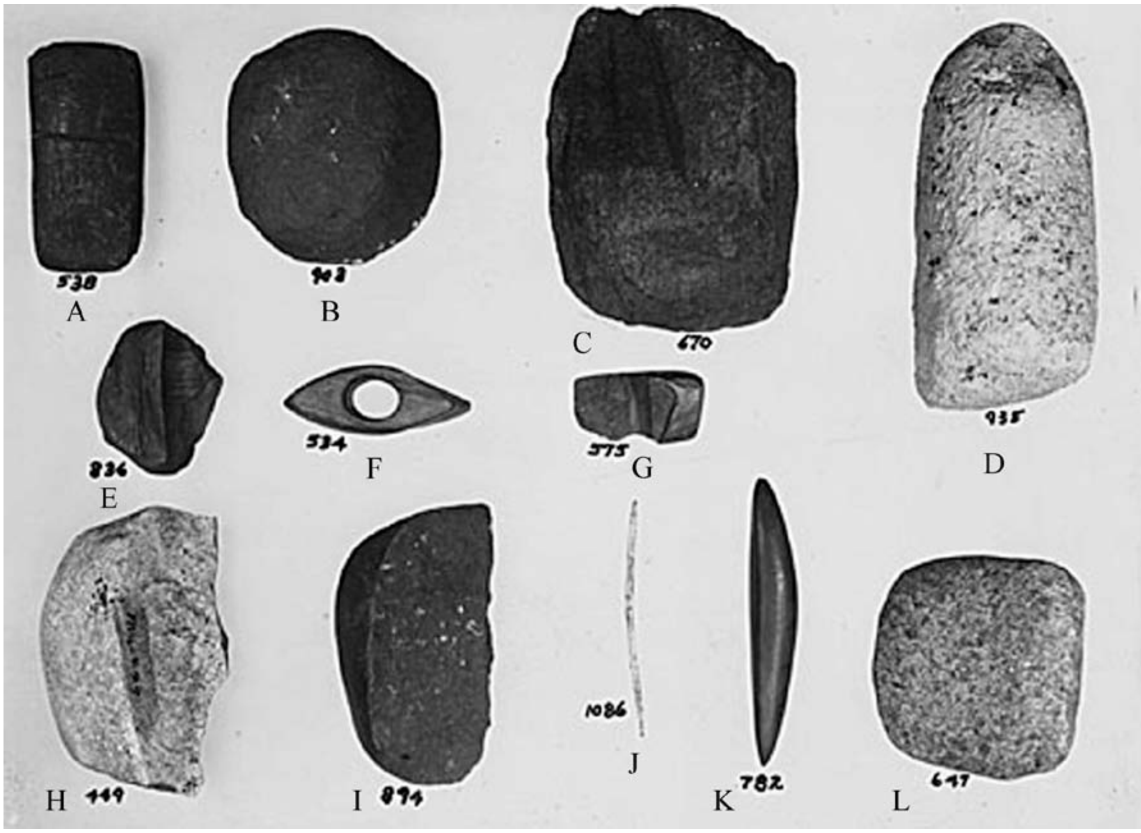


Figure 7-25. Ground and Pecked Stone Objects from Baker. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

The potential social function of atlatl weights is what initially led to their description as 'bannerstones'. According to Baer (1921), the recovery of three bannerstones attached to stone rods in North Carolina that led to the misnaming of these objects was likely fabricated. Nevertheless, a variety of authors have pointed out that certain atlatl weight types are highly stylized and likely served as markers of status and/or prestige (Burdin 2004, Kwas 1982, Lutz 2000, Precourt 1973).

The atlatl weights from Baker and Chiggerville likely fall into both the functional and social/stylistic categories. Atlatl weights from Baker are all manufactured from sedimentary rocks, consistent with Burdin's (2004:65-66) observation that Middle Archaic atlatl weights tend to be manufactured from softer stones. Object Cat. #534

(Figure 7-25f) is a broken atlatl weight manufactured from indurated shale (commonly referred to as 'banded slate'), suggesting this object may be derived from sources north of the Ohio River (Farnsworth 1987). This object is 59 mm long, 28 mm wide, and 22 mm thick. It is not symmetrical and is poorly formed. The bore holes are elliptical in shape and measure 17 x 12 mm and 17 x 13 mm.

Object Cat. #538 (Figure 7-25a) is a complete bar atlatl weight manufactured from locally available siderite (commonly referred to as hematite). The object is 70 mm long, 35 mm wide, and 20 mm thick and weighs 91.7 g. This object is grooved by a deep, narrow incision on one face and the opposite face exhibits several incisions in a roughly cross-hatched pattern that may be decoration.

Object Cat. #575 (Figure 7-25g) is a broken atlatl weight manufactured from indurated shale. The bore of this object is elliptical in shape. No measurements could be obtained from this specimen.

Object Cat. #782 (Figure 7-25k) is a complete claystone atlatl weight. This is the only example of a 'boatstone' atlatl weight from either of the two sites. It measures 89 mm long, 16 mm wide, and 14 mm thick.

Object Cat. #836 (Figure 7-25e) is a broken atlatl weight manufactured from indurated shale. This object is roughly manufactured and split along the bore. It is possible that the atlatl weight was intentionally damaged, suggesting it may have originally been associated with a burial, although it was not recovered from a burial context.

Atlatl weights from Chiggerville include examples manufactured from both sedimentary and igneous rocks, consistent with Burdin's (2004) observation that Late

Archaic groups utilized higher frequencies of harder igneous and metamorphic stones to manufacture atlatl weights. The best example of an atlatl weight from this site is the winged atlatl weight found associated with Burial No. 44 (Figure 7-26a). Unfortunately, this atlatl weight was missing from the collection at the time of this study and could not be analyzed by the author.

Figure 7-26. Atlatl Weights and Other Ground and Pecked Stone Objects from Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Object Cat. #1449 (Figure 7-26f) is a complete atlatl weight manufactured from locally available limestone. This object is 42 mm long, 40 mm wide, 26 mm thick, and weighs 56.1 g. It is a prismatic atlatl weight with a rounded bore hole that measures 15 mm in width. The object was broken when recovered but repaired by the WPA.

Object Cat. #1450 (Figure 7-26b) is a broken atlatl weight manufactured from limestone. This object is 63 mm long. An incised groove located at the weight's mid-section and oriented perpendicular to its long axis may be an attempt at repair. Object Cat. #1451 (Figure 7-26d) is a broken prismatic atlatl weight manufactured from limestone.

Object Cat. #1453 (Figure 7-26g) is a unique chipped stone atlatl weight manufactured from locally available Ste Genevieve chert. The weight is complete and humpbacked in form. It is 58 mm long, 32 mm wide, 24 mm thick, and weighs 48.7 g. This object would likely be classified as a core by most analysts, but the fact that it is bifacially worked and thinned by the removal of very shallow biface thinning flakes indicates that it was not worked to yield flakes.

Object Cat. #1457 (Figure 7-26m) is a broken bar atlatl weight manufactured from granite. It is 37 mm wide and 10 mm thick and is trianguloid in shape, tapering toward the broken end. The object has rounded corners and is discolored, likely from having been burned.

Object Cat. #1459 (Figure 7-26j) is a broken bar atlatl weight manufactured from siderite. This object has a rectanguloid, expanding form and may be a fragment of a gorget.

Object Cat. #1486 is an initial stage atlatl weight that was abandoned for unknown reasons prior to completion. This object is 57 mm long, 53 mm wide, 46 mm thick, and weighs 218.8 g. It has been roughly shaped and a small bore hole has been started at one end. This object is classified as granite, but the material type is uncertain due to a lack of breaks exposing the minerals.

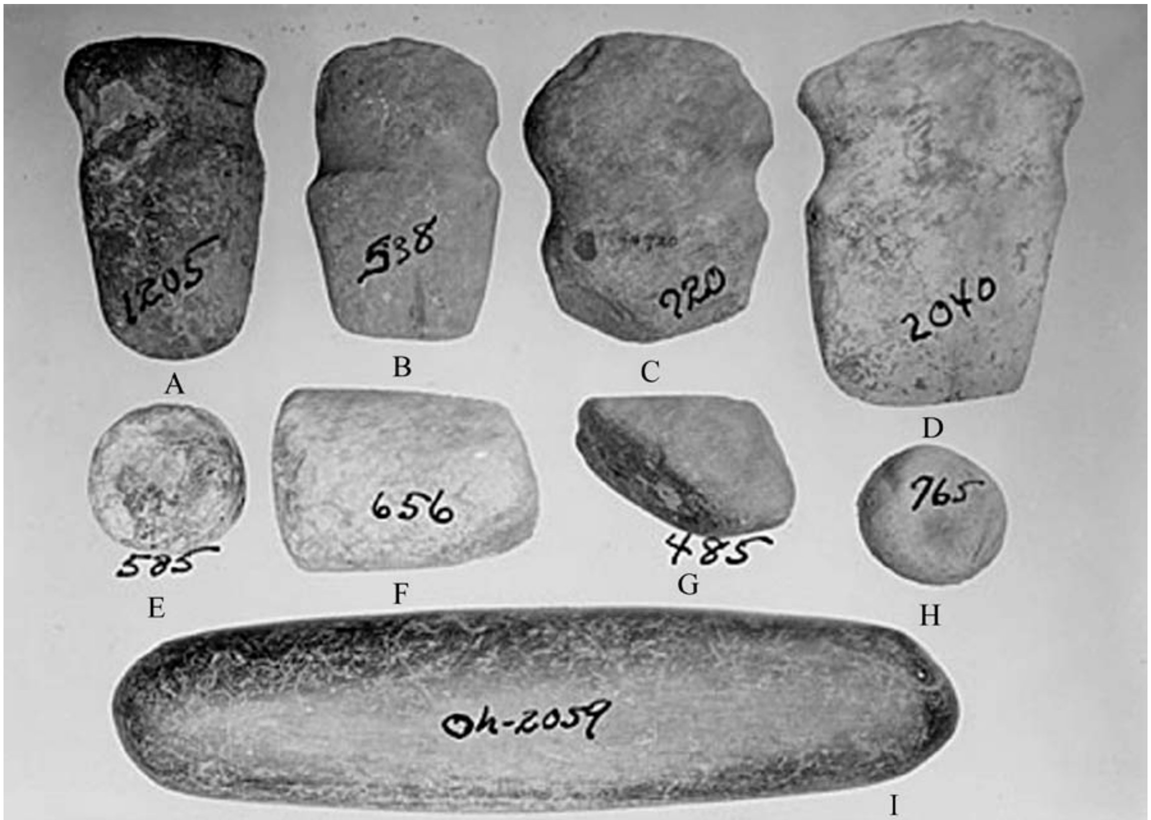


Figure 7-27. Ground and Pecked Stone Axes and Pestles from Chiggerville. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Object Cat. #1818 (Figure 7-26c) is a broken atlatl weight that is 59 mm long and manufactured from limestone. The length measurement is only correct if the length was the same across the entire object.

A total of six axes were recovered at Baker and fifteen at Chiggerville (Table 7-49). One of the axes at Baker was fully grooved and the other five were unidentifiable fragments. The fully grooved axe (Figure 7-25l) was manufactured from diorite, and another axe was manufactured from an unidentified mafic igneous rock (Figure 7-25i). Two of the remaining unidentifiable axes were manufactured from limestone (Figure 7-25h) and the other two are siderite. One of the latter exhibits evidence of a groove, but not enough of the object remains to identify whether this was a fully or partially grooved axe.

Of the fifteen axes recovered from the Chiggerville site, eight are fully grooved, one is notched, and the remaining six are unidentifiable fragments. Of the fully grooved axes, five are mafic igneous rocks (Figure 7-27a-b), one is an unidentified igneous rock (Figure 7-27c), one is siltstone, and one is limestone (Figure 7-27d). The limestone axe was found associated with Burial No. 31; its bit is undamaged and was likely resharpened for burial. The notched axe is manufactured from limestone. One of the unidentifiable fragments is granite. The other six axes are mafic igneous rocks, and four of these exhibit evidence of grooves.

Three ground stone beads were recovered from Chiggerville. Object Cat. #1437 is a tubular bead found in association with Burial No. 23. This bead is 25 mm long, 9 mm wide, 9 mm thick, and weighs 2.8 g. It exhibits a 4 x 4 mm rounded bore hole. Raw material has been identified as sandstone, but this is uncertain due to a high degree of polish. The object has a reddish color, possibly from red ochre.

Object Cat. #1438 is an oblate bead with a flattened spherical form found in association with Burial No. 93. It is 19 mm long, 18 mm wide, 12 mm thick, and weighs 3.3 g. The rounded bore hole is 4 x 4 mm. Raw material identification is uncertain due to the presence of a high polish, but the bead is likely manufactured from siderite.

Object Cat. #1447 is a barrel-shaped bead found associated with Burial No. 83. This object is manufactured from limestone and is 21 mm long, 11 mm wide, 11 mm thick, and weighs 3.3 g. It has a rounded 4 x 4 mm bore hole and is pink, possibly from burning or application of red ochre.

One object (Cat. #1549) from Chiggerville has been classified as a stone billet. It is manufactured from an unidentified sedimentary rock and weighs 78.4 g. The billet has pitting around its edges and at both ends, indicating a hammering function. The object's exterior is waterworn, precluding exact identification of material.

Object Cat. #1565 from Chiggerville is a roughly chipped celt manufactured from sandstone. Whether this object functioned as an axe is uncertain given its raw material type. Staats (1988) has demonstrated that celts can have many functions, including woodworking, hide removal, honing, peeling bark, wedging, and chiseling.

Two limestone fragments from Chiggerville (Cat. #s 873 and 1407) are flakes from the production or use of ground and pecked stone tools. Many ground and pecked stone tool forms were initially flaked prior to final shaping, and several pestles and axes from the site exhibit damage that takes the form of flake removals.

Hammerstones are stones that exhibited pitting on one or more edges indicative of use as a hammer, perhaps in the manufacture of pecked or chipped stone tools. Five such objects were recovered from Baker and another 19 were recovered from Chiggerville (Table 7-49). Two of the hammerstones from Baker are chert hammerstones made from recycled chert cores, while the other three are granite. The three chert hammerstones from Chiggerville apparently are not recycled cores. One is a chert cobble with evidence of hammering and another may be cherty limestone. The remaining hammerstones from Chiggerville are granite (n = 2), quartzite (n = 3), limestone (n = 5), sandstone (n = 4), unidentified sedimentary rock (n = 1), and marble or quartzite (n = 1).

Two hoes were recovered by the WPA, one each from Baker and Chiggerville. The hoe from Baker (Cat. #1084) is a fragmentary chipped stone hoe manufactured from either Muldraugh or Fort Payne/Dover chert. The object is a large, ovate biface with a large segment of cortex at one end. It was found on the site's surface and likely dates to a later component. The hoe from Chiggerville (Cat. #1454) is notched and manufactured from sandstone (Figure 7-26e). This object is heavily plow damaged and is likely associated with the Late Prehistoric component at the site.

Two objects from Baker and five from Chiggerville were classified as mano/hammerstones on the basis of their ovoid form, pitting, and the presence of faceting on some examples. For instance the granite mano/hammerstone (Cat. #903) depicted in Figure 7-25b) is pitted on all edges and is platformed on the widest face with two steep bevels leading to a flattened facet. Most mano/hammerstones, however, have a more rounded form. Cat. #903 is also unique in that it exhibits a wide, shallow annular groove around its mid-section. The second mano/hammerstone from Baker is manufactured from quartzite. Of the five mano/hammerstones from Chiggerville, two are limestone examples that were recovered in association with Burial Nos. 32 (Cat. #1485) and 63 (Cat. #1484). Of the remaining three, one is granite (Figure 7-27e), one is mafic igneous rock, and one is sandstone. Mano/hammerstones are typically interpreted as generalized manufacturing and plant processing tools (Winters 1969:61-62).

Large stones with multiple pits were classified as nutting stones, although it is possible these are large examples of the smaller 'pitted cobbles'. Spears (1975) has demonstrated that use of stones as anvils in both nutcracking and bipolar reduction can result in the formation of shallow pits. It is likely that stones with very deep pits were intentionally manufactured as nutting stones since Spears' (1975) experiments indicate that nutcracking results in only 1 to 2 mm deep U-shaped pits, and the very deep pits exhibited on some Green River specimens are likely too deep to facilitate bipolar reduction. The nutting stones from Baker (Cat. #289) and Chiggerville (Cat. #1468) are very large and manufactured from sandstone. Both pitted stones from Baker are sandstone. The six from Chiggerville are sandstone (n = 3), granite (n = 1), and limestone (n = 2). One of the limestone examples (Cat. #1578) has single pits on two faces, a cylindrical cross-section, and a wide, shallow groove around the cylinder at its mid-point.

The largest class of ground and pecked stone artifacts at Baker and Chiggerville are pestles. These objects come in a variety of shapes and sizes and are generally interpreted to be tools associated with the processing of seeds and nuts. A total of 23 pestles were recovered from Baker. Of these, one is a bell-shaped pestle manufactured from limestone that is pitted at its distal end. Another seven are conical pestles, five of which are manufactured from limestone (Figure 7-25d), one is granite, and one is a mafic igneous rock. One of the limestone conical pestles (Cat. #1068) is pitted at its distal end. Another limestone pestle has an irregular shape, one is a siderite pestle fragment, and the remaining thirteen are limestone pestle fragments.

The 218 pestles from Chiggerville include 32 that are bell-shaped. Of these, 26 are limestone, 4 are sandstone, 1 is siderite, and 1 is a mafic igneous rock. Fourteen of the limestone bell-shaped pestles, one of the sandstone bell-shaped pestles, and the one siderite pestle are all pitted at the distal end.

Another 61 pestles from Chiggerville are conical in shape. Of these, 53 are limestone (Figure 7-27f), 3 are sandstone, 2 are siderite, 1 is siltstone, 1 is a mafic igneous rock, and 1 is an unidentified igneous rock. Twelve of the limestone conical pestles are pitted at their distal ends.

Four of the pestles from Chiggerville are cylindrical, and three of these are manufactured from limestone. One of the limestone cylindrical pestles was found in association with Feature No. 6 and another with Feature No. 30. The cylindrical pestle depicted in Figure 7-28i is smoothed and rounded, rendering identification of its raw material impossible. This object exhibits use-wear on one side that suggests it was used more to grind along one long margin rather than to smash at the ends.

Twenty-three of the Chiggerville pestles are irregularly shaped limestone pestles and one is an irregularly shaped sandstone pestle. One limestone pestle is square in cross-section. Finally, the 96 unidentifiable pestle fragments are manufactured from limestone (n = 87), siderite (n = 4), siltstone (n = 2), sandstone (n = 1), granite (n = 1), and quartzite (n = 1).

One rimsherd of a sandstone vessel (Cat. #200040) was recovered from Chiggerville. This object was classified with the ceramics by the WPA. One object (Cat. #199) is a faceted piece of siderite that was likely ground to produce pigment.

Two abraders were recovered from Baker. One is a piece of chert cortex that has been recycled into an abrader. It exhibits a single, deep incision. The second abrader (Figure 7-25c) is sandstone and has three deep, narrow grooves on one face and a single groove on another face.

One object recovered from Chiggerville (Cat. #1600) is an amorphous piece of roughly chipped limestone that may be a preform for a small pestle or some other tool.

This object is classified as an unidentified ground/pecked stone object that was likely abandoned during manufacture.

Finally, 19 objects from Baker and 35 from Chiggerville are classified as unidentified ground/pecked stone fragments (Table 7-49). These are broken ground and pecked stone objects that cannot be classified as to type. At Baker, 5 of these fragments are mafic igneous rocks, 8 are limestone, 5 are granite, and 1 is siderite. At Chiggerville, 25 are limestone, 4 are siderite, 3 are sandstone, 1 is a mafic igneous rock, 1 is quartzite, and 1 is an unidentified stone. Examples from Chiggerville are depicted in Figures 7-26h, n and 7-27h.

Comparison of the Two WPA Assemblages

The primary means of assessing the relative complexity of the Baker and Chiggerville inhabitants on the basis of ground and pecked stone technology is through an evaluation of the diversity of tool forms used in plant food processing. As discussed in chapter 2, an increased diversity of plant food processing gear and increased labor input into the manufacture of this gear is considered a proxy of decreased mobility and is equated with increasing complexity (e.g., Wright 1994). As can be seen from Table 7-50, only three kinds of plant processing items were recovered at either site, indicating that there is no difference in the diversity of plant processing tool forms at the two sites. Chiggerville yielded a much higher number and relative frequency of ground and pecked stone plant processing tools (72.6 percent of ground and pecked stone implements from the site compared with 41.8 percent at Baker), however, suggesting increased labor input into plant processing equipment and, thus, greater complexity with regard to subsistence activities at Chiggerville. The greater number of axes at Chiggerville may also reflect more labor input into ground and pecked stone technologies indicative of decreasing mobility. Unfortunately, a Chi-square analysis of these differences was not permissible due to the large number of cells with expected counts less than 5.

Table 7-50. Ubiquity of Ground and Pecked Stone Plant Processing Tools at Baker and Chiggerville.

		Functional Type			
		Mano/ Hammerstone	Pestle	Pitted/ Nutting Stone	Total
Baker	Count	2	23	3	28
	Expected Count	0.8	26.2	1.1	28.0
Chiggerville	Count	5	218	7	230
	Expected Count	6.2	214.8	8.9	230.0
Total	Count	7	241	10	258
	Expected Count	7.0	241.0	10.0	258.0

Finally, some insights into the relative complexity of these groups might be evident in the atlatl weights at the two sites. As described above, three of the atlatl weights at Baker were manufactured from non-local indurated shale, suggesting interaction between the Baker site inhabitants and groups to the north of the Ohio River. Furthermore, the presence of a stylized boatstone form and one possible decorated atlatl weight at Baker adds weight to the hypothesis that these objects were used in social messaging (see chapters 2 and 3). Although the one winged atlatl form at Chiggerville may indicate continued participation in such communication networks, the fact that the majority of the atlatl weights from this site appear to be utilitarian forms manufactured from locally available materials (it is uncertain whether the two granite weights indicate exchange or interaction) supports the hypothesis that the Middle Archaic Baker groups were more complex with regard to interaction and communication networks.

The Relative Complexity of Hunter-Gatherers at Baker and Chiggerville

Analysis of the chipped and ground and pecked stone assemblages at Baker and Chiggerville has provided several insights into the relative complexity of the inhabitants of these two sites. With regard to technological organization, no differences were found in the frequencies of recycled tool forms manufactured at the two sites, but Large Side Notched Cluster hafted biface blades were found to be shorter (not statistically significant) and narrower (statistically significant) than Saratoga Cluster hafted biface blades at Chiggerville. This, coupled with the presence of bipolar and blade-like flakes and the overwhelmingly higher frequency of small recycling and maintenance flakes at Baker indicates that the Baker assemblage is highly curated and, therefore, more complex with regard to technological organization. However, the Baker assemblage also exhibits a larger variety of chert types and is the only assemblage that includes bipolar cores, suggesting that the Baker site inhabitants practiced an embedded procurement strategy that led to raw material conservation. The focus on the use of Ste Genevieve chert at Chiggerville and the presence of only bifacial and amorphous cores at that site suggests logistically organized chert procurement indicative of a more complex technological organization. Overall, then, the Chiggerville chipped stone tool assemblage reflects a more complex technological organization than the Baker assemblage.

Examination of the chipped stone assemblages for evidence of specialization in the manufacture of chipped stone bifaces also suggests that the inhabitants of the Chiggerville site were more complexly organized. Analyses of variability in the size of bifaces and hafted bifaces at the two sites indicated that the Baker site bifaces were more variable than those from Chiggerville, but the hafted bifaces from Chiggerville were more variable. Since distributions in metric data used in these analyses were not normally distributed, statistical significance of these differences could not be determined and these variables could not be used to evaluate relative complexity. However, the variety of Late Archaic forms other than Saratoga Cluster hafted bifaces at Chiggerville and the greater variability in blade thinning techniques practiced at Baker suggests that the Baker hafted bifaces were not manufactured by craft specialists while leaving open the possibility of specialization at Chiggerville. This conclusion was confirmed by analysis of debitage, which yielded evidence for all stages of reduction at Baker. The overrepresentation of medium sized and secondary flakes at Chiggerville, on the other hand, provides additional evidence for specialization among these groups and suggests increased complexity in organization of production is represented at this site. Although not definitive, analysis of the chipped stone assemblages suggests that the hunter-gatherers at the Baker site practiced a form of embedded procurement where most or all members of the group obtained chert as it was available and as part of their regular foraging practices. Production of at least some of the chipped stone tools at the Chiggerville site, on the other hand, possibly was conducted by flintknapping specialists who organized themselves into logistical task groups to preferentially obtain Ste Genevieve chert, which they reduced into bifaces that they carried to the Chiggerville site for further trimming, use, and possibly distribution.

Analysis of the Baker and Chiggerville ground and pecked stone assemblages was more equivocal. Diversity of plant processing tool types at the two sites was equal, indicating no difference in relative complexity; however, Chiggerville yielded higher counts and relative frequencies of plant processing tools and ground and chipped stone axes. The increased use of ground and pecked stone plant processing gear suggests greater labor input into the production of tools, a common proxy for reduced mobility that would indicate greater complexity at Chiggerville. Unfortunately, tests for the statistical significance of these variables were not permissible. The presence of stylized atlatl weights manufactured from exotic raw materials at Baker suggests greater involvement by these groups in long-distance exchange and/or widespread networks of communication, suggesting greater complexity at Baker.

Chapter Eight

Mortuary Practices at Baker and Chiggerville

Mortuary remains from the Green River middens have attracted the attention of archaeologists and physical anthropologists for nearly 100 years. Beginning with Dr. M. G. Miller's (2002) examination of burials from Moore's (2002) excavations at Indian Knoll, anthropologists who have worked with Green River human remains include Aleś Hrdlička (1927); three Earnest Hooton students—Charles Snow (1946), George Neumann, and Ivar Skarland (1939); Francis Johnston (Johnston and Snow 1961); Robert Sundick (1972); Mary Lucas Powell (1996); and George Milner (Milner and Jefferies 1998). Incidentally, Miller (2002) was also the first analyst to identify evidence for interpersonal conflict at the Green River sites—Moore's (2002) Burial No. 166 at Indian Knoll exhibited a peri-mortem projectile wound affecting the individual's second lumbar vertebra (Miller 2002:477-478).

Discussed in more detail below, the 117 individuals (in 114 burials) from the Chiggerville site were first analyzed by Skarland (1939), whose study emphasized craniometrics. In the 1970s, two students from Western Michigan University—Norman Sullivan (1977) and Larry Wyckhoff (1977)—reanalyzed the collection and provided more detailed data pertaining to demography, pathology, sub-adult growth, and biodistance. Most recently, Eric Bushèe (1998) conducted a brief study of osteoarthritis, comparing frequencies of this degenerative disease among males and females at the site, and Price et al. (1986) found high levels of strontium among the Chiggerville burials, consistent with consumption of freshwater mussels. A systematic analysis of the four human burials from Baker has yet to be published.

In this chapter, I compare the complexity of mortuary practices, leadership roles, and exchange at the Chiggerville and Baker sites. To begin, I outline a theoretical framework for the interpretation of mortuary data, focusing specifically on the ways in which identities can be interpreted based on burial practices and burial associations. Next, I describe the Chiggerville and Baker mortuary assemblages, paying particular attention to intra-site patterning and burial associations. Finally, I place the Chiggerville and Baker sites within a macroregional framework, comparing these sites to other Archaic sites in the Green River and eastern United States. While burials from the Chiggerville site exhibit larger numbers of exotic trade goods and other artifact types, suggesting an increased involvement in networks of interregional interaction and exchange leading to increased diversity in leadership roles and status positions during the Late Archaic, the presence of an intriguing pattern of burial placement at Baker suggests a more formalized set of mortuary rituals existed during the Middle Archaic. Overall, mortuary data from these two sites suggest increased complexity during the Late Archaic, but the Baker intra-site mortuary pattern and low burial sample size renders this conclusion equivocal.

Mortuary Theory, Identity, and Complexity

The interpretation of mortuary behaviors is difficult given the high degree of variability in mortuary practices worldwide. In his study of mortuary behaviors among the indigenous peoples of California, Kroeber (1927) concluded that burial rites were a product of ‘fashion’ since they were not found to correlate with other cultural traits or geographical regions. Since burial practices did not pattern regularly with reference to Californian culture areas defined on the basis of other traits, Kroeber (1927:313) concluded that "disposal of the dead often shows a fluctuating history instead of the relative stability which a first judgment might attribute to it." This study cautions that, at least in some cases, mortuary practices are neither related to nor a product of such integral functions of culture as the food quest.

Peter Ucko's (1969) excellent cross-cultural study of mortuary practices lends support to Kroeber's (1927) observations, but also provides some contrary examples that illustrate how mortuary behaviors can be interrelated with other social, political, and/or economic practices. The author argues that many standard archaeological interpretations, such as the use of burial practices as a relative dating technique, are problematic given the variety of mortuary behaviors found in any particular culture. While it is often true that the placement of burial goods, the elaboration of tombs, orientation, etc. have some meaning, this cannot be assumed to be the case *a priori*. The author suggests studying burial practices in terms of relative frequencies over a given area to better understand their meanings and significance (Ucko 1969).

Ucko's (1969) ethnographic survey led him to conclude that burial practices may or may not reflect religious beliefs, belief in an afterlife, relative wealth of individuals, or status. For instance, among the Nuer of Sudan and the Nupe of Nigeria, burial of the dead is simply a means of disposing of a corpse. Among the Nankanse of Ghana, burial goods are placed in graves only on occasions that the souls of living persons become trapped in the graves and cannot be extracted. The grave associations, which have little to do with the buried individual, are to protect the individual whose soul is in the grave from death. Among the Lugbara of Uganda, however, burial objects "are simply the visible expression of part of a person's social personality, the visible expression of his having left the living" (Ucko 1969:265). Among some societies, such as the Nandi of Kenya, individuals are left unburied so that they might be eaten by hyenas, which facilitates the soul's journey to the afterlife (Ucko 1969:270).

One persistent problem with interpreting mortuary remains is the fact that the act of burial oftentimes serves "to create an idealized representation—a 're-presenting' of the individual by others rather than by the man himself" (Parker Pearson 1999:4). As such, misrepresentation of reality may occur and individuals may be buried with objects and rites that reflect something other than their persona in life. This is particularly true given that the act of burial is not performed by the deceased but by others who may have much to gain by representing the dead in particular ways (Parker Pearson 1999:9). In cases where secondary treatment of corpses is common, the corpse becomes a kind of material culture that may take on meanings beyond those associated with the individual while alive, and it may be these meanings, rather than the individual's living persona, that are reflected in final burial (e.g., Metcalf and Huntington 1991:97).

Keeping these caveats in mind, most archaeologists tend to interpret mortuary remains within a materialist framework, relating mortuary patterning to issues of identity, economics, and territoriality. As discussed in chapter 2, Lewis Binford (1971) found that age and sex differences are the most common factors distinguishing mortuary behaviors among hunter-gatherers, with individuals of different ages being buried in different locations and those of different sexes being buried with sexually distinct clothing, personal items, and tools symbolic of the sexual division of labor. No statistical differences in mortuary treatment were found between hunter-gatherers, shifting agriculturalists, and pastoralists, suggesting that differences between hunter-gatherers practicing a foraging mode of production and those practicing a lineage mode of production would also not be detectable. The greater number of dimensional distinctions exhibited in burial practices by settled agriculturalists compared with the other groups, however, does indicate a relationship between mortuary behaviors and economic complexity.

While Binford's (1971) cross-cultural study does indicate that some aspects of mortuary patterning can be used to interpret social identity and economic complexity, Carr (1995) cautions researchers to be aware that philosophical-religious factors account for a significant amount of variability in mortuary behaviors. His meticulous analysis of Human Relations Area Files data found that mortuary practices are structured by a wide range of factors. Aspects of social personae and social organization that are commonly found expressed in mortuary behaviors include age, gender, vertical and horizontal social position, and personal identity, with vertical and horizontal social position and age being the most important (Carr 1995).

Carr (1995:190-191) also found that mortuary behaviors were correlated with sociopolitical complexity:

> The balance with which social, philosophical-religious, circumstantial, and physical factors were found to determine mortuary practices varies in a systematic and understandable way with sociopolitical complexity and cultural evolution. Philosophical-religious factors were observed more frequently, but with a declining differential relative to social organizational factors, from band-level hunter-gatherers through complex hunter-gatherers to horticultural tribes. Social factors predominated in societies with petty hierarchies, but beliefs were again found more influential in paramount chiefdoms.

Aspects of personal identity were found to be more commonly expressed among less complex societies, while horizontal social position became a more important determinate of mortuary patterning with increasing sociopolitical complexity. Gender had little influence on mortuary behaviors, and vertical social position and/or age were important determinants at all levels of sociopolitical complexity (Carr 1995).

Although Carr's (1995) study indicates that some aspects of mortuary behaviors reflect the social personae of the deceased, it is still uncertain as to whether artifacts associated with burials can be interpreted as indicative of these individuals' identities. For instance, MacDonald (2001) argues that the association of young adults with high quality grave goods at the Hohokam site of La Ciudad reflects the grief experienced by kin at the loss of a particularly important individual of high potential labor and reproductive value rather than a wealthy or prestigious individual. Similarly, Fiedel (1989) argues that the association of exotic marine shell objects with infants and children at Upper Paleolithic, Mesolithic, Natufian, and Archaic North American sites reflects gifts from close kin rather than ascribed status, as proposed by Winters (1968).

According to Alekshin (1983), differences in the association of burials with certain utilitarian goods can inform the archaeologist about the sexual division of labor of a particular society by identifying those tasks that were characteristically performed by men and those that were performed by women. Charles' (2005) study of sex-based differences in burial associations among Middle Woodland burials in Illinois supports this suggestion. Illinois Hopewell males and/or subadults are commonly found with nonlocal items of copper, marine shell, and mica, while ceramic vessels and bladelets are nearly always found with females and/or subadults. Charles (2005) interprets this pattern as evidence that exchange was controlled by men and the domestic farming economy dominated by women.

The sexual division of labor can also be approached through analyses of skeletal remains. For instance, in pre-contact Mesoamerica and the Neolithic Near East, burials of females exhibit deformation of the knees and shoulders as a result of the repetitive grinding of grain on stone mortars (Arnold 2006). Of course, this simple association between skeletal sex and a particular activity can be problematic. Critiques from third-wave feminists emphasize the performative, culturally constructed nature of both sex and gender. Neither category should be assumed to be biologically determined on the basis of skeletal morphology, anatomical differences, or reproductive capabilities (Geller 2005).

Although Carr (1995) found that gender had little influence on mortuary variability, many others find gender to be an important component of mortuary studies. Two different, but complementary, approaches to gendered mortuary analysis are possible. The first involves the study of material culture as a means of interpreting prehistoric gender roles and relations. According to Lesick (1997:38), gender personae "are created, ordered, and perpetuated in respect to associations with material culture." That is to say, the creation of gendered identities is only possible through association with particular, engendered material objects. For instance, in Western society one's gender is more actively invoked by gendered clothing than by the genitalia that clothing covers (Lesick 1997).

The second approach to a gendered mortuary analysis is to treat the body itself as material culture and approach gender via an empirical analysis of skeletal evidence for culture-specific practices like foot binding and the division of labor (Sofaer 2006). Such an approach also addresses the fluidity of gender in that it can relate gender specific tasks to an individual's life cycle and account for changing gendered practices:

> Since skeletal change occurs in both males and females and there is, as yet, no convincing evidence to suggest that one sex has a greater propensity to activity-induced change than the other, gender is not accessed through assumptions of natural and immutable sexual differences. Instead, gender can be examined independently of sex-based assumptions with sex regarded as one of a number of elements of gender. The skeleton may be affected by changes that are deliberate expressions of gender ideology or which are inadvertently produced through a lifetime of gendered activities (Sofaer 2006:113).

Returning to the interpretation of material associations, the association of certain individuals with symbolically important objects may be indicative of the leadership roles held by those individuals. According to Annette Weiner (1992), such objects, known as 'inalienable possessions', "are imbued with the intrinsic and ineffable identities of their owners… The loss of such an inalienable possession diminishes the self and by extension, the group to which the person belongs" (Weiner 1992:6). Inalienable possessions act as a material referent of social memory and history. They also mediate exchanges by providing a class of objects that individuals craftily attempt to keep out of circulation in the face of demand. As such, inalienable possessions are active components of the social, political, and economic spheres and possession of such items confers high prestige and demonstrates the possessor's ability to lead (Weiner 1992). Some key characteristics that distinguish inalienable possessions are that they: 1) are not subject to mundane exchange transactions; 2) rarely circulate or do not circulate widely; 3) are considered to be repositories of knowledge; 4) require special knowledge to produce; 5) are produced in gendered contexts, oftentimes enhancing the prestige of their producers; 6) are often singularities, 7) are used in ceremonies of authentication and commemoration, 8) are used to authenticate individuals as well as collective identities, and 9) are important for both the establishment and the defeat of hierarchy (Mills 2004:240).

In addition to objects and skeletal remains, aspects of social, political, and economic organization can be approached through analyses of burial areas, monuments, and cemeteries. Saxe's Hypothesis #8, discussed in chapter 2, is an excellent example of this in that it links the construction of mounds and/or corporate burial areas to social organization. According to Saxe (1970:119), groups united at the local level into formal corporate groups (i.e., clans or tribes) are more likely to utilize the placement of the dead to assert their claims to a particular territory or set of resources. Charles and Buikstra (1983, 2002; Buikstra and Charles 1999) utilize this hypothesis to assert the existence of formal corporate groups during the Middle Archaic Helton phase in Illinois. A similar process of nation-building and the construction of group identity through burial monumentalism is illustrated by the wooden mausoleums of the Berawan of Borneo and the Egyptian pyramids. "As the pharaohs built the pyramids, so did the pyramids build Pharaonic civilization" (Metcalf and Huntington 1991:161).

Among highly mobile hunter-gatherers organized into loosely integrated bands, such investments in mortuary monuments and territorial markers are not necessary. Among the !Kung, for instance, funeral rites consist of simple burials with little ceremony. Burials are a means for relatives and close friends to part company with the deceased and dispose of the body. After burial, trading partnerships are either cancelled or inherited by siblings or descendants and camps are relocated away from the burial area (Wiessner 1983a).

Littleton and Allen (2007) provide a particularly salient perspective on the mortuary landscapes of small-scale hunter-gatherers. Using data from the Murray River valley of southeastern Australia, they identify a pattern of re-use of particular landforms for burial by diverse groups. Drawing from the ethnohistoric record pertaining to Australian burial rituals, they argue that burial locations in Australia do not act as symbols of corporate territorial claims but as 'persistent places' that structured land use among groups with a fairly fluid social organization. Such burial areas were highly visible, were avoided as habitation sites, and were preferred for burial locations partly due to their unsuitability for habitation (Littleton and Allen 2007). This distinction between cemeteries, intentionally created by corporate groups for the purpose of asserting territorial claims, and persistent places, unintentionally created by a number of different groups but made meaningful as a result of history and association with the dead, is important for interpreting the archaeology of hunter-gatherer mortuary behaviors.

Social Roles along the Green River

Moving now to the issue of burial associations, social roles, and the identity of Green River Archaic individuals, it is essential to identify the contexts within which various social personae were being constructed at these sites. In general, the late Middle to Late Archaic period in the Midsouth and Midwest, including that period of time encompassing the Green River shell midden occupations, was a time of considerable social and economic change (see chapter 3). As discussed in chapter 2, if this change corresponded with an increase in organizational complexity, it can be predicted that an increased number of social, ideological, and/or political roles will be evident within Green River society. This section summarizes the available literature on Archaic social roles and outlines which roles are most likely to be evident in the Baker and Chiggerville mortuary assemblages.

As discussed above, Barbara Bender (1985a) interprets the Late Archaic archaeological record as evidence for developing social complexity marked by societies throughout the Midcontinent participating in widespread networks of exchange directed in part by individual social, political, ideological, and economic leaders. To Bender, the burial of exotic goods with certain people supports a model of developing status differentiation, possibly at the level of individual lineages. The interaction of these social, political, ritual, and economic processes in the contexts of increasing population and sedentism constituted a dynamic feedback loop which could be differentially manipulated by individuals vying for alliances and prestige. The unintended result of such competition among individuals and groups was the emergence of status inequalities.

Referring specifically to Indian Knoll, Bender (1985:57) states "that in this society status is associated not just with an individual but with lineages or families, for the more elaborate grave-goods cross-cut both age and sex distinctions." This hypothesis is supported by Winters (1968:206-207), who states that the burial of atlatl parts with men, women, and children may indicate the transfer of corporate property, not gender or the sexual division of labor. Certain forms of material culture found in Green River Archaic burials, then, might be appropriately classified as inalienable possessions that were communally owned and that served to check the development of high ranking individuals or institutionalized inequality within these corporate groups while at the same time providing a material representation of hierarchy among them (e.g., Mills 2004, Weiner 1992). An individual buried with an inalienable possession might reasonably be interpreted to be a high-ranking member of a social group, whether it be a lineage, clan, or sodality.

Another important social persona expected to be present in the Green River region is Marquardt's (1985) trader-diplomat. Supported by analyses conducted by Goad (1980) and Winters (1968), Marquardt maintained that emerging status differentiation during the late Middle to Late Archaic was taking place in the context of long-distance exchanges of marine shell and other exotic goods. Trader-diplomats who negotiated alliances bolstered by long-distance exchange were able to gain prestige by maintaining economic links to groups outside western Kentucky. As part of these economic interactions, however, environmental (both social and natural) information that benefited the group as a whole also was exchanged. This process validated emerging status differentiation by providing political, economic, and ideological mechanisms that facilitated the movement of goods, people (through marriages), and information.

The prevalence of shamans and other ritual specialists among hunter-gatherers and the cross-cultural importance of philosophical-religious factors in structuring mortuary patterns suggest that these individuals may also be identifiable within Green River Archaic burials (Carr 1995). Webb (1950a:340), for instance, identified fourteen possible occurrences of medicine bags at Carlston Annis, most with adult males, and both Watson (2005:622-623) and Winters (1968:181) suggested that flutes, pipes, rattles, and other incised and decorated artifacts held symbolic meanings and/or were used in ceremonial contexts. The fact that shamanic roles are indicated in later Middle Woodland burials in Ohio further supports the suggestion that such roles were expressed in mortuary contexts during the Archaic (Field et al. 2006).

Finally, three additional aspects of personal identity might be expressed materially in Archaic burial assemblages—gender, age, and occupation. According to Carr (1995), gender tends to be weakly expressed cross-culturally in the mortuary domain. Nevertheless, the importance of the gendered division of labor (Claassen 1991, 1996) and its potential role in changing economic practices during the late Middle to Late Archaic (Watson and Kennedy 1991) may have provided ideal contexts for the development of strong gender identities (e.g., Doucette 2001). Unfortunately, it is currently difficult to discuss gender roles in Archaic contexts without conflating the theoretical concept of gender and skeletally determined biological sex (Geller 2005), and artifact associations are not always useful in interpreting gendered identities (Lucy 1997). Nevertheless, it is hoped that additional studies of gender along the Green River can eventually yield more nuanced interpretations of gender and gender roles such as those discussed by Field et al. (2006).

Unlike gender, however, Carr (1995) found that age was one dimension of social organization that was frequently observed in burial contexts. Winters (1968:203), for instance, noted that copper and marine shell artifacts oftentimes accompanied pre-adolescent burials along the Green River and suggested that these associations were indicative of ascribed status, "whether that status be engendered by psychological factors, sociological factors or a combination of the two." Similar assertions connecting the burial of children with exotic goods to ascribed status have been made by Schulting (1996) in reference to Mesolithic populations and by various researchers utilizing Upper Paleolithic and Natufian data. Among known egalitarian groups such as the San, however, the association of women and children with shell ornaments does not translate into status inequalities (Fiedel 1989). In analyzing Epipaleolithic burials in Western Europe, Vanhaeren and d'Errico (2003) found that the sizes of beads worn by children tend to be smaller than those worn by adults, suggesting some kind of age grading among these groups. Similar age distinctions may be found among Archaic populations in eastern North America.

Finally, burial associations may be indicative of personal identity or occupation. Although not found to be strongly represented in burial practices cross-culturally, personal identity as a determinant of mortuary practices did tend to decline systematically in frequency with increasing sociopolitical complexity (Carr 1995:174). This may indicate that such roles as accomplished hunter, flintknapper, or hide-worker will be expressed in the burial assemblages of hunter-gatherer societies. The possibility that Archaic populations were experiencing an increase in social complexity during the late Middle and Late Archaic, however, suggests that these aspects of personal identity and the degree to which they are represented through time at the Green River sites may be susceptible to marked temporal variation.

Drawing on these theoretical insights into hunter-gatherer mortuary practices, this chapter first describes available data pertaining to mortuary behaviors at the Baker and Chiggerville sites and then attempts to assess the relative complexity of the mortuary activities at these sites through an analysis of burial associations and intra-site mortuary patterning. Three domains of complexity are considered in this chapter. Associations of burial goods are used to assess the potential number of social roles represented at the sites to assess the relative complexity of leadership roles. Exotic raw materials used to manufacture burial goods at each site are enumerated to provide data on the frequency and intensity of exchange at the two sites. Intra-site spatial patterning is used to assess the degree to which burial locations were structured by ritual and memory. Evidence for patterned burial disposal suggests the presence of formal cemeteries, while a lack of patterning suggests informal disposal of the dead (Milner and Jefferies 1998), consistent with a persistent places model. The site with the highest number of social roles and best evidence for vertical status differentiation is considered the most complex in the first domain. The site with the greatest number of goods obtained through exchange is considered the most complex in the second. For the third domain, a site with evidence for a formal cemetery area is considered more complex than one without such evidence.

Chiggerville Mortuary Data

The first skeletal analysis utilizing the Chiggerville assemblage was conducted by Harvard anthropologist Ivar Skarland (1939) who, as a student of Earnest Hooton, was primarily interested in the craniometric data this series could provide (Haskins and Herrmann 1996). Unfortunately, the Chiggerville skeletal assemblage is poorly preserved, so the quantity of data Skarland could derive from these 114 burials (MNI = 117) was limited. Nevertheless, he did note that one-third of the males from the site exhibited auditory extoses and that severe dental attrition was common. Furthermore, bone pathologies were found to be rare, except in cases where extreme tooth wear resulted in abscessing (Skarland 1939).

Fortunately, for the purposes of this paper, re-analyses of the Chiggerville burial population were conducted in the 1970s by Norman Sullivan (1977) and Larry Wyckhoff (1977), graduate students at Western Michigan University. Of particular importance are their updated estimates of the sexes and ages of these individuals utilizing the relatively modern techniques of dental eruption, non-metric traits of the cranium and pelvis, cancellar regression, and comparisons of the pubic symphyses, although poor preservation meant many could be aged only on a relative basis utilizing the controversial technique of the amount of dental attrition present (Sullivan 1977, Wyckhoff 1977). One must keep these caveats in mind, then, when interpreting the mortality data presented below.

The sexing techniques utilized by Sullivan (1977) are standard, so the sex ratio of 1.07 males to every female estimated by him at Chiggerville can be considered accurate. Sullivan’s mortality profiles, however, might be somewhat skewed but represent the best comparative data available for the Chiggerville population. According to Sullivan (1977), comparison of the Chiggerville mortality profiles with living populations indicates an under-representation of infants relative to sub-adults, although most deaths at the site occurred during the first ten years of life. The profile exhibits two major peaks, one at 0 to 9 years of age and another for young adults aged 20 to 29 years. The average age at death at Chiggerville is 24.57 years (Sullivan 1977:42). The only major pathologies exhibited in this assemblage were arthritis and osteoporosis (Sullivan 1977:54-55).

In addition to the aging and sexing data provided above, analysis of the Chiggerville burials was conducted utilizing five primary data sources—Webb and Haag’s (1939:14-15) burial goods table, the original WPA burial notes and photographs, Charles Snow’s burial cards (filled out by Ivar Skarland), the Webb Museum artifact catalog, and reanalysis of the mortuary goods by the author. What follows is a brief description of each burial excavated by the WPA at the site.

Burial No. 1

Burial No. 1 (Snow's Burial 15-1) was found fully flexed on its right side. In the field, this burial was identified as mature, and Skarland identified the individual as of advanced age. According to Sullivan (1977), the burial is an adult male aged 50 to 59 years. No artifacts were found in association and no evidence for prehistoric violence or conflict was recorded.

Burial No. 2

Burial No. 2 (Snow's Burial 15-2) was likely fully flexed, although it is difficult to tell from the field notes. No position was provided. In the field this individual was identified as a juvenile male, and Skarland listed the burial as a male aged 17 to 19 years. Wyckhoff (1977) classified this individual as a sub-adult aged 15 to 20 years. Webb and Haag (1939) did not list any burial associations with Burial No. 2, but a broken pointed implement (awl) is associated with this burial in the Webb Museum catalog. No photograph was available to check this association, and this object is not included as a burial association in the discussion below. No evidence of prehistoric violence or conflict was recorded.

Burial No. 3

Burial No. 3 (Snow's Burial 15-3) was fully flexed but in an unidentifiable position. The burial was recognized as an infant in the field and by Skarland. Wyckhoff (1977) provided an age of 1 to 3 years for this individual. No artifacts were found in association and no evidence for violence was recorded.

Burial No. 4

Burial No. 4 (Snow's Burial 15-4) was fully flexed on its right side. Classified in the field as a mature female, Skarland considered the individual to be advanced in age and possibly female. Sullivan (1977) classified the burial as a female aged 30 to 39 years. Webb and Haag (1939) did not list this burial as one with burial associations, although the Webb Museum catalog identifies two unidentifiable projectile point fragments as from this burial. The associated photograph does not illustrate these projectile point fragments, and they are not included among the burial associations discussed below. No evidence of violence of recorded.

Burial No. 5

Burial No. 5 (Snow's Burial 15-5) was fully flexed on its right side. In the field the individual was classified as a mature male, and Skarland identified the burial as a male around 50 years old. Sullivan (1977) concurred with the sex identification, but provided a reduced age estimate of 30 to 39 years. No artifacts were found in association and no evidence of prehistoric violence was recorded.

Burial No. 6

Burial No. 6 (Snow's Burial 15-6) was fully flexed on its left side. This individual was identified as a mature male in the field and as a male aged 42 to 47 years by Skarland. Sullivan (1977) agreed with the original sex identification but extended the age estimate to 40 to 49 years. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded.

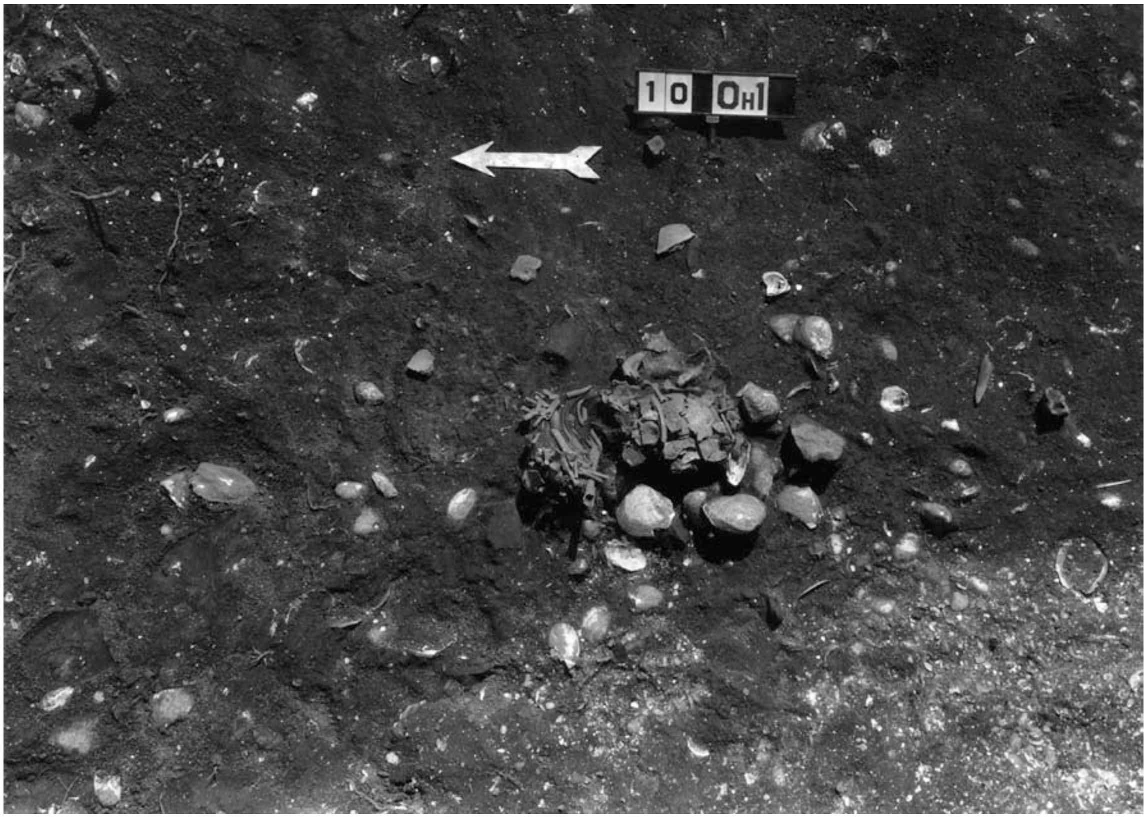


Figure 8-1. Burial No. 7. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 7 (Figure 8-1)

In the field, Burial No. 7 (Snow's Burial 15-7) was identified as a fully flexed infant lying on its left side. Skarland felt this individual was less than a year old, and Wyckhoff (1977) provided an age of 1 to 3 years. Three potsherds (FS #10) and a 'flint blade' (FS #11) were recorded in association with this burial in the field, although the field burial form for this burial states that the sherds "could easily be accidental and of later date, having worked down from the surface." Analysis of the artifacts indicate that the 'flint blade' is a biface and that the three sherds consist of two shell-tempered, plain body sherds and one shell-tempered, fabric-impressed body sherd. Examination of the burial photo (Figure 8-1) indicates that the objects are not in direct association, although they are close enough to the burial to have been in a burial pit if one were present. Given that this burial was found just below the plowzone, it is considered an Archaic burial and the sherds and biface considered incidental associations. They are not included among the burial associations discussed below. No evidence for prehistoric violence was recorded.

Burial No. 8 (Figures 8-2 and 8-3)

Burial No. 8 consists of three individuals, only two of whom were identified in the field. Burial No. 8A (Snow's Burial 15-8) was identified in the field as a fully flexed child placed on its left side. Skarland considered the child to be less than 10 years old, and Wyckhoff (1977) provided an age of 6 to 9 years.

According to Webb and Haag (1939), 2 drilled teeth and 11 disk shell beads were recovered with this burial, but the original field burial form and the Webb Museum catalog place several other objects in association. A total of 4 shell beads (FS #12), 2 tusk beads (FS #13), a flint scraper (FS #14), a flint point (FS #15), 2 pestles (FS #s 16 and 17), and flint chips (FS #18) were recorded with this individual in the field.

Unfortunately, the marine shell objects from this burial were not present in the Webb Museum collections, but examination of the burial photos clearly indicates that at least 11 shell beads (likely FS #12) were located in a cluster near the arms and that two marine shell tooth effigy pendants (FS #13) were nearby, probably part of the same necklace or other ornament. One stemmed projectile point that was either not identified as associated with this burial in the Webb Museum catalog or that is missing from the collection is located in direct association on the individual's ribs. It is not clear whether this point or an unassociated Saratoga Expanding Stemmed point located nearby is FS

Figure 8-2. Burial Nos. 8 (right) and 9 (left, below). Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

#15. FS #14 is a Saratoga cluster hafted scraper located near the pelvis and likely not in direct association. The two pestles (FS #s 16 and 17) and two pieces of debitage (FS #18, classified as 2 knives in the Webb Museum catalog) are also not in association. This individual is missing its skull, but this may represent disturbance from plowing or the intrusion of Burial No. 9 (Figure 8-2). Possible evidence of violence includes the missing skull, the interment of this individual in a multiple burial, and the projectile point found near the ribs.

Burial No. 8B (Snow’s Burial 15-91) was recorded as an infant in the field. Skarland estimated the individual's age at 3 to 4 years, but Wyckhoff (1977) provided a range of 1 to 3 years. No artifacts were found in association with this burial. Burial No.

8C was not identified in the field or by Snow or Skarland. This individual is represented by remains identified by Wyckhoff (1977) as from an infant aged less than 1 year old. It is likely that these bones were found commingled with the remains of Burial No. 8B.

Figure 8-3. Burial No. 8 Close Up. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 9 (Figure 8-2)

Burial No. 9 (Snow's Burial 15-9) was identified in the field as a fully flexed adult male on its left side. Skarland identified this individual as a male of around 25 years of age, but Sullivan (1977) provided an age range of 30 to 39 years. He concurred with Skarland's sex identification. Three 'flint blades' (projectile points, FS #s 19-21) were identified with this individual in the field. All three points were in direct association with the burial. Two were located next to the skull and pointing in the same direction, as if both were originally hafted to darts or foreshafts and encircled by the individual's right arm. The third (not depicted in the photo) was found between the ribs, under the left arm. Two of these points are Saratoga Expanding Stemmed and one is a Terminal Archaic Barbed cluster point. The location of one point between the ribs and the possible association of this burial with Burial No. 8 (a multiple burial) suggest this individual was a victim of prehistoric violence.

Burial No. 10

Burial No. 10 (Snow's Burial 15-10) was identified in the field as a fully flexed mature female on its left side. Skarland agreed with the field assessment, providing an age range of 45 to 50 years. Sullivan (1977) identified this individual as a female aged 30 to 39 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 11

Burial No. 11 (Snow's Burial 15-11) was identified in the field as a fully flexed adult male on its right side. Skarland provided a large age range of 25 to 50 years for this individual. Sullivan (1977) also concluded that the individual was male, providing a more precise age of 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 12

Burial No. 12 (Snow's Burial 15-12) was identified as a fully flexed mature male on its right side. Skarland agreed, characterizing the individual as of advanced age. Sullivan (1977) concluded this male burial was 30 to 39 years of age. A 'stone' is listed as from this burial in the Webb Museum catalog. This object is an unmodified waterworn chert pebble. The burial photograph indicates this object was located near the burial but not in direct association. No evidence for prehistoric violence was recorded.

Burial No. 13

Burial No. 13 (Snow's Burial 15-13) was a fully flexed adult male found lying on its right side. Skarland agreed with the field sex identification, narrowing the individual's age range to 45 to 50 years. This burial was not analyzed by Sullivan (1977) or Wyckhoff (1977). According to the field burial form, the individual was "in a pack of yellow soil which was intrusive into the black soil and shells of the heap." No artifacts were found in association and no evidence of prehistoric violence was present.

Burial No. 14

Burial No. 14 (Snow's Burial 15-14) was identified in the field as a fully flexed mature male lying on its right side. Skarland agreed the burial was a male and provided an age range of 30 to 40 years. Using more advanced analytical methods, Sullivan (1977) concluded the burial was a female aged 40 to 49 years. No artifacts were in association, but the skull was surrounded by rocks, suggesting that the burial was partly intrusive into a feature. No evidence for prehistoric violence was recorded.

Burial No. 15

Burial No. 15 (Snow's Burial 15-15) was a fully flexed adult male on its left side. Skarland concluded this male was aged 20 to 30 years, and Sullivan (1977) concurred, adjusting the age slightly to 20 to 29 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 16

Burial No. 16 (Snow's Burial 15-16) was identified as a fully flexed adult male on its right side. Skarland concluded the individual was a male over 25 years of age, and Sullivan (1977) provided a more precise age of 20 to 29 years. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded.

Burial No. 17

Burial No. 17 (Snow's Burial 15-17) was a partly flexed infant lying on its right side. Skarland was not certain of the individual's age but suggested that it was a newborn. Wyckhoff (1977) concluded that the infant was either an unborn fetus or a newborn. According to the original field burial forms, a total of 17 paired mussel shells (FS #25) were found near the head of this individual, but examination of the burial photograph suggests these mussels were refuse and not intentional burial associations. No other burial associations were present with this individual and no evidence for violence was recorded.

Burial No. 18

Burial No. 18 was a dog burial found fully flexed and lying on its back. No humans were in association.

Burial No. 19

Burial No. 19 (Snow's Burial 15-18) was recorded as an incomplete burial of an infant placed on its back. Skarland also identified the burial as an infant, and Wyckhoff (1977) concluded the individual was less than a year old. The individual was buried on top of Feature No. 23 (a hearth or fireplace) and is missing its skull, legs, and arms, indicating that the burial was either disturbed or a victim of prehistoric violence. Webb and Haag (1939) failed to record the 11 disk shell beads (FS # 26) found by the waist of this individual.

Burial No. 20

Burial No. 20 (Snow's Burial 15-19) was identified in the field as a fully flexed adult male lying on its back. Skarland concurred that the individual was a male and provided a tentative age range of 35 to 45 years. Sullivan (1977) identified the burial as a male aged 40 to 49 years. No artifacts were found in association, but the fact that this burial was part of a multiple burial (along with Burial No. 21) suggests that this individual was the victim of prehistoric violence.

Burial No. 21

Burial No. 21 (Snow's Burial 15-20) was identified in the field as a fully flexed adult female lying on its left side. Skarland agreed that the individual was a female and observed that all epiphyses were fused. Sullivan (1977) concluded the woman was 40 to 49 years old at death. This individual was not associated with any artifacts. A multiple burial (along with Burial No. 20), additional evidence for prehistoric violence includes the fact that the burial was missing some limbs and its skull.

Burial No. 22

Burial No. 22 (Snow's Burial 15-21) was a fully flexed infant that Skarland identified as between 3 and 5 years old. Wyckhoff (1977) concluded the individual was 1 to 3 years old. No artifacts were found associated with this individual and no evidence for prehistoric violence was recorded.

Burial No. 23

Burial No. 23 (Snow's Burial 15-22) was a fully flexed infant found lying on its right side. Skarland estimated the age of this individual as 4 to 5 years, but Wyckhoff (1977) extended this to 3 to 6 years. According to the original burial forms, this burial was associated with red ochre (FS #37), 190 disk shell beads (FS #40 to 230), a chert point (FS #38), and a tubular stone bead (FS #39). Reanalysis of these objects resulted in the identification of 154 disk shell beads (the remainder are likely lost), 2 tubular shell beads, and a tubular sandstone bead all placed at the individual's neck as though part of the same necklace. The projectile belongs to the Etley cluster and is likely associated, although it is not depicted on the field burial drawing or in the burial photo. It is possible that the point is evidence for prehistoric violence, but no other such evidence was recorded.

Burial No. 24

Burial No. 24 (Snow's Burial 15-23) was identified in the field as a fully flexed mature male lying on its right side. Skarland agreed that the burial was a male and provided an age range of 35 to 45 years. Sullivan (1977) identified Burial No. 24 as a male aged 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 25

Burial No. 25 (Snow's Burial 15-24) was a fully flexed mature female lying on its right side. Skarland characterized this female burial as of advanced age, and Sullivan (1977) provided an age range of 30 to 39 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

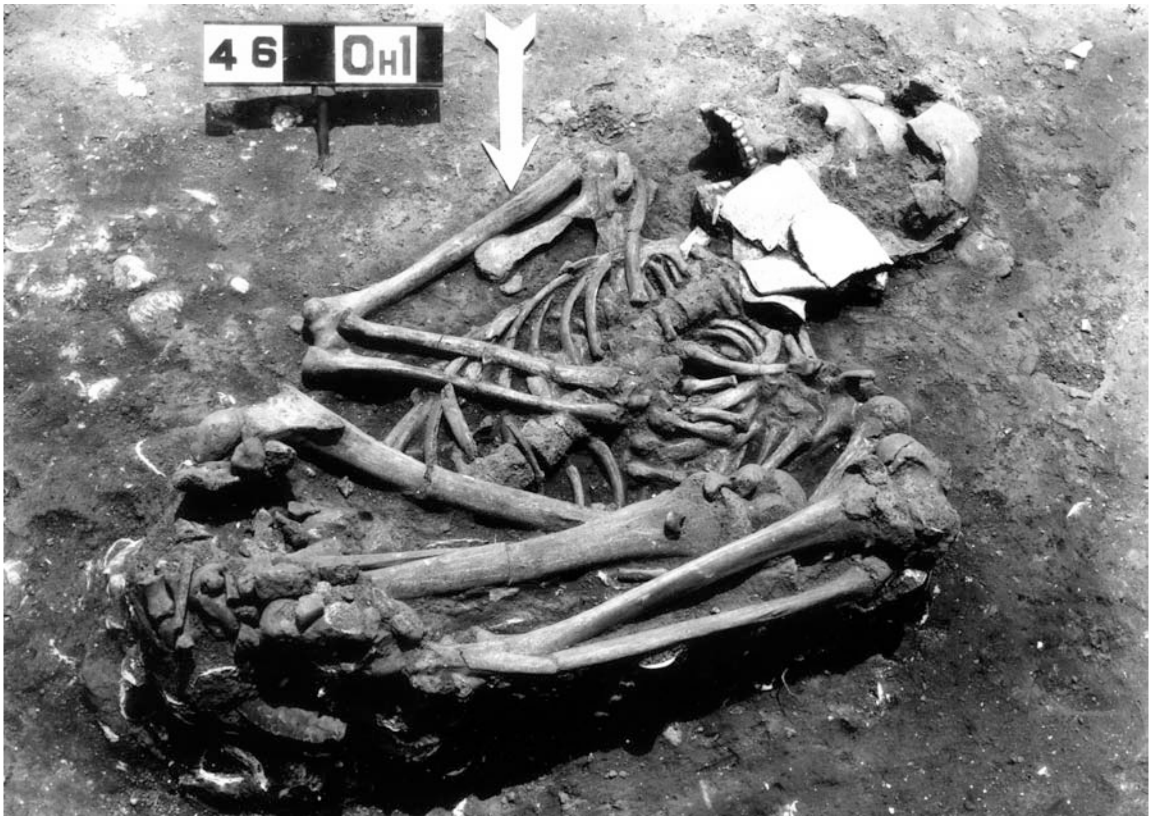


Figure 8-4. Burial No. 26. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 26 (Figure 8-4)

Burial No. 26 (Snow's Burial 15-25) was identified in the field as a fully flexed juvenile male lying on its left side. Skarland identified this individual as a male aged 15 to 17 years, but Wyckhoff reduced this to 12 to 15 years. This burial is potentially associated with Burial Nos. 27 and 28, but it is likely that the three were simply located near one another.

According to Webb and Haag (1939), Burial No. 26 was associated with 2 perforated conch sections (mis-identified as turtle shells on the original field forms). A spear point (FS #231) was also identified with this burial in the field. Analysis of the burial photo suggests that four marine conch shell sections were placed over the individual's face. These are described as "ceremonially killed" in the photograph caption. Two conch shell objects and several fragments that likely represent a third are present in the Webb Museum collections associated with this burial. It is likely that these three objects were all components of a single headdress or mask worn by the individual.

One Elk River projectile point found near the feet is likely not in association. A second point (an Etley) associated with this burial is not visible in the burial photograph. This point exhibits an impact fracture and, if embedded in the burial, would provide evidence for prehistoric violence.

Burial No. 27

Burial No. 27 (Snow's Burial 15-26) was a partly flexed adult female placed on its right side. Skarland identified this burial as a female aged 18 to 21 years. Sullivan confirmed the individual's sex, but provided an age range of 20 to 29 years. No artifacts were found in association and the only possible evidence of prehistoric violence was the fact that Burial Nos. 26, 27, and 28 may represent a multiple burial.

Burial No. 28

Burial No. 28 (Snow's Burial 15-27) was identified in the field as a fully flexed adult on its left side. Both Skarland and the original field forms characterize this burial as a possible female, and Skarland considered the age to be unidentifiable. Sullivan (1977) also could not provide an age for this individual, but he concluded that the burial was a female. No artifacts were found in association. In addition to being a possible multiple burial, Burial No. 28 was missing its skull and several limbs.

Burial No. 29

Burial No. 29 (Snow's Burial 15-28) was identified in the field as a possible male that was fully flexed on its right side and of mature age. Skarland also felt this individual was a possible male, and he provided an age range of 35 to 40 years. Sullivan (1977) identified this burial as a female aged 30 to 39 years. A projectile point identified as a broken spear point (FS #244) on the original burial forms was not in association with this burial in the burial photograph. No evidence for prehistoric violence was recorded.

Burial No. 30

Burial No. 30 (Snow's Burial 15-29) was a fully flexed mature male placed on its left side. Skarland identified this individual as a male of around 50 years old. According to Sullivan (1977), this individual is a female aged 40 to 49 years. No artifacts were found in association with this burial. The skull was missing, suggesting the individual was a victim of violence.

Burial No. 31 (Figure 8-5)

Burial No. 31 (Snow's Burial 15-30) was a partly flexed child lying on its right side. The field form and Skarland both considered this individual to be a possible male, and Skarland felt Burial No. 31 was 8 years old. Wyckhoff (1977), on the other hand, assigned an age range of 9 to 12 years to this individual. Although clearly associated with a dog burial (also designated Burial No. 31), the disturbance of shell beads evident in Figure 8-5 suggests that this dog was intrusive. Burial No. 31 was also considered to be associated with Burial No. 32 by the WPA excavators, but the horizontal distance between these burials suggests that the two are independent of one another.

The field burial forms state that Burial No. 31 was associated with an axe (FS #273), but the position of the axe on the burial drawing suggests that it was not in association. Disk and tubular shell beads (FS #273-555) are in association and represent between 3 and 7 distinct objects (e.g., necklaces, bracelets) based upon their sizes and positions in the burial photograph. No evidence of prehistoric violence was recorded.

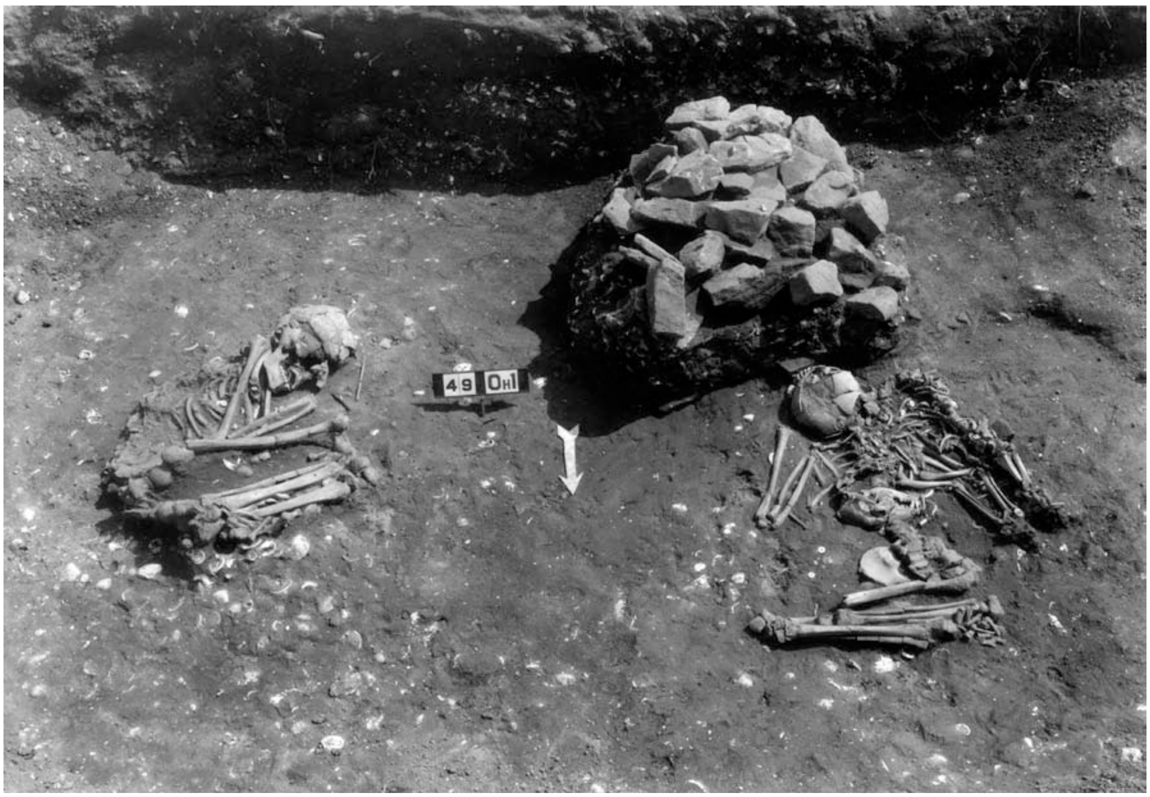


Figure 8-5. Burial Nos. 31 (right) and 32 (left). Feature No. 26 is a large pile of sandstone boulders. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 32 (Figure 8-5)

Burial No. 32 (Snow's Burial 15-31) was recorded as a fully flexed adult possible male lying on its left side. Skarland assigned the possible male an age range of 20 to 31 years. Sullivan (1977) concluded the individual was a male and assigned an age range of 20 to 29 years. No evidence of prehistoric violence was recorded.

According to the field burial forms, this individual was associated with beads (FS #248-271), an awl or needle (FS #246), a blackened bone tube or awl (FS #247), and a stone ball (FS #272). Webb and Haag (1939) listed only 12 disk shell beads and 2 bone awls with this burial. Analysis of the burial photograph and artifacts in the Webb Museum indicate that at least 27 disk shell beads and 2 pointed implements were in association. The 27 disk shell beads are likely all from the same object located in the chest area in the photograph (probably a necklace). One pointed implement is a shaped bone pin that is in association in the burial photograph. The other is a broken bone awl that is likely not in association. The stone ball is a mano/hammerstone that is not depicted in the photo and that is likely not in association. Also associated with this burial in the Webb Museum catalog are a piece of circumferentially groove-and-snapped antler tool production debitage and a perforated deer astragulus. The former was likely an incidental inclusion, but the latter may be a burial association.

Burial No. 33

Burial No. 33 (Snow's Burial 15-32) was recorded in the field and by Skarland as an infant. The individual was fully flexed and buried on its left side. According to Wyckoff (1977), this individual was between 3 and 6 years of age. The burial photograph depicts a turtle carapace (FS #245) that is most likely in association near the individual's head. No evidence of prehistoric violence is recorded.

Burial No. 34

Burial No. 34 (Snow's Burial 15-33) was identified on the field burial form as a fully flexed mature to senile male placed on its left side. Skarland classified the individual as a possible female aged 30 to 50 years, while Sullivan (1977) considered the burial a female aged 50 to 59 years. No artifacts were found in association with this burial and no evidence of prehistoric violence was recorded.

Burial No. 35

Burial No. 35 (Snow's Burial 15-34) was a fully flexed mature male buried on its back and recorded as a male older than 45 years. Sullivan (1977) agreed that the burial was a male but did not attempt to determine the individual's age. No artifacts were found in association and no evidence of prehistoric violence was recorded.

Burial No. 36

Burial No. 36 (Snow's Burial 15-35) was a partly flexed infant found lying on its back and classified by Skarland as less than one year old. Wyckhoff (1977) agreed with this age estimate. Examination of the burial photograph indicated that the individual had two disk shell beads (FS #559-560) located near its back and two turtle carapaces (FS #556-557) near its head. A perforated freshwater mussel shell (FS #558) was also found in association near the lower limbs. The only possible evidence for prehistoric violence was some missing limbs, but this may represent disturbance or differential preservation.

Burial No. 37

Burial No. 37 (Snow's Burial 15-36) was a fully flexed infant lying on its right side. Skarland considered this burial to be less than one year old, an age confirmed by Wyckhoff (1977). No burial associations or evidence of prehistoric violence were recorded with this burial.

Burial No. 38

Burial No. 38 (Snow's Burial 15-37) was recorded in the field as a fully flexed mature female lying on its right side. Skarland and Sullivan (1977) both agreed with the sex identification. Skarland described the individual's age as advanced, and Sullivan assigned the burial an age of 40 to 49 years. No artifacts were found in association and no evidence of prehistoric violence was recorded.

Burial No. 39

Burial No. 39 (Snow's Burial 15-38) was recorded as a fully flexed adult male on its right side. Skarland considered the burial a middle-aged female, and Sullivan (1977) assigned the female an age range of 30 to 39 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 40

Burial No. 40 (Snow's Burial 15-39) was a fully flexed adult female found lying on its left side. Skarland assigned the female an age range of 20 to 30 years, and Sullivan (1977) reduced this to 20 to 29 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 41

Burial No. 41 (Snow's Burial 15-40) was recorded in the field as a fully flexed adult possible female lying on its right side. Skarland also classified the burial as a possible female and concluded that the individual was of an advanced age. Sullivan (1977) concluded the burial was a female aged 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 42

Burial No. 42 (Snow's Burial 15-41) was a partly flexed mature male lying on its right side. Skarland agreed the individual was a male and assigned an age of 35 to 50 years. Sullivan (1977) confirmed Skarland's sex identification, but reduced the age range to 30 to 39 years. This burial was recorded as being associated with Burial No. 46, but it is likely these two burials were just near one another.

Webb and Haag (1939) and the original field notes assign 130 disk shell beads (FS #561-691) to this burial, but only 117 were located in the Webb Museum collection. Only 8 beads were evident in the burial photograph. These are all located at the neck, and it seems likely that the beads were all part of a single necklace. No evidence for prehistoric violence was recorded.

Burial No. 43

Burial No. 43 (Snow's Burial 15-42) was identified in the field as a fully flexed mature female lying on its right side. Skarland assigned the female an age of 40 years to senile, while Sullivan (1977) provided an age range of 30 to 39 years. Sullivan agreed with Skarland's sex identification. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 44 (Figures 8-6 to 8-8)

Burial No. 44 was the most richly adorned burial recovered at the Chiggerville site. This individual was recorded in the field as a partly flexed adult female lying on her right side. In the field, the burial was considered associated with Burial No. 47, but it is evident from the burial photographs that Burial No. 44 intruded into Burial No. 47. Skarland identified this burial as a female aged 30 to 35 years, and Sullivan (1977) characterized the burial as a female aged 20 to 29 years. No evidence for prehistoric violence was recorded.

The original field burial forms assigned the following objects to this burial: 39 small disk shell beads (FS #694-733), 13 large disk shell beads (FS #734-747), 12 drilled

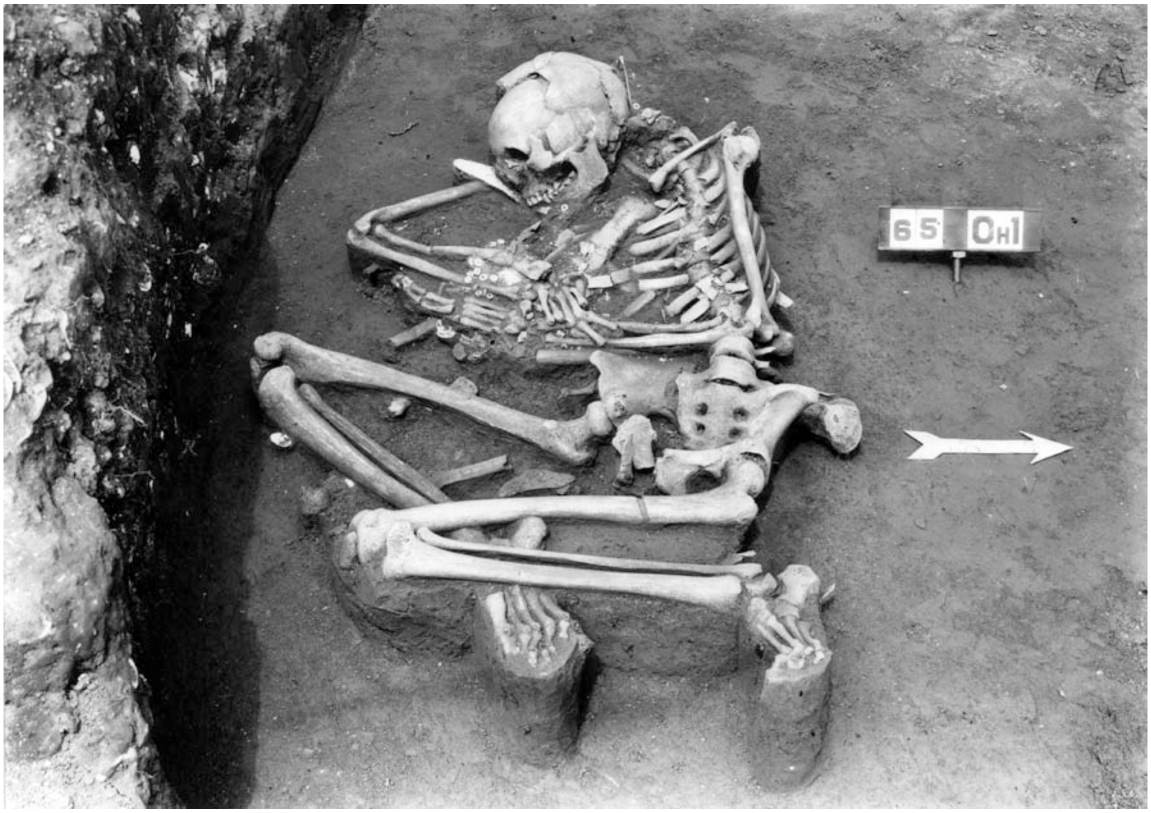


Figure 8-6. Burial No. 44. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

animal teeth (FS #748-760), 4 drilled shell strips (FS #761-765), 2 drilled large sections of shell (FS #766-767), a bannerstone (FS #768), and at atlatl (FS #769). Analysis of the burial photographs indicates that the shell beads were divided into two bracelets and that a few of the beads were located at the neck, possibly on a necklace. The atlatl was intentionally broken and consisted of a winged atlatl weight (Figure 7-26a) and a large antler atlatl hook located at an approximately 90 degree angle to the orientation of the atlatl weight. This object was held in the individual's arms.

The two perforated trianguloid conch shell pendants associated with this individual were located under the head and were likely both part of the same head ornament or headdress. The perforated teeth (2 are missing and could not be identified) are wolf canines (n = 7), and P4s (n = 2) that make up a single necklace placed under the

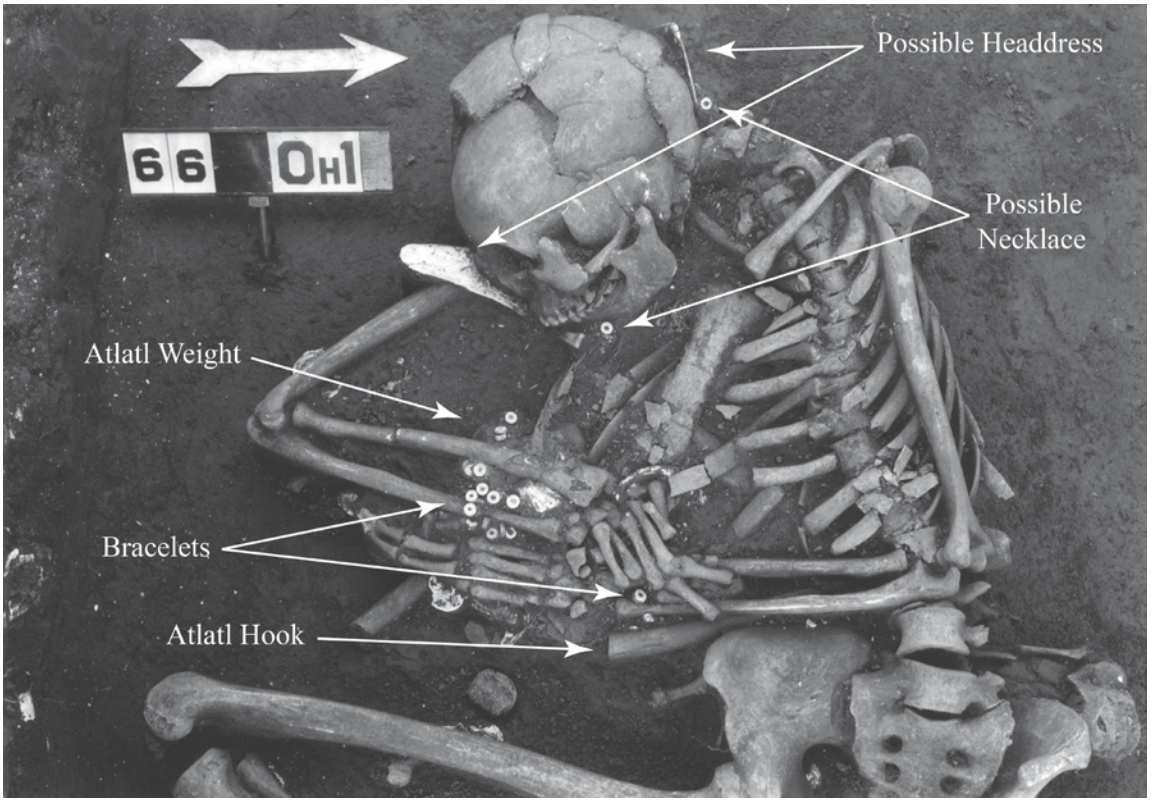


Figure 8-7. Burial No. 44 Close Up. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

thoracic vertebrae and in direct association with the four sectioned freshwater mussel shell strips. According to the field burial forms, the tooth necklace continued around the neck of the individual. It is likely the freshwater mussel shell sections were also part of this necklace. Unfortunately, the atlatl weight was missing from the Webb Museum collection and could not be analyzed for this study.

Burial No. 45

Burial No. 45 (Snow's Burial 15-44) was identified in the field as a fully flexed possible male of mature age found on its left side. Skarland classified this individual as a possible male older than 35 years, and Sullivan (1977) identified Burial No. 45 as a female aged 50 to 59 years. Although Webb and Haag (1939) failed to identify any artifacts with this burial, the field burial form indicates that a bone awl (FS #770) was

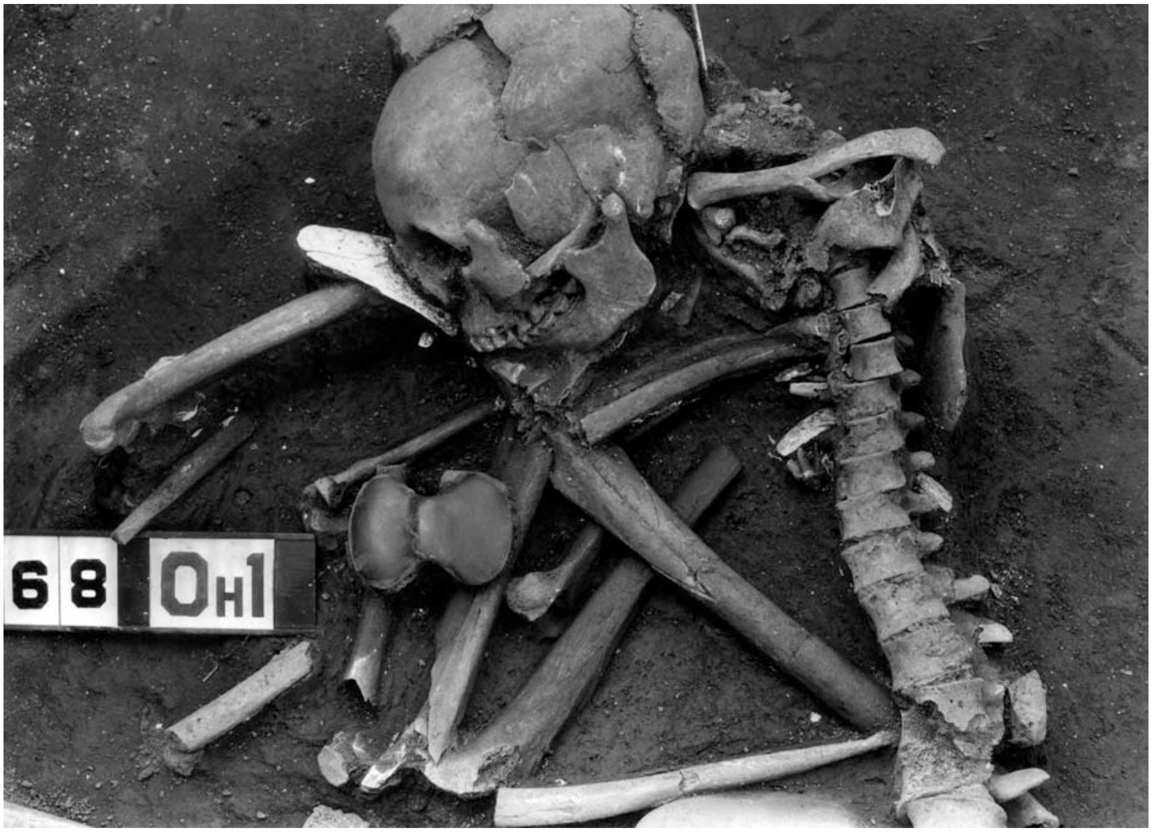


Figure 8-8. Burial No. 44 Close Up with Atlatl. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

associated with this individual. The object is a heavily shaped and polished pointed implement or bone pin. In the burial photograph the pin is clearly located with the burial near the individual's skull.

Burial No. 46

Burial No. 46 (Snow's Burial 15-45) was as a partly flexed infant lying on its back. Skarland provided an age of 2 to 3 years for this individual, which Wyckhoff (1977) modified to 1 to 3 years. No artifacts were found in association and no evidence of violence was recorded. This burial is listed as associated with Burial No. 42 on the field burial forms, but these two burials are likely only near one another and not a double burial.

Burial No. 47

Burial No. 47 (Snow's Burial 15-46) was a badly disturbed burial located under Burial No. 44. Sullivan (1977) listed the sex of this individual as indeterminate. No age estimation could be made. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded.

Burial Nos. 48, 49, and 50

Burial No. 48 (Snow's Burial 15-47) was part of a multiple burial that also included Burial Nos. 49 (Snow's Burial 15-48) and 50 (Snow's Burial No. 15-49). All three were recorded in the field as adults of unknown sex and position. Skarland indicated that all three burials were adults. Sullivan (1977) considered the sex of Burial Nos. 48 and 49 indeterminate and did not provide an age estimate for any of the three. Burial No. 50 was classified as a male. These burials were mixed and disturbed by plowing. It is likely the seven plain, shell-tempered sherds associated with the group were intrusive from the plowzone as well. Unfortunately, no burial photo was taken so this mixed association cannot be confirmed. These sherds consist of two rimsherds, four body sherds, and one base sherd and are not included among the burial associations discussed below.

Burial No. 51

Burial No. 51 (Snow's Burial 15-50) was identified in the field as a fully flexed adult female lying on its right side. Skarland considered this individual to be a possible female aged 25 to 35 years. Sullivan (1977) concurred that the individual was a female, but reduced the age estimate to 20 to 29 years. No artifacts were associated with these burials and no evidence of prehistoric violence was recorded.

Burial No. 52

Burial No. 52 was a dog burial represented by only some longbones and vertebrae. No human burials were in association.

Burial No. 53

Burial No. 53 (Snow's Burial 15-51) was a fully flexed mature male documented as lying on its right side. Skarland concurred with the field sex identification and assigned an age of over 45 years to this individual. Sullivan (1977) identified this burial as a female aged 40 to 49 years. The Webb Museum catalog lists a pestle as in association with this burial; however, the object exhibits no signs of use and is an unmodified waterworn chert cobble or geode. The burial photograph depicts the object near the burial's pelvis, but it was likely not an intentional burial association and has not been included in the discussion of burial goods below. The presence of an extra mandible with this burial may be evidence for prehistoric violence if the mandible was a trophy. It is also possible that the mandible was an incidental inclusion in the burial fill due to commingling.

Burial No. 54

Burial No. 54 (Snow's Burial 15-52) was a fully flexed mature male placed on its left side. Skarland agreed that the individual was a male but was unsure about the age, assigning a range of 35 to 50 years. Sullivan (1977) identified the individual as a male aged 40 to 49 years. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded.

Burial No. 55

Burial No. 55 (Snow's Burial 15-53) was identified in the field as an adult of indeterminate sex found fully flexed on its left side. Skarland assigned an age range of 35 to 50 years to this individual. Sullivan (1977) identified the burial as a male aged 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 56

Burial No. 56 (Snow's Burial 15-54) was recorded in the field as the fragmentary remains of an infant. This burial was adjacent to Feature No. 32, an amorphous rock-lined hearth or 'fireplace', and had probably been disturbed by activities associated with this feature. Skarland did not attempt an age estimate, but Wyckhoff (1977) concluded the individual was less than 1 year old. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 57

Burial No. 57 (Snow's Burial 15-55) was a fully flexed infant lying on its right side. Skarland could provide no additional age estimates for this burial, but Wyckhoff (1977) concluded the individual was less than 1 year old. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 58

Burial No. 58 (Snow's Burial 15-56) was identified in the field as a fully flexed possible female of mature age found lying on its right side. Skarland also identified the individual as a possible female and provided an age of 35 years to advanced. Sullivan (1977) concluded the burial was that of a female aged 30 to 39 years old at the time of death. The field burial forms list a stone object (FS #792) as in direct association, but no such object is catalogued with this burial. Examination of the burial photograph indicates that the stone object is a small pestle or cylindrically shaped unmodified cobble. The object was in direct association with the burial, having had been placed just below the feet. No evidence for prehistoric violence was recorded.

Burial No. 59

Burial No. 59 (Snow's Burial 15-57) was a partly flexed mature individual of indeterminate sex found lying on its left side. Skarland was unsure about the age and sex of this burial, listing it as possibly mature. Sullivan concluded that the burial was of a 40 to 49 year old individual of indeterminate sex. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 60

Burial No. 60 (Snow's Burial 15-58) was a poorly preserved individual represented by only a few bone fragments and teeth. Skarland did not provide an age estimate for this burial, but Wyckhoff (1977) concluded the infant was less than 1 year old. The field burial forms list two shell objects (FS #793-794) and nine paired mussels (FS #795-804) as in direct association. The two shell objects are earplugs or pins manufactured from the columellae of large marine gastropods, and the paired mussels are freshwater bivalves. Examination of the burial photograph indicates that the paired mussel shells are not in direct association but are part of the site's refuse matrix. The two columella pins were placed toward the feet of the individual. A rodent incisor that was not catalogued by the WPA investigators was located near the individual's head.

Whether this object was an incidental inclusion or a rodent incisor tool placed with the burial cannot be ascertained. No evidence for prehistoric violence was recorded.

Burial No. 61

Burial No. 61 (Snow's Burial 15-59) was recorded as a fully flexed adult possible male found lying on its left side. Skarland assigned an age of 25 to 40 years to the possible male, and Sullivan (1977) concluded the individual was a male aged 20 to 29 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 62

Burial No. 62 was a dog found partially flexed on its left side. No human burials were in association.

Burial No. 63 (Figure 8-9)

Burial No. 63 (Snow's Burial 15-60) was an infant found fully flexed and lying on its left side. Skarland could not revise the field age estimate, but Wyckhoff (1977) concluded the individual was between 1 and 3 years of age. The similarity in artifact types shared between this burial and the nearby Burial No. 64 indicates that the two are directly associated with one another. Evidence for prehistoric violence includes burial as part of a multiple burial and missing limbs.

On the field burial forms, Burial No. 63 is listed as associated with a mortar (FS #805), a worked rock (FS #806), a conch shell mask (FS #807), a composite shell atlatl weight (FS #808-817), and three disk shell beads (FS #818-820). Examination of the burial photographs and catalogued artifacts indicates that the worked rock is a mano/hammerstone. This object was likely associated with the mortar as part of a feature that was disturbed by the placement of the two burials. The conch shell gorget/mask is perforated and was located at the neck of the individual, and the atlatl weight was distributed in sections by the legs and under the gorget/mask. The shell beads are not discernible in the photographs.

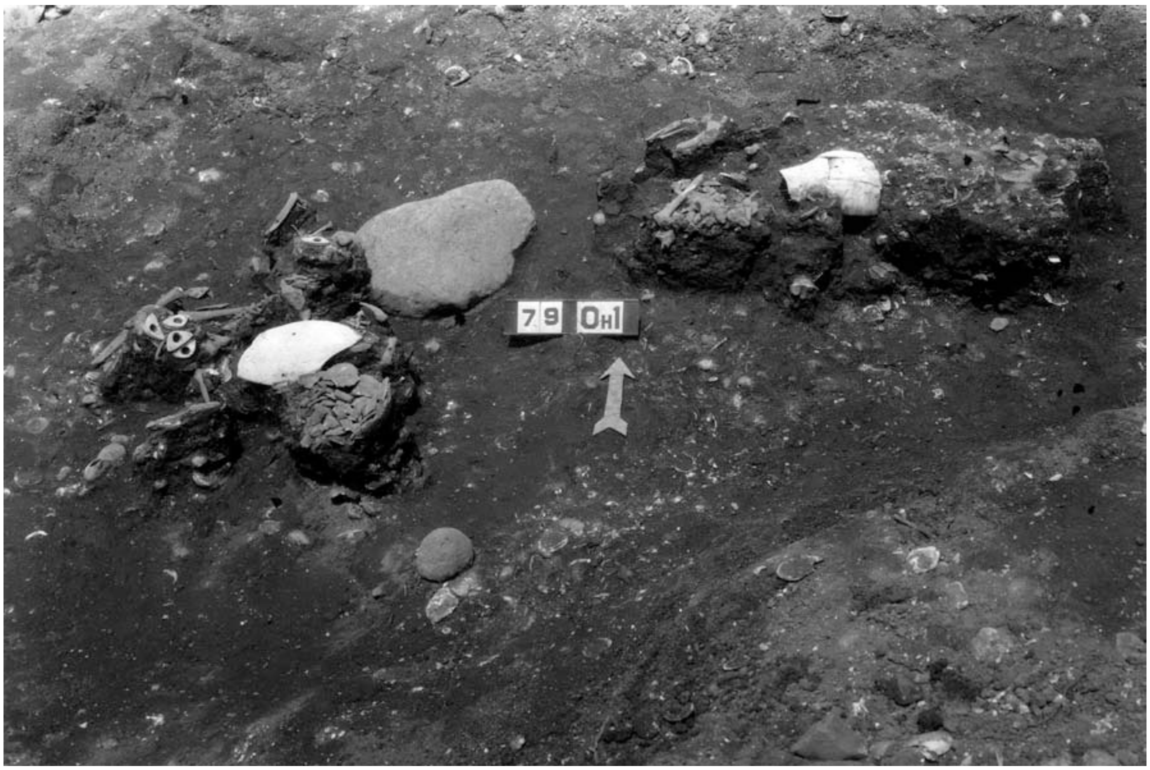


Figure 8-9. Burial Nos. 63 (left) and 64 (right). Note that the mortar is not lying flat on the burial surface and the mano/hammerstone has been displaced to the south. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 64 (Figure 8-9)

Burial No. 64 (Snow's Burial 15-61) was an infant found fully flexed on its right side. Skarland could not revise the original field age, but Wyckhoff (1977) identified the individual as 3 to 6 years old. The similarity in artifact types shared between this burial and the nearby Burial No. 63 indicates that the two are directly associated with one another. Evidence for prehistoric violence includes burial as part of a multiple burial and missing limbs.

The original field burial forms recorded a turtle shell (FS #821), 29 disk shell beads (FS #822-850), and 539 ground shell beads (FS #851-1389) in direct association with this burial. Webb and Haag (1939) revised these original identifications, noting that the 'turtle shell' was actually a perforated conch section (gorget/mask). The ground shell beads are manufactured from freshwater *Leptoxis* shells. Although it is difficult to tell from Figure 8-9, it appears as though the perforated gorget/mask is lying on top of a blanket or sash of these *Leptoxis* beads. The disk shell beads are not discernible in the photograph. A bone pointed implement listed in the catalog as from this burial is broken and is likely an incidental inclusion.

Burial No. 65

Burial No. 65 (Snow's Burial 15-62) was identified in the field as a fully flexed adult possible male lying on its right side. Skarland noted that the possible male was 40 years to advanced in age. Sullivan (1977) concluded that the individual was a female aged 20 to 29 years. A bone pointed implement is listed in the Webb Museum catalogue as associated with this burial, but this object is not evident in the burial photograph and is not considered among the associated burial goods discussed below. No evidence for prehistoric violence was recorded.

Burial No. 66

Burial No. 66 (Snow's Burial 15-63) was a partly flexed mature male lying on its right side. Skarland assigned this male an age range of 35 to 50 years, an age estimate that Sullivan (1977) revised to 30 to 39 years. Sullivan agreed with Skarland's sex identification. The field burial forms for this individual list a ceremonially killed drilled fossil conch shell (FS #1391) in association. This identification was revised by Webb and Haag (1939) to a perforated conch shell. The object is similar to the other perforated marine shell objects identified as gorget/masks. Examination of the burial photograph indicates the object was placed near the individual's elbows. No evidence for prehistoric violence was recorded.

Burial No. 67

Burial No. 67 (Snow's Burial 15-64) was the poorly preserved, fragmentary remains of an infant. Skarland's identification was consistent with the field identification, but Wyckhoff (1977) concluded the infant was less than 1 year old at the time of death. The burial was listed on the field forms as associated with Burial No. 74. The two were near one another but are likely not a multiple burial.

In the field, 27 disk shell beads (FS #1394-1421) and 12 paired mussels (FS #1422) were listed as associated. The burial is superimposed atop a hearth (Feature No. 39) that contained paired mussels, and the mussels from the burial are most likely also from this feature. The disk shell beads are grouped together at the individual's neck, indicating they are likely from a single necklace. Small animal bones were found near the burial's pelvis, and these are likely also associated with Feature No. 39.

Burial No. 68

Burial No. 68 (Snow's Burial 15-65) was a fully flexed child found lying on its right side. Skarland assigned an age of 12 to 13 years to this individual. Sullivan (1977) extended this age to 9 to 12 years. In the field, this burial was considered to be associated with Burial Nos. 69 and 72, but examination of the burial photograph indicates this association may be incidental. If the three burials do represent a multiple burial, this would provide possible evidence for prehistoric violence. No artifacts were found in association with Burial No. 68.

Burial No. 69

Burial No. 69 (Snow's Burial 15-66) was a fully flexed infant found lying on its back. This burial was potentially part of a multiple burial that included Burial Nos. 68 and 72. Skarland estimated this individual to be around 3 years of age, but Wyckhoff (1977) extended this to 1 to 3 years. An Elk River projectile point (FS #1390) was listed as associated with Burial No. 69, but the burial photograph indicates that the point was to the southeast and oriented away from the burial. This suggests that it was not an intentional association. It is possible that the point, along with the multiple burial, provides evidence for prehistoric violence but a more detailed skeletal analysis is required to test this hypothesis.

Burial No. 70 (Figure 8-10)

Burial No. 70 (Snow's Burial 15-67) was a fully flexed infant found lying on its left side. Skarland assigned an age of 2 to 3 years to this burial, and Wyckhoff (1977) extended this to 1 to 3 years. According to the original field burial forms, a bone pendant (FS #1392) and a flint scraper (FS #1393) were found in association. The Webb Museum catalog also includes a bone awl with Burial No. 70, but this object is not evident in the burial photograph and is now missing. The 'bone pendant' is a rectanguloid turtle shell with two perforations depicted as Figure 16:i in Webb and Haag (1939). This object is present in the Webb Museum collection but is not catalogued as associated with a burial. The scraper is a Late Archaic McWhinney hafted scraper that is depicted in the burial photograph as near the feet but probably not an intentional association. Only the turtle carapace object is listed as associated with the burial in the discussion below. This object may be a net mesh gauge, but its position in the burial photograph suggests it is part of the individual's clothing. No evidence for prehistoric violence was recorded.

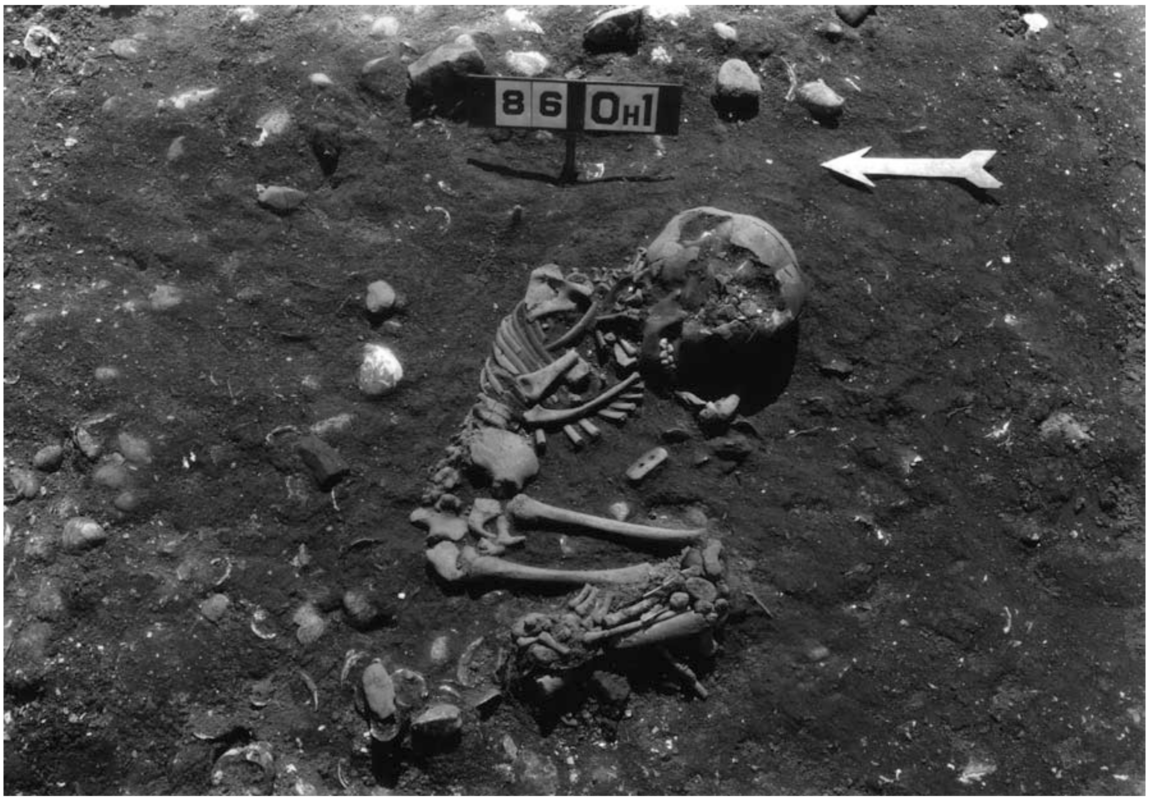


Figure 8-10. Burial No. 70 depicting the Rectanguloid Object in Association. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

Burial No. 71

Burial No. 71 (Snow's Burial 15-68) was a partly flexed infant found lying on its left side. Skarland assigned an age of 2 to 3 years to this individual, but Wyckhoff (1977) reduced this to less than 1 year. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 72

Burial No. 72 (Snow's Burial 15-69) consisted of the fragmentary remains of an infant. Skarland could not refine this identification, but Wyckhoff (1977) assigned the individual an age of less than 1 year. This individual was associated with Burial Nos. 68 and 69. The original field burial forms list 14 shell beads (FS #1424-1438) and a conical antler spear point (FS #1423) with this burial. Webb and Haag (1939) do not list any objects, and, unfortunately, there is no burial photograph illustrating this individual. It is possible that the antler projectile point, along with the multiple burial, provide evidence for prehistoric violence. However, it is also possible that the point was not in association at all.

Burial No. 73

Burial No. 73 (Snow's Burial 15-70) was an adult male lying extended on its back. Skarland assigned this male an age of 20 to 40 years, and Sullivan (1977) reduced this to 20 to 29 years. The original field burial forms listed several items in association with this burial. These included shell disk beads (FS #1441-1584), a stone object (FS #1439), and a flint point (FS #1440). According to Webb and Haag (1939), the stone object was a stone bar atlatl weight, although the object is listed in the Webb Museum catalog as a gorget. In the burial photograph, this object and the projectile point are both located under the individual's head. Unfortunately, the stone object is missing from the collection and could not be analyzed as part of this study. Its position in the burial photograph suggests that it is in association, and it is discussed below as an atlatl weight. The disk shell beads (141 remain in the collection) were all clustered at the neck as though they were part of a single necklace. The unidentified projectile point fragment was likely an incidental inclusion; however, it may be evidence for prehistoric violence as well.

Burial No. 74

Burial No. 74 (Snow's Burial 15-71) is represented by the fragmentary remains of an infant, an age identification that was left unmodified by Skarland. Wyckhoff (1977), on the other hand, concluded the individual was less than 1 year old at the time of death. The burial was listed on the field forms as associated with Burial No. 67. The two were near one another, but are likely not a multiple burial. A total of 37 disk shell beads (FS #1585-1622) were associated with this burial but their position relative to the body could not be determined due to the lack of a burial photograph. No evidence for prehistoric violence was recorded.

Burial No. 75

Burial No. 75 (Snow's Burial 15-72) was a partly flexed infant recorded on the original field burial forms as lying on its left side. Skarland assigned an age range of 1 to 2 years to this individual. Wyckhoff (1977), however, concluded the infant was less than 1 year old at death. A yellow stone object (FS #1623) was listed as in association on the field burial forms. This object is an unmodified siderite concretion that was likely not in association. No burial photograph was taken, but the field drawing notes that the object was just west of or under the left side of the burial. This object is not included among the burial associations discussed below. No evidence for prehistoric violence was recorded.

Burial No. 76

Burial No. 76 (Snow's Burial 15-73) was identified in the field as a fully flexed mature female that had been placed on its left side. Skarland assigned the female an age of over 50 years, which Sullivan (1977) revised to 30 to 39 years. Sullivan concurred with Skarland's sex identification. On the field burial form, this burial is associated with a bone awl (FS #1624) and a lozenge-shaped piece of shell (FS #1625). Webb and Haag (1939) listed the burial as associated with a shell pendant, but no shell objects matching this description are present in the Webb Museum catalog or collection. Examination of the burial photograph indicates a shell object was located near the knees of the individual, but this object appears to be mussel shell. It is likely it was discarded as a fragment of shell in the field, and the field notes were not corrected. The awl is located near the individual's hands and was likely intentionally placed with the burial at the time of interment. No evidence for prehistoric violence was recorded.

Burial No. 77

Burial No. 77 (Snow's Burial 15-74) was a fully flexed mature male lying on its left side. Skarland identified this individual as a male aged 40 years to advanced. Sullivan (1977) considered the individual to be a male aged 50 to 59 years. A total of 65 disk shell beads (FS #1627-1692) were recovered with this individual. Four are depicted at the neck in the burial photograph, suggesting these beads were part of a single necklace. No evidence for prehistoric violence was recorded.

Burial No. 78

Burial No. 78 (Snow's Burial 15-75) was identified in the field as a fully flexed adult male lying on its left side. Skarland agreed that the individual was a male and assigned an age range of 45 years to mature. Sullivan (1977) identified the burial as a female aged 50 to 59 years. The burial photograph depicts a chert drill (FS #1626) in association at the individual's neck. No evidence for prehistoric violence was recorded.

Burial No. 79

Burial No. 79 was the burial of a fully flexed dog. No human burials were in association.

Burial No. 80

Burial No. 80 (Snow's Burial 15-76) was a highly fragmentary burial of an infant. Skarland could provide no additional age estimates for this burial, but Wyckhoff (1977) concluded the individual was less than 1 year old. According to the field burial forms, this individual was associated with a drilled section of a conch shell (FS #1704), 11 disk shell beads (FS #1693-1703), and mussel shells that were lain around the burial with their interiors facing upwards. Seven of the disk shell beads remain in the collection, and an eighth bead is more appropriately classified as a tubular shell bead than a disk shell bead. These objects were not evident in the burial photograph, but the photo does make it clear that the burial was placed in a shell-filled pit and that the mussel shells were lying with their interiors facing upward. Whether this was intentional or a result of excavation is unknown. The perforated shell object is a trianguloid pendant that was located near the humerus. No evidence for prehistoric violence was recorded.

Burial No. 81

Burial No. 81 (Snow's Burial 15-77) was a fully flexed mature male found lying on its left side. Skarland agreed with the original age and sex identifications, but Sullivan (1977) classified the individual as a male aged 50 to 59 years. Although Webb and Haag (1939) listed no objects with this burial, the original field burial forms list a grey flint spear point (FS #1705) in association. Unfortunately, no burial photograph is available for this burial. However, the fact that the biface is one of the few unbroken bifaces from the site supports its intentional placement with this individual, so it is included among the burial associations discussed below.

Burial No. 82

Burial No. 82 (Snow's Burial 15-78) was represented in the field as only a few fragmentary remains of an adult. Skarland considered the individual to be a mature adult of indeterminate sex, and Sullivan (1977) could not provide an age or sex estimate. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded.

Burial No. 83

Burial No. 83 (Snow's Burial 15-79) was identified in the field as a fully flexed adult female that had been placed on its left side. Skarland considered the individual to be a possible female aged 20 to 30 years, and Sullivan (1977) concluded the burial was a female aged 20 to 29 years. This individual was buried with a string of 80 shell beads (FS #1713-1792) and a single barrel-shaped limestone bead (FS #1793) around its waist and a necklace of 10 disk shell beads (FS #1794-1803) around its neck. Webb and Haag (1939) identified the 80 beads around the waist as tubular shell beads, but only 19 beads were present in the Webb Museum collection from this burial and none were tubular. Two marine shell canine tooth shaped effigies catalogued as from this burial are likely the missing objects associated with Burial No. 8A. No evidence for prehistoric violence was recorded. Burial No. 87, a dog, was found interred immediately below this burial.

Burial No. 84

Burial No. 84 (Snow's Burial 15-80) was a highly fragmentary burial. Skarland provided no information pertaining to age or sex, but Wyckhoff (1977) was able to identify this individual as a 6 to 9 year old. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 85

Burial No. 85 consisted of two individuals. Burial No. 85A (Snow's Burial 15-81) was a fully flexed infant lying on its left side. Burial No. 85B was not identified in the field or by Skarland, who could provide no additional age estimates for 85A. Wyckhoff (1977) was the first to recognize two individuals aged less than 1 year old among these commingled remains. Neither burial was associated with any burial objects and no evidence for prehistoric violence was recorded.

Burial No. 86

Burial No. 86 (Snow's Burial 15-82) is represented by the fragmentary remains of an adult. Neither Skarland nor Sullivan (1977) could provide any additional age or sex information for this individual. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 87

Burial No. 87 was a fully flexed dog burial interred immediately below Burial No. 83. It is likely the dog and human are associated with one another, but this cannot be determined with certainty given the fragmentary nature of the remains from Burial No. 87. It is possible that the dog remains were disturbed when digging the pit for Burial No. 83.

Burial No. 88

Burial No. 88 (Snow's Burial 15-83) was a partly flexed infant lying on its left side. Skarland did not provide an age estimate for this individual, but Wyckhoff (1977) identified the remains as those from a fetus or newborn. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 89

Burial No. 89 (Snow's Burial 15-84) was identified in the field as a fully flexed senile possible male lying on its right side. The individual was highly fragmentary and had been disturbed by an intrusive pit. Skarland concurred that this individual was a possible male and assigned an age of mature to senile. Sullivan (1977) provided a much younger age range of 20 to 29 years and concluded that the burial was that of a male. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 90

Burial No. 90 (Snow's Burial 15-85) was identified as the highly fragmentary remains of an infant. Skarland could provide no further age estimations for this individual, but Wyckhoff (1977) concluded the burial was less than 1 year old at death. According to the original field burial forms, the Webb Museum catalog, and Webb and Haag (1939), two shell disk beads (FS #1804-1805) were found in association with this burial, but no burial photograph was taken so this could not be confirmed. These beads are included among the burial associations discussed below. No evidence for prehistoric violence was recorded.

Burial No. 91

Burial No. 91 (Snow's Burial 15-86) was recorded as the fragmentary remains of an infant found lying on its right side. Skarland and Wyckhoff (1977) both identified the individual as less than 1 year old. The individual was found as part of a multiple burial along with Burial Nos. 92 and 93, possibly providing evidence for prehistoric violence. No artifacts were found in association.

Burial No. 92

Burial No. 92 (Snow's Burial 15-87) was identified in the field as a fully flexed adult male lying on its right side. Skarland provided an age range of 20 to 24 years for this individual, and Sullivan (1977) extended this to 20 to 29 years. No artifacts were found in association. The placement of this burial in a multiple burial with Burial Nos. 91 and 93 provides some evidence for prehistoric violence.

Burial No. 93

Burial No. 93 (Snow's Burial 15-88) was an adult male described on the field burial form as a "compact mass of bones next to skull." Skarland identified this individual as a male of around 20 years of age. Sullivan (1977) agreed that the individual was a male and assigned an age range of 20 to 29 years. Artifacts associated with this burial on the field burial form include *Anculosa* (*Leptoxis*) beads found around the waist (FS #2097-2354), shell disk beads around the neck (FS #2355-2454), an oblate spheroid bone bead (FS #2455), and a flint point (FS #2456). Webb and Haag (1939) listed 100 disk shell beads, 236 *Anculosa* beads, and 1 bone bead from this burial.

The *Leptoxis* beads are ground flat on one face to facilitate tying to a fabric. These are not discernible in the burial photograph, but were probably attached to a blanket or sash wrapped around the burial as they are described as having been placed in five rows. The disk shell beads were likely part of a single necklace worn by the deceased individual. The 'bone bead' is an oblate-shaped siderite bead that may have been incorporated into the shell bead necklace. Unfortunately, this bead is not discernible in the photograph and is not included in the burial drawing. The projectile point is an Early Archaic Lost Lake point that was located near the skull and that was likely in association with the burial at the time of interment. This point may represent an early component at the site but is more likely a recycled or 'heirloom' object. It may also provide evidence for prehistoric violence. The field notes state that this burial may either be a secondary burial or the remains of an individual disturbed by the placement of Burial No. 92. If the latter is the case, then the evidence for violence is reduced.

Burial No. 94

Burial No. 94 (Snow's Burial 15-89) was identified in the field as a fully flexed juvenile female lying on its stomach. Skarland provided an age of 17 to 18 years for the female, but Sullivan (1977) concluded that the burial was 20 to 29 years old. Sullivan concurred with Skarland's sex identification. A total of 288 ground *Leptoxis* beads (FS #1806-2095) were recorded in association with this burial, of which 273 remain in the collection. These objects were placed around the individual's neck as a collar three rows wide. Examination of the burial photograph suggests that the individual's legs were separated from the pelvis, which may provide evidence for prehistoric violence.

Burial No. 95

Burial No. 95 (Snow's Burial 15-90) was an infant found lying on its right side. Skarland estimated the age of this individual as around 3 years old, and Wyckhoff (1977) provided a revised age range of 1 to 3 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 96

Burial No. 96 was a fragmentary infant burial that was listed as missing by the WPA. This burial was apparently found and analyzed by Wyckhoff (1977), who provided an age of less than 1 year to the individual. The field burial form states that charcoal (FS #2457) was recovered with this burial, and a worked stone, biface, and projectile point are all listed in the Webb Museum catalog as in association. Examination of these objects indicates that the 'worked stone' is an unmodified waterworn chert pebble and the projectile point is an unidentified fragment. The biface is complete, but the lack of a burial photograph precludes assessment of whether this artifact was intentionally placed with the burial. None of these objects are included among the burial associations discussed below. No evidence for prehistoric violence is present.

Burial No. 97

Burial No. 97 (Snow's Burial 15-92) was identified in the field as a fully flexed adult possible male placed on its left side. Skarland also characterized the burial as a possible male and provided an age range of 25 to 35 years. Sullivan (1977) revised this identification to a female aged 40 to 49 years. Examination of the burial photograph indicated that a turtle carapace (FS #2459) was found in association between the knees and neck. No evidence for prehistoric violence was recorded.

Burial No. 98

Burial No. 98 (Snow's Burial 15-93) was a partly flexed mature male found lying on its right side. Skarland agreed with the field sex identification, but revised the age to advanced to mature. Sullivan (1977) agreed that the individual was a male but did not assign an age range. This burial was disturbed by Feature No. 44, which was superimposed over the burial. An Elk River projectile point (FS #2458) was found in association with the burial at the individual's knee. The point may be an intentional burial good or evidence for prehistoric violence. This individual is also missing a leg, which may have been disturbed by Feature No. 44 or removed as a trophy if the burial was the victim of violence. The projectile point is not included among the burial associations discussed below.

Burial No. 99

Burial No. 99 was a fully flexed dog burial found lying on its right side in a pit dug into the subsoil. No human burials were in association.

Burial No. 100

Burial No. 100 was a fully flexed dog burial found lying on its left side at the shell midden/subsoil transition. No human burials were in association.

Burial No. 101

Burial No. 101 (Snow's Burial 15-94) was a fully flexed senile female found lying on its right side. Skarland classified the female as mature to senile, and Sullivan (1977) revised the age estimation to 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 102

Burial No. 102 (Snow's Burial 15-95) was identified in the field as a fully flexed infant. Skarland could not revise the field age estimation, but Wyckhoff (1977) concluded that the burial was less than 1 year old. The field burial form lists paired mussels (FS #2461-2470) and a broken awl or needle (FS #2460) as associated with this burial. Unfortunately, no burial photograph is available to assess whether these objects were intentionally placed with this individual. The bone implement associated with this burial is not listed in the Webb Museum catalog, so this object could not be analyzed. The fact that this object was broken suggests it was an incidental inclusion. Since paired mussels associated with other burials at this site were found to be refuse, this burial is not considered to have had any intentional burial associations. No evidence for prehistoric violence was recorded.

Burial No. 103

Burial No. 103 (Snow's Burial 15-96) was an adult female found lying on her right side. Skarland described this individual as a female aged 35 years to mature. Sullivan (1977) considered the sex of Burial No. 103 to be indeterminate, but provided an age of 40 to 49 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 104

Burial No. 104 (Snow's Burial 15-97) was a fully flexed mature male found lying on its right side. Skarland concurred that this individual was a male and provided an age range of advanced to mature. Sullivan (1977) agreed with Skarland's sex identification but provided no age range for this burial. Webb and Haag (1939) list no artifacts in association, but the original field burial forms list a projectile point (FS #2471) that may be evidence for prehistoric violence. This point is not listed in the Webb Museum catalog and is not discernible in the burial photograph. It is not included in the discussion of burial goods provided below.

Burial No. 105

Burial No. 105 (Snow's Burial 15-98) was a partly flexed infant found lying on its right side. Skarland provided an age range of around 1 to 2 years for this individual, but Wyckhoff (1977) states that the burial was less than 1 year old. This individual was associated with Burial No. 106, possibly indicating prehistoric violence. A total of 29 disk shell beads (FS #2473-2501) were found near the individual's head and red ochre (FS #2472) was present.

Burial No. 106

Burial No. 106 (Snow's Burial 15-99) was represented by the fragmentary remains of an infant found in association with Burial No. 105. Skarland could not provide a more precise age estimate for this burial, but Wyckhoff (1977) concluded the burial was a fetus or newborn. The young age of these two burials argues against violence as an explanation for the multiple burial. No artifacts were found in association.

Burial No. 107

Burial No. 107 (Snow's Burial 15-100) was identified as a fully flexed senile female lying on its right side. Skarland agreed that this individual was female. He provided an age range of advanced to senile. Sullivan (1977) concurred that the burial was female but refined the age range to 40 to 49 years. A perforated turtle carapace (FS #2502) was placed at the feet of the burial. No evidence for prehistoric violence was recorded.

Burial No. 108

Burial No. 108 (Snow's Burial 15-101) was a fully flexed adult male placed on its right side. Skarland concurred with the field age identification and provided an age range of 40 years to mature. This burial intruded into Burial No. 109. No artifacts were found in association, but the radius and ulna of the left arm were missing, providing possible evidence for prehistoric violence.

Burial No. 109

Burial No. 109 (Snow's Burial 15-102) was a fully flexed adult male found lying on its right side. Skarland identified this individual as a male aged 35 years to mature. Sullivan agreed that the burial was male, but revised the age range to 50 to 59 years. Webb and Haag (1939) did not list any artifacts in association with this burial, but examination of the burial photograph indicated that a large section of a poorly preserved antler was located near the individual's feet at the same depth as the burial. It is not immediately adjacent to the skeleton, but its position suggests that it was an intentional burial good. No evidence for prehistoric violence was recorded.

Burial No. 110

Burial No. 110 (Snow's Burial 15-103) was a fully flexed child found lying on its right side. Skarland provided an age estimation of 8 to 9 years for this burial, an estimation that Wyckhoff (1977) revised to 6 to 9 years. Five disk shell beads (FS #2503-2507) were recorded as in association, but no photograph is available to confirm this or to discern where the beads were located in relation to the skeleton. No evidence for prehistoric violence was recorded.

Burial No. 111

Burial No. 111 (Snow's Burial 15-104) was a fully flexed child placed on its right side. Skarland assigned an age of 8 to 9 years to this individual, but Sullivan (1977) revised this to 6 to 9 years. The original field burial form states that this burial was associated with red ochre (FS #2508) and unworked deer bone. The deer bones are likely incidental inclusions. Webb and Haag (1939) lists 2 dogs with this burial, but this is likely a typographic error since no dogs are mentioned on the field burial forms and no dogs are visible in the burial photograph. No evidence for prehistoric violence is present.

Burial No. 112

Burial No. 112 (Snow's Burial 15-105) was a fully flexed mature female placed on its right side. Skarland agreed with the field sex identification and provided an age range of 35 years to mature. Sullivan (1977) also classified the burial as a female and provided an age range of 20 to 29 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 113

Burial No. 113 (Snow's Burial 15-106) was identified in the field as a partly flexed juvenile male placed on its left side. Skarland identified this male as a 12 to 14 year old. Wyckhoff (1977) revised this age to 12 to 15 years. Examination of the burial photograph indicates that a turtle carapace (FS #2509) was placed at the individual's left elbow. One foot was missing from this burial, providing possible evidence for prehistoric violence or evidence for disturbance.

Burial No. 114 (Figure 8-11)

Burial No. 114 (Snow's Burial 15-107) was a fully flexed adult male found lying on its left side. The burial was associated with two dogs, one (Burial No. 118) that was lying atop the burial and one (Burial No. 115) that was lying to its side. Skarland identified the human burial as a male aged 20 to 35 years, and Sullivan (1977) revised this age to 30 to 39 years. Sullivan (1977) concurred that the burial was a male. Burial

Figure 8-11. Burial No. 114 and Dog Burial No. 115. Note that the skull of the human burial is located at its feet. Courtesy of the W. S. Webb Museum of Anthropology, University of Kentucky.

No. 114 was missing its legs below the knees and the skull was located at the feet opposite the neck, suggesting that this burial was either disturbed (possibly by the dog burials) or the victim of prehistoric violence.

Several perforated teeth (FS #2510-2535) were associated with this burial. All teeth were canines of a wolf or dog. Most were found at the neck, suggesting they were all part of a modified tooth necklace. One object was found with the skull near the feet. The two disk shell beads described as from this burial by Webb and Haag (1939) are not listed in the Webb Museum catalog or listed among the burial goods on the field burial forms. A perforated bone pointed implement listed among the objects from this burial in the Webb Museum catalog is not discernible in the burial photograph. Neither of these objects are listed as burial associations in the discussion below.

Burial No. 115

Burial No. 115 was a partly flexed dog burial placed on its left side. This burial was associated with the human Burial No. 114 and the dog Burial No. 118.

Burial No. 116

Burial No. 116 (Snow's Burial 15-108) was a partly flexed adult male found lying on its left side. This burial was associated and partially commingled with dog Burial Nos. 117 and 120. Skarland identified this burial as a male aged 25 to 30 years. Sullivan (1977) agreed with Skarland's sex identification and provided an age range of 20 to 29 years. No artifacts were found in association and no evidence for prehistoric violence was recorded.

Burial No. 117

Burial No. 117 was an extended dog burial found lying on its right side. It was associated with the human Burial No. 116 and the dog Burial No. 120.

Burial No. 118

Burial No. 118 was a fragmentary dog burial found lying atop the human Burial No. 114. It was also associated with the dog Burial No. 115.

Burial No. 119

Burial No. 119 (Snow's Burial 15-109) was a fragmentary adult burial placed on its left side. Skarland identified this burial as a mature adult but provided no sex identification. Sullivan (1977) identified this individual as a male but provided no age range. The burial intruded into Feature No. 52 (a rock-lined hearth). Worked bone (FS

#2538) recorded as associated with this burial on the field burial form is probably from this feature. No evidence for prehistoric violence was recorded.

Burial No. 120

Burial No. 120 was a dog burial found lying on its right side. It was in association with the human Burial No. 116 and the dog Burial No. 117.

Burial No. 121

Burial No. 121 (Snow's Burial 15-110) represents the fragmentary remains of an infant identified by Skarland as a possible child. Wyckhoff (1977) provided no additional information pertaining to this burial. Red ochre and a turtle carapace (FS #2539) were recorded as associated with this burial on the field burial forms. No photograph was available to assess these associations, but they are included below among the other burial associations. No evidence for prehistoric violence was recorded.

Burial No. 122

Burial No. 122 (Snow's Burial 15-111) was a highly fragmentary adult burial. Skarland also identified the individual as an adult but provided no sex identification. Sullivan (1977) considered the sex of this individual indeterminate, but provided an age range of 30 to 39 years. No artifacts were found in association with this burial and no evidence for prehistoric violence was recorded. This burial was located directly above Burial No. 123.

Burial No. 123

Burial No. 123 (Snow's Burial 15-112) was a fully flexed mature male lying on its left side. Skarland identified this burial as a male aged 45 years to mature. Sullivan (1977) concurred that the individual was a male, but he revised the age estimate to 40 to

49 years. This burial was located immediately below Burial No. 122. No artifacts were in association and no evidence for prehistoric violence was recorded.

Burial No. 124

Burial No. 124 (Snow's Burial 15-113) was identified in the field as a partly flexed possible male child lying on its right side. Skarland identified this burial as a possible male aged 7 to 8 years. Wyckhoff (1977) revised this age estimate to 6 to 9 years. No artifacts were found in association. Part of the radius and ulna, part of the left hand, and all of the right hand are missing, providing possible evidence for prehistoric violence.

Burial No. 125

Burial No. 125 (Snow's Burial 15-114) was a partly flexed mature male found lying on its left side. Skarland identified this individual as a male aged 35 to mature. Sullivan (1977) concurred with Skarland's sex identification, but revised the age to 30 to 39 years. A turtle carapace (FS #2540) was found associated with this burial at the individual's head. No evidence for prehistoric violence was recorded.

Burial Goods and Identity at Chiggerville

Although Webb and Haag (1939) identified 35 burials with grave associations out of the 114 originally identified at the site, the Webb Museum catalog indicated that as many as 42 burials may have had associations. Burials with associations identified during this re-analysis of the Webb Museum collections, field notes, and burial photographs are: Burial Nos. 8A, 9, 19, 23, 26, 31, 32, 33, 36, 42, 44, 45, 58, 60, 63, 64, 66, 67, 70, 72, 73, 74, 76, 77, 78, 80, 81, 83, 90, 93, 94, 97, 98, 105, 107, 109, 110, 111, 113, 114, 121, and 125. The only one of these burials whose association is considered equivocal is Burial No. 98. The projectile point associated with this individual may be an incidental inclusion or may have been embedded in the individual at the time of death.

Of the total of 117 individuals represented at Chiggerville, just under 36 percent included grave good associations. Table 8-1 uses Sullivan (1977) and Wyckhoff's (1977) age categories to examine the distribution of burial goods across age classes. As can be seen from this table, while only 39.3 percent of the Chiggerville mortuary assemblage is younger than 20 years of age, 47.6 percent of the burials with grave associations fall within this age category. Examination of Figure 8-12 indicates that over 40 percent of the total number of burials with grave goods associations are younger than 10 years of age and that most of the remainder are between 20 and 40 years old. This distribution is consistent with MacDonald's (2001) study, cited above, that found that many grave associations reflected grieving for young family members who represented lost reproductive value.

Table 8-1. Distribution of Burial Goods across Age Classes.

Age Class	#/% of Burials	#/% of Males	#/% of Females	#/% with Goods	#/% of Males with Goods	#/% of Females with Goods
F-B	3/2.6%	-	-	0/0%	-	-
B-1	20/17.1%	-	-	9/45.0%	-	-
1-3	9/7.7%	-	-	2/22.2%	-	-
3-6	3/2.6%	-	-	3/100%	-	-
6-9	5/4.3%	-	-	3/60%	-	-
9-12	2/1.8%	-	-	1/50%	-	-
12-15	2/1.8%	-	-	2/100%	-	-
15-20	1/0.9%	-	-	0/0%	-	-
20-29	17/14.5%	9/52.9%	8/47.1%	6/35.3%	3/33.3%	3/37.5%
30-39	16/13.7%	7/43.8%	8/50%	7/43.8%	5/71.4%	2/25%
40-49	19/16.2%	7/36.9%	10/52.6%	2/10.5%	0/0%	2/20%
50-59	7/6.0%	4/57.1%	3/42.9%	5/71.4%	3/75%	2/66.7%
Indeterminate	13/11.1%	5/38.5%	1/7.7%	2/15.4%	1/20%	0/0%
Total	117	32/27.4%	29/24.5%	42/35.9%	12/37.5%	8/27.6%

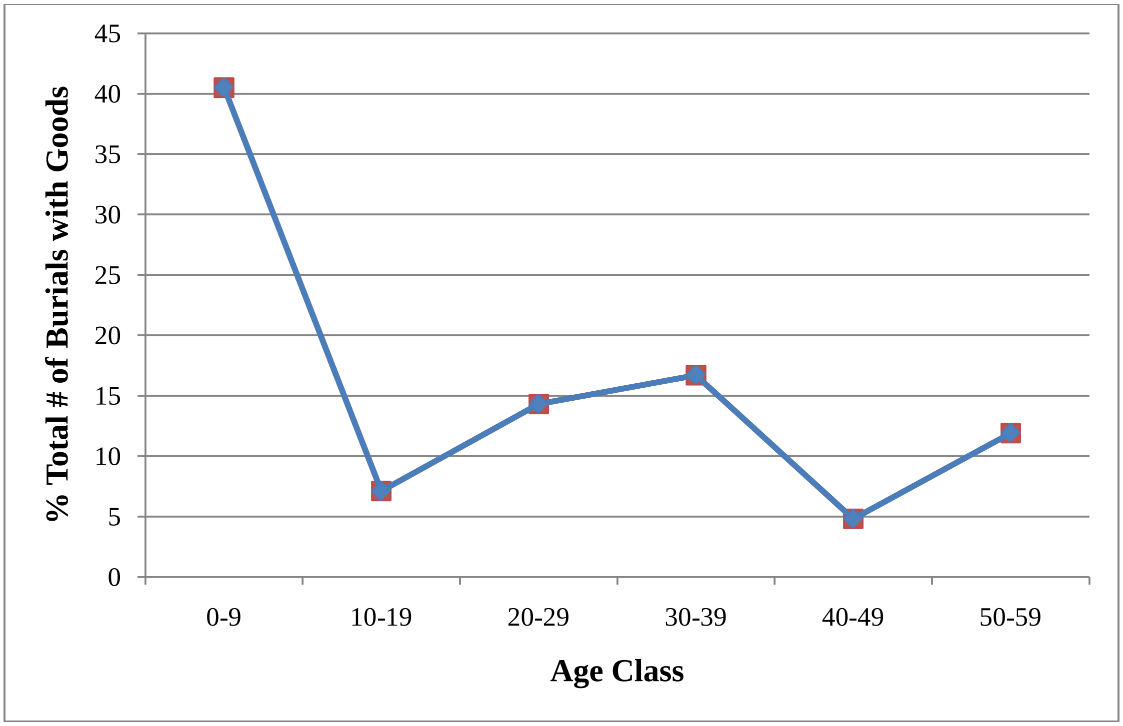


Figure 8-12. Line Graph depicting the Percentage of Burials with Grave Associations by Age Class. Ages are based on Sullivan (1977) and Wyckhoff (1977).

Among adults aged 20 and up, 37.5 percent of males were associated with burial goods and 27.6 percent of females had grave associations, suggesting that males are slightly more likely to be accompanied by burial furniture than females. Table 8-2 examines the kinds of burial goods found associated with males, females, and sub-adults. Although a small sample compared to the Green River sites as a whole, these distributions exhibit some interesting patterns. Of particular note is the fact that marine shell beads are the most common artifact type recovered with burials and that the majority of these beads were found with infants and sub-adults. The recovery of so many marine shell objects with unsexed infants and sub-adults proscribes any interpretation of these artifacts with regard to gender, but confirms Winters' (1968:204) observation that pre-adolescents are more often equipped with exotic marine shell items than adults. Based upon the aforementioned ethnographic data cited by Fiedel (1989) and statistical

Table 8-2: The Incidence of Artifact Types by Gender and Age at the Chiggerville Site (15Oh1).

	Adult Males Age 20-29	Adult Males Age 30+	Adult Females Age 20-29	Adult Females Age 30+	Infants/ Sub-adults
Marine Shell Beads (n = 100+)	2	1	0	0	2
Marine Shell Beads (n = <100)	1	1	2	0	12
Marine Shell Pendants	0	0	1	0	1
Perforated Marine Gorget/Masks	0	1	0	0	3
Marine Shell Ear Plugs	0	0	0	0	1
Marine Shell Teeth Effigies	0	0	0	0	1
Ground *Leptoxis* Beads (n = 100+)	1	0	1	0	1
Perforated Freshwater Mussel Shell	0	0	0	0	1
Atlatl Parts	1	0	1	0	1
Stone Beads	1	0	1	0	1
Perforated Wolf/Dog Teeth	0	1	1	0	0
Turtle Carapace	0	1	0	2	4
Perforated Turtle Shell Object	0	0	0	0	1
Projectile Point/ Biface/Knife	1	3	0	0	2
Drill	0	0	0	1	0
Bone Awl/Pin	1	0	0	2	0
Stone Object	0	0	0	1	0
Antler	0	1	0	0	0
Perforated Deer Astragulus	1	0	0	0	0
Red Ochre	0	0	0	0	4
Dogs	2	1	0	0	1

analyses of grave goods associations by Rothschild (1975), we can conclude that these beads do not represent ascribed status (Watson 2005:550). The fact that individuals of all ages and both sexes were accompanied by marine shell beads suggests that access to these items was not restricted. It is likely, then, that the individuals buried with marine shell beads were not the ones responsible for introducing the artifacts into the Green River region, although access may have been restricted to members of trader-diplomats' lineages or those with whom they had built alliances. Additional DNA and biodistance studies are needed to better resolve this question.

One potential problem with the hypothesis that marine shell beads were widely dispersed is the fact that these artifacts do not occur regularly at sites outside the Green River and Pickwick Basin areas (e.g., Eva and Koster). One possibility is that close to the coast marine shell necklaces and bracelets and decorated articles of clothing, baskets, mats, etc., were traded widely among individuals. Farther from the coast among the hunter-gatherers of the Green River valley and Pickwick basin, however, these artifacts increased in value as a result of a more limited supply. It is possible that the Green River peoples were so far removed from the production of these artifacts that they were ultimately unaware of their marine origin, not unlike the aboriginal peoples of the Australian interior who traded in marine shell objects but who were unaware that large bodies of water even existed (Safer and Gill 1982:124). The concentration of marine shell artifacts in the shell middens and their unique distributions were not due to the position of the Green River sites between the northern copper and southern shell exchange spheres (contra Goad 1980), but due to the increased value of the shell artifacts so far from their sources. The distribution of marine shell beads suggests that these artifacts were relatively common but may have been important in negotiating localized interpersonal alliances (e.g., marriages). It is probable that stone beads functioned in a similar way, since they were oftentimes incorporated into necklaces and other ornaments along with those of marine shell.

Age differences can also be noted when calculating the numbers and kinds of burial goods found with adults. For instance, socially valued objects like marine shell gorget/masks and atlatls were restricted primarily to sub-adults and adults younger than 30. Interestingly, only utilitarian objects and turtle carapaces (possibly utilitarian bowls) were found with females over the age of 29. While it is certain that some younger females were able to acquire some degree of status so as to be associated in death with exotic and socially charged material goods, older individuals, particularly females, were much less likely to retain this status.

In terms of gendered associations, it is difficult to interpret artifact distributions at Chiggerville due to the small sample sizes involved and the ubiquity of unsexed sub-adults at the site. It does appear that all artifact types, save utilitarian goods and drilled wolf/dog teeth, are found with sub-adults, although the lack of these artifact classes may be a product of sampling bias. Furthermore, although the majority of associations are with sub-adults, none except red ochre occurs in proportions that would indicate that such associations are anything more than a result of the over-representation of sub-adults in the burial population. The placement of red ochre in the graves of four sub-adults and no adults, however, suggests that only the graves of younger individuals were treated with this substance. Furthermore, the association of one infant with marine shell earplugs supports Winters' (1968:203) contention that these artifacts are found primarily with younger individuals. It would seem that, although Rothschild's (1975) observation that age is a much more common denominator than sex in determining who was buried with artifacts is supported, neither age nor sex is strongly marked by material culture at Chiggerville.

One possible exception to this is the association of shell pendants with females and perforated conch shell sections with males. The form of each of these artifact types (perforated sections of marine shell oftentimes found in multiples of two) suggests that these objects are portions of composite artifacts, possibly headdresses or clothing. The fact that they are sometimes decorated with incised designs indicates that they conveyed important symbolic messages concerning the identities of their wearers. Based upon their manufacture from relatively large sections of exotic marine shell, it is possible that these artifacts mark the role of trader-diplomats and that those buried with these artifacts maintained important economic (and probably social and ritual) leadership positions. The fact that the one sexed individual buried with shell pendants is a female and the one sexed individual with perforated conch sections is a male may be evidence that these identity markers had gendered connotations as well. The small sample size and burial of sub-adults with these artifacts are currently problematic and will require additional analyses of the artifacts themselves to determine whether 'shell pendants' and 'perforated conch sections' are uniform as to class.

Another class of artifacts commonly discussed with reference to gender is the atlatl, or spear-thrower, thought to be an important piece of Archaic hunting equipment. In addition to use as hunting tools, both Burdin (2004) and Lutz (2000) have concluded that these artifacts, and particularly the ornate stone atlatl weights, communicated symbolic information and had important social or ceremonial functions within Archaic societies. Utilizing analyses of temporal and geographic distributions within the lower

Ohio River valley, for instance, Burdin (2004) demonstrated that the number of bannerstones increased from the Middle to the Late Archaic while the variability in types first increased and then declined. Burdin interpreted this trend to be related to initial competition among late Middle Archaic societies, followed by symbolic entrainment wherein particular groups developed positions of status that were adopted by other less prominent groups in the region. The concentration of bannerstones of all forms at seven sites within Burdin's study area suggests that these sites represented the central occupations of these higher status groups. The raw materials utilized in the manufacture of bannerstones and atlatls, their forms, and the kinds of objects and designs (e.g., feathers, incised designs) used to decorate them were likely important markers of identity, indicating the particular lineage or sodality to which one belonged (Burdin 2004).

At Chiggerville, three individuals were associated with three atlatls, including an infant with a composite shell atlatl weight, an adult male with a bar atlatl weight and a female (Burial No. 44, discussed below) with a winged atlatl weight and an antler atlatl hook. The distribution of atlatls at this site supports Winters' (1968:206) suggestion that these artifacts relate "to the transfer of the contents of a corporate estate, and [have] nothing to do with the sex of the individual per se." While it would appear that atlatls were not restricted on the basis of gender at these sites (Watson 2005, Winters 1968), it is likely that in certain contexts they served as markers of a corporate group and of identity as an accomplished hunter. It is interesting to note that only sub-adults and younger adults under the age of 30 were buried with these important hunting tools and identity markers.

Additional artifacts that may have served as markers of personal accomplishment and/or occupation at Chiggerville include projectile points, bone awls, antlers, drilled teeth, and dogs, all of which, aside from the bone awls, are equipment utilized in hunting (bifaces, points, and dogs) or hunting trophies (antlers and drilled teeth) and might reasonably be interpreted as indicating the role of hunter. This hypothesis is further supported by the fact that certain of these artifact types co-occur in individual burials. Burial No. 114, for instance, was associated with two dogs and a necklace of drilled teeth. Burial No. 44, the only female 'hunter', was associated with both drilled teeth and an atlatl. Finally, Burial No. 8A, a sub-adult, was associated with a projectile point and marine shell tooth effigies. This latter individual's status as a hunter (or possibly a warrior) may have been exaggerated by the fact that he or she was found in a pit containing multiple individuals, suggesting he or she fell victim to interpersonal violence. Including this individual, 9 males (Burial Nos. 9, 32, 73, 81, 93, 98, 109, 114, and 116), 1 female (Burial No. 44), and 4 sub-adults (Burial Nos. 8A, 31, 63, and 72) might be characterized as hunters or warriors. If the manufacture of hunting equipment and trophies from marine shell indicates an exaggerated status due to the circumstances of an individual's death, then Burial Nos. 8A and 63, associated with the effigy teeth and a composite marine shell atlatl weight, respectively, would not be hunters in the traditional sense. The antler point associated with Burial No. 72 is a problematic association (see above), and the one other sub-adult listed above (Burial No. 31) was associated only with a dog, which may have been a pet as much as a hunting companion. This would leave only adult hunters/warriors, as many as 90 percent of whom were male.

In terms of the gendered division of labor, then, it would seem that both males and females at Chiggerville were hunters, although males were more likely to be associated with hunting equipment than females and only males were buried with projectile points. Bone awls, on the other hand, were found in association with both males (n = 1) and females (n = 2), suggesting that these tools either functioned in multiple tasks (which is likely) or that clothing manufacture was a multi-gendered activity. These data suggest that gender roles were not fixed among these hunter-gatherer groups. It should also be noted that the relative lack of hunting or hide-processing equipment with sub-adults supports Rothschild's (1975) conclusion that 'technomic' artifacts are typically associated with adults and thus indicative of the activities individuals performed in life.

The final social persona discussed above as likely to be identifiable utilizing mortuary goods is that of the shaman or ritual specialist. As mentioned previously, both Watson (2005) and Winters (1968) suggested that flutes, pipes, and rattles are indicative of the presence of these individuals, and Webb (1950a) identified the remains of certain animal elements as potential medicine bag contents (although this was challenged by Marquardt and Watson 2005c and Watson 2005). In addition, Marquardt and Watson (2005c:636) suggest that copper was procured by ritual specialists traveling north "seeking exotic materials for use in medicines or ceremonies." Unfortunately, with the possible exception of seven individuals buried with turtle carapaces, none of these items are present at Chiggerville. Furthermore, the fact that four of these seven individuals are sub-adults and that none of the turtle carapaces were positively identified as rattles suggests that they are cups or spoons and not ritual equipment.

Another potential indicator of ritual specialists is the presence of blankets, belts, sashes, or collars of *Leptoxis* beads, such as those found at Elizabeth (Albertson and Charles 1988, Charles et al. 1988) and Indian Knoll (Burial No. 116, Webb 1974:Figure 21B). The fact that these belts or sashes are manufactured from locally available gastropod shells indicates that the individuals wearing them are not expressing an identity as a trader-diplomat, although they may be lineage leaders. At Chiggerville, three individuals (an adult male, an adult female, and a sub-adult) were associated with *Leptoxis* shells. The beads associated with Burial No. 64, the sub-adult, are arranged so as to suggest a blanket or sash, while the beads associated with Burial No. 93, the adult male, adorned a blanket or sash that was wrapped around the individual's waist. The female burial (Burial No. 94) wore her beads like a collar around her neck. Based upon Feature No. 4 at Elizabeth, *Leptoxis* belts, sashes, and collars may be indicative of lineage leaders or ritual specialists while *Leptoxis* blankets are placed over children. The presence of *Leptoxis* belts and sashes in sub-adult burials at Indian Knoll and the recovery of numerous ground *Leptoxis* beads in general midden contexts during the 2009 excavations at Chiggerville, however, indicates that additional research is needed before any interpretation of these ground shell beads can be accepted (Webb 1974).

Also notably absent at Chiggerville are a variety of artifacts common at other Green River sites including incised and decorated bone pins and over-sized bifaces. While proper interpretation of the absence of these artifacts is problematic due to sampling biases, the lack of incised and decorated bone pins may be the result of temporal variation since these are most common in the late Middle Archaic Helton phase and related components in Illinois and Indiana (Jefferies 1995, 1997). The presence of over-sized bifaces at the other Green River sites, on the other hand, may represent accomplished flintknappers or craft specialists (*sensu* Cross 1990, 1993) or trader-diplomats who participated in the Benton Interaction Sphere (see Jefferies 1996b).

Before concluding this section on the social personae indicated by the Chiggerville mortuary assemblage, I want to describe one individual I consider to have been a particularly important member of the Chiggerville community. Burial No. 44 is a biologically sexed adult female who died between the age of 20 and 29 years (Sullivan 1977:32). At least three marine shell artifacts were associated with this individual, including two shell bead bracelets and a headpiece consisting of two shell pendants. An additional ornament consisting of twelve drilled animal teeth and four freshwater mussel shell strips (probably a necklace) was also recovered. After removal of her arms, Burial No. 44 was found to be grasping a winged atlatl weight (the only one recovered from the site) and an atlatl hook. The arrangement of these atlatl parts in relation to one another indicates that the atlatl had been broken, perhaps ritually, upon placement in the grave.

That this person was someone of considerable importance cannot be denied, and it seems likely that she was an individual who fulfilled multiple social roles at the Chiggerville site. Her burial with marine shell bead bracelets and a headpiece consisting of marine shell pendants suggests she may have been one of Marquardt’s (1985) trader-diplomats, actively involved in the negotiation of exchange relationships and marriage alliances with distant groups. Her association with drilled animal teeth and an atlatl suggests she may also have been an accomplished hunter and/or member of a hunting sodality (see Burdin 2004). Finally, her burial with the only ornate stone atlatl weight found among the more than three thousand artifacts from the site indicates she was likely an important lineage or clan leader. Of those excavated by the WPA, then, the most important individual buried at the Chiggerville site was a woman.

Baker Mortuary Data

Unfortunately, burial cards from the Baker site are missing and no published descriptions or studies exist for this assemblage. As a result, no discussion of age, sex, or other demographic factors can be provided. Nevertheless, what follows is a description of data from the field burial forms for each of the burials recovered at the site.

Burial No. 1

Burial No. 1 was a dog burial found lying fully flexed on its left side. In the field notes, project supervisor David Stout identified the burial as that of a human child, but states that John Cotter argued for the burial being a dog at the time of excavation. McBride (2000) agreed with Cotter, and examination of the field burial photograph confirms that the burial is non-human.

Burial No. 2

Burial No. 2 was a fully flexed dog burial found lying on its left side. According to Stout's field notes, this burial may have been associated with the remains of a second animal, but this has not been confirmed.

Burial No. 3

Burial No. 3 was the poorly preserved remains of a fully flexed adult individual found lying on its left side. A Kirk Corner Notched projectile point (FS #1), a straight-based drill, and a triangular based drill (FS #2-3) were found in direct association with this burial. Unmodified bone from this burial was retained by the WPA excavators and is listed in the Webb Museum catalog (Cat. #100554). No evidence for prehistoric violence was recorded.

Burial No. 4

Burial No. 4 was a poorly preserved and disturbed burial found in pit Feature No. 8. Several artifacts were found in the pit feature, but none of those listed in the Webb Museum catalog were considered to be in direct association with the burial. Examination of the burial photograph seems to indicate that a bone pin was present near the burial and may have been in association, but this object, if listed in the Webb Museum catalog, is not listed as from a burial and so its association with Burial No. 4 cannot be confirmed. Diagnostic artifacts from the pit feature include a Godar/Raddatz hafted drill, a Godar/Raddatz hafted scraper, and a Matanzas projectile point, confirming the pit's Middle Archaic affiliation. No evidence for prehistoric violence was recorded.

Burial No. 5

Burial No. 5 was a fully flexed dog burial found lying on its right side. A few bones of other animals and charcoal were also found mixed with the dog's remains.

Burial No. 6

Burial No. 6 consisted of the poorly preserved and highly fragmentary remains of a human burial. No artifacts were found in association and no evidence for prehistoric violence was recorded. Unmodified bone was recovered along with this burial (Cat. #100552).

Burial No. 7

Burial No. 7 was not recorded as a burial in the field. The remains were highly fragmentary and disturbed by bioturbation. They were recovered in the field and recorded as Feature No. 7, a shallow pit feature dug into the subsoil and containing human bones, animal bones, rocks, shells, and flint. Several artifacts were recovered from the pit feature but none were considered to be in direct association with the burial. Unfortunately, none of these artifacts were temporally diagnostic. No evidence for prehistoric violence was recorded.

Unfortunately, no discussion of the age and gender identities of these individuals can be provided given the lack of basic demographic data from this collection. The recovery of two drills and a projectile point from Burial No. 3 may reflect personal identity as a hunter. The lack of marine shell artifacts, any objects that might be considered inalienable possessions, and any musical instruments, medicines bags, or other ritual paraphernalia indicates that trader-diplomats, prestigious individuals, and ritual specialists are either not included in the Baker mortuary assemblage or these identities were not reflected in Middle Archaic burial practices.

Comparison of Intra-site Spatial Patterning and Evidence for Complexity

Figure 8-13 depicts the distribution of human and dog burials at Chiggerville. As can be seen, the overall intra-site pattern is one of overlapping burials in no specific arrangement concentrated toward the river side of the shell midden. Dog burials are intermingled with and appear to have been treated similarly to human burials. Although the pattern is not random, the burial arrangement does not seem to reflect an intentional burial plan, aside from the preference for placement near water.

Figure 8-14 provides a much different pattern. This figure depicts burials from the Baker site. While markedly fewer burials were interred at this location, the suggestion of a patterned arrangement of humans and dogs is evident. Humans are

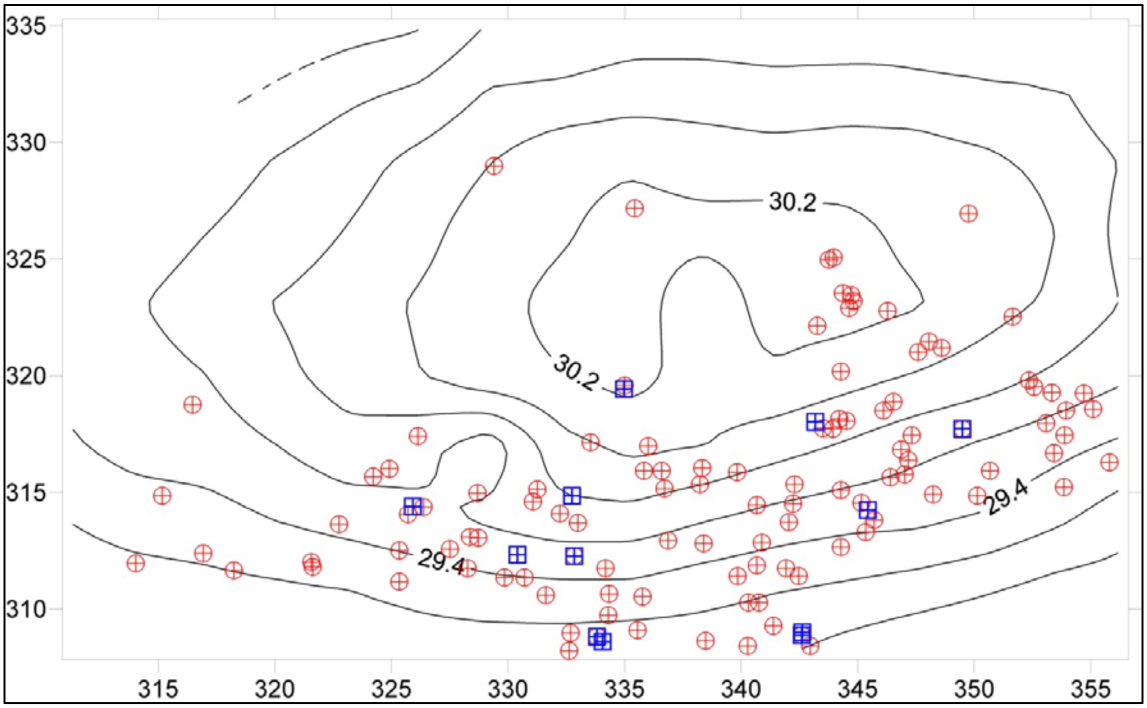


Figure 8-13. Spatial Distribution of Human (red circles) and Dog (blue squares) Burials at the Chiggerville Site. The map is oriented to the WPA grid, with the river toward the bottom.

buried in a single row toward the bluff side of the site in the direction of the Green River, reflecting the nearness to water preference noted at Chiggerville. The dogs, however, are placed away from the humans in a roughly arcuate pattern and in a down-slope direction. This pattern may appear coincidental were it not for the fact that the same pattern also has been observed at the Middle Archaic Jackson Bluff site (Site 15Oh12) where a row of 7 human burials were surrounded by ten dogs in an arcuate arrangement (Moore and Leger 2009).

Placing these patterns within the context of the landscape theory provided above, the burial distribution at the Chiggerville site is consistent with that expected by small-scale hunter-gatherers utilizing the site as a persistent place. The site's burial pattern conforms to a general set of mortuary principles—burials are primarily flexed in shallow

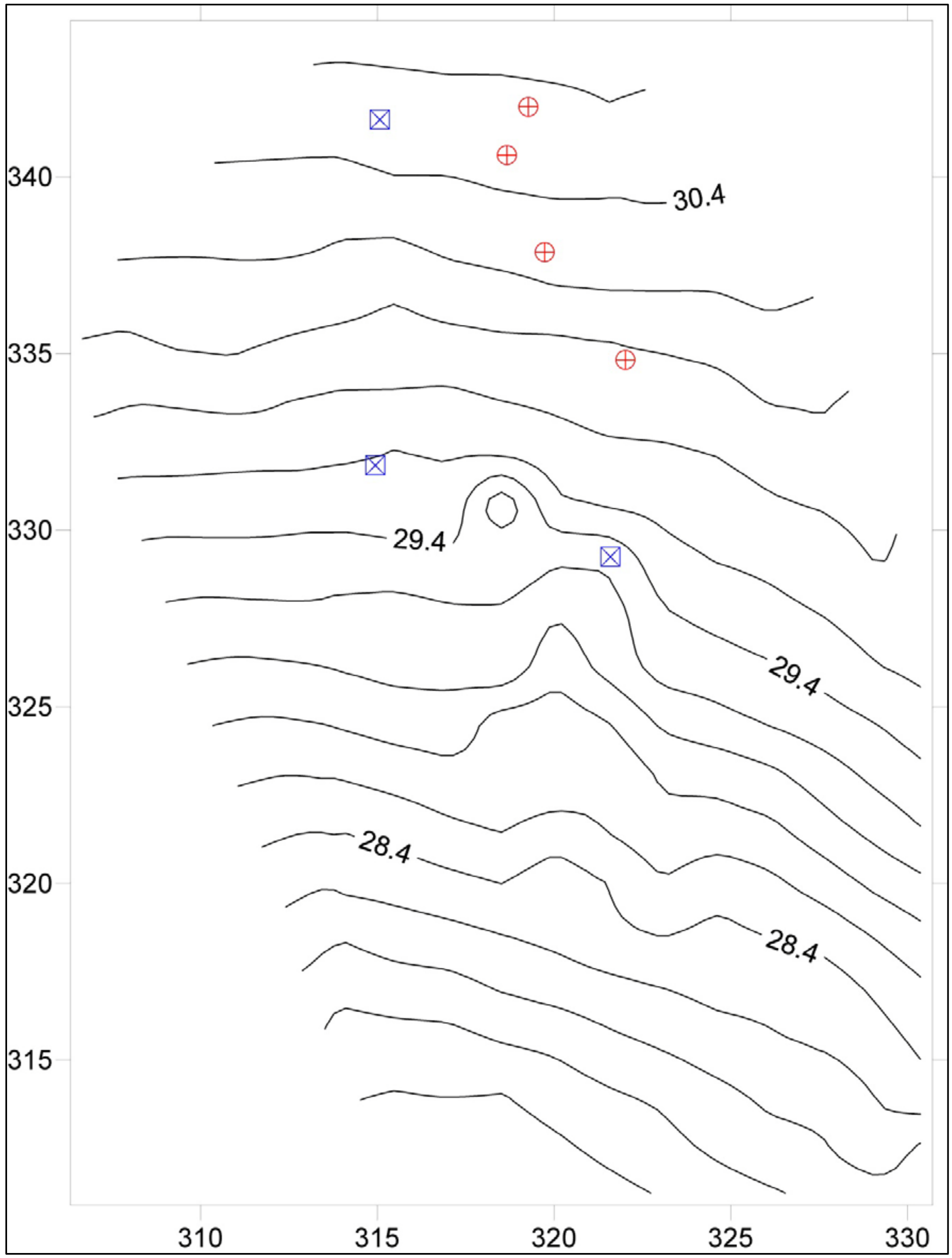


Figure 8-14. Spatial Distribution of Human (red circles) and Dog (blue squares) Burials at the Baker Site. The map is oriented to the WPA grid with the river to the right.

graves and placed toward the water—but no internally consistent rules concerning burial placement can be discerned. One caveat to bear in mind when considering this pattern, however, is the fact that so many burials were interred at Chiggerville over a period of several hundred years. It is possible that additional patterns are present, but that these patterns are overlapping and obscured.

Burial data from Baker, on the other hand, does not appear to reflect a persistent place model. These burials are placed in a single row and surrounded by an arc of dog burials, suggesting that the pattern in non-random. Such a pattern might be indicative of use of the Baker site as a corporate burial area by a group of relatively complex hunter-gatherers wishing to assert territorial claims to the Baker site and its associated mussel shoals. It is also possible that the burials represent a single or short-term burial episode and that the degree of disturbance recorded for the human burials is mixing due to secondary burial processing rather than to post-depositional disturbances. If the Baker site burials do represent a single, short-term burial episode than neither a persistent place nor a corporate burial area model are supported.

Comparisons with Other Green River Sites

Although somewhat skewed due to the techniques utilized in aging and as a result of poor preservation, the demographic data from Chiggerville can be reasonably compared with those derived by other researchers working with the Green River collections. For instance, Johnston and Snow's (1961) re-analysis of the Indian Knoll burials, also fraught with aging and sexing biases (Stewart 1962), provided a sex ratio of 1.21 males to every female and an average age at death of 18.56 years. The reconstructed mortality profile indicated peaks from 0 to 9 years and from 20 to 29 years, as at

Chiggerville. A total of 170 individuals at Indian Knoll died before the first year of life, however. Correcting for these newborns, who were most likely under-represented in the Chiggerville population due to preservation biases, the average age at death is elevated to 22.93 years (Johnston and Snow 1961:240-241). It should be noted that one reason the sex ratio is so different from the Chiggerville ratio is that Johnston and Snow (1961) included sexes of infants and sub-adults in their sample, a practice whose accuracy is considered suspect by the majority of physical anthropologists (Stewart 1962).

Demographic data from Read and Carlston Annis, derived utilizing fully modern aging and sexing techniques, also compare favorably with those from Chiggerville. At Read, Herrmann (1990:43-44), utilizing a sample also biased by poor preservation, found a mean age at death of 22.0 years and an adult mean of 33.5 years, indicating a life expectancy of 22.2 years. The adult sex ratio at Read was 1.10 males to every female (Haskins and Herrmann 1996:117). At Carlston Annis, Mensforth (1986:30, 38; 2005:459) found a mean age at death of 21.9 years and an adult mean of 34.7 years, indicating a life expectancy of 22.4 years. The adult sex ratio at Carlston Annis was 0.98 males to every female.

Nicholas Herrmann (2002) took a unique comparative approach to the study of variation among burials at six Green River Archaic sites—Chiggerville, Indian Knoll, Ward, Barrett, Carlston Annis, and Read. Using metric and non-metric cranial data, he performed a statistically based biodistance study that compared these sites to each other and to the Eva site in Tennessee. He found that Green River populations were biologically distinct from the Eva assemblage and from one another, with the westernmost (Barrett and Ward) and easternmost sites grouping together. Although he failed to adequately situate his conclusions within hunter-gatherer theory or any kind of theoretical osteoarchaeology (e.g., he did not problematize assumptions like non-metric cranial traits corresponding with mating networks), his study did suggest variation among populations that have typically been considered as a single archaeological culture.

With the possible exception of Herrmann (2002), analyses of mortality profiles from Chiggerville, Indian Knoll, Read, and Carlston Annis indicate similar populations undergoing similar aging processes and health risks. It would appear that all four sites represent the same group(s) of hunter-gatherers and that no one sex or age group (aside from infants at Read and Chiggerville due to preservation) are systematically missing from these samples. As a result, any interpretations based upon observed mortuary patterns at these sites can be confidently attributed to temporal or cultural factors without the added confounding factor of missing members of the burial populations. The same cannot be said for smaller sites like Baker, Jimtown Hill, or Jackson Bluff.

Discussion of Green River burial practices can be divided into three sub-topics: the location of burials, burial types, and burial associations. As demonstrated above using biological data, it would appear that most or all Green River Archaic individuals were eventually interred in the shell middens at the larger sites. Some debate has developed, however, as to whether the middens represent formal cemetery areas or the informal disposal of individuals at habitation sites. According to Claassen (1991, 1996), the presence of numerous paired bivalves at some sites suggests that, while many of the shell middens may represent habitations, at least some are intentionally mounded cemeteries. Additionally, she argues that, while freshwater mussel meat was important, it was primarily “the shell itself that was valued, to erect monuments and as a burial context for a specific subset of community members including many women who themselves may have been shellfishers, provisioners of storable protein, and shamans by virtue of an ideological system that associated shell with value, procreation and death" (Claassen 1991:295). Such shell midden mortuary monumentalism would suggest that Green River Archaic peoples were complexly organized and territorial (e.g., Saxe 1970).

Milner and Jefferies (1998), however, have convincingly argued that the soil and shell deposits and feature and grave distributions at the Read site are more consistent with a refuse heap than an intentionally constructed mound. For instance, returning to the original WPA notes and photographs, these authors found that graves were distributed according to topography, not shell distributions, and that no burial plan could be discerned from the distributions or orientations of burial pits (see also Hensley 1991b, 1994). Indeed, the only large Green River site that may have contained a formal cemetery space was Barrett, which contained an area between stakes 140L1 and 150L2 where forty burials were clustered in such a manner "that it was sometimes extremely difficult to extricate individuals and to determine proper sequential relationships" (Webb and Haag 1947:14). Below these were additional individuals who could not be recovered due to the premature termination of the project. This concentration of burials, described as denser "than any heretofore observed by these authors in any other shell middens" by Webb and Haag (1947:14) may represent a formal disposal area, but additional research is needed to test this hypothesis.

Comparing the distribution maps provided above (Figures 8-13 and 8-14) to Read, it is apparent that the primary determining factor of where individuals were interred was not shell (which was deepest in the center of the site) but nearness to water. This is supported by the presence of the deep, downward slope of midden deposits from 70L6 through 70L10 at Chiggerville (Figures 5-9 and 5-10). If the 70 foot profile does indicate the presence of a slough, as Webb and Haag (1939:10) assert, then burials were preferentially placed close to this aquatic feature without regard to the distribution of shell in the midden. Furthermore, analysis of the field drawings, notes, and burial photographs indicates that paired bivalves associated with burials at Chiggerville were refuse from surrounding middens and features rather than intentional components of the mortuary rite.

Turning now to burial types, the majority of the Green River Archaic interments were fully or partially flexed, having been placed in shallow, round pits dug either into the middens themselves or into the subsoil (Table 8-3, see also Watson 2005:550). Of the remaining burials, most of those that are described as disturbed were probably originally flexed or partially flexed. Only seventy-seven individuals were extended, and some of these may have been intrusive, belonging to later components. There is very little variation, therefore, in the kinds of burials found at these sites.

Although Boisvert (1978) argued that Green River hunter-gatherers were characterized by an egalitarian social structure on the basis of the high frequency of grave goods, Figure 8-15 suggests that proportionally very few individuals were accompanied by artifacts. Furthermore, Webb (1950a:288) noted that the majority of the burial associations from these sites consisted of necklaces, bracelets, and other ornaments that may have been worn in life. These two pieces of information together suggest that very few individuals were buried with non-perishable grave associations and that most (or all) of the objects that were buried with them consisted of items they would have owned

Table 8-3. Green River Burial Types by Site[a]

Site	Burial Form						
	Flexed	Partially Flexed	Extended	Disturbed	Incomplete/ Skull only/ Dismembered	Reburial	Infants/ UID
Chiggerville	75	17	1	21	--	--	3
Indian Knoll	524	248	11	97	--	--	--
Carlston Annis	267	60	2	54	1	2	4
Read	172	52	6	11	--	--	6
Ward	188	49	26	51	--	29	90
Kirkland	29	7	2	6	--	--	26
Barrett	212	60	20	51	36	33	--
Butterfield	53	18	9	61	--	12	--
Parrish	94	12	1	20	--	6	--
Total	1614	523	78	372	37	82	129

[a]Data derived from Webb and Haag (1939, 1940, 1947) and Webb (1950a, b; 1974)

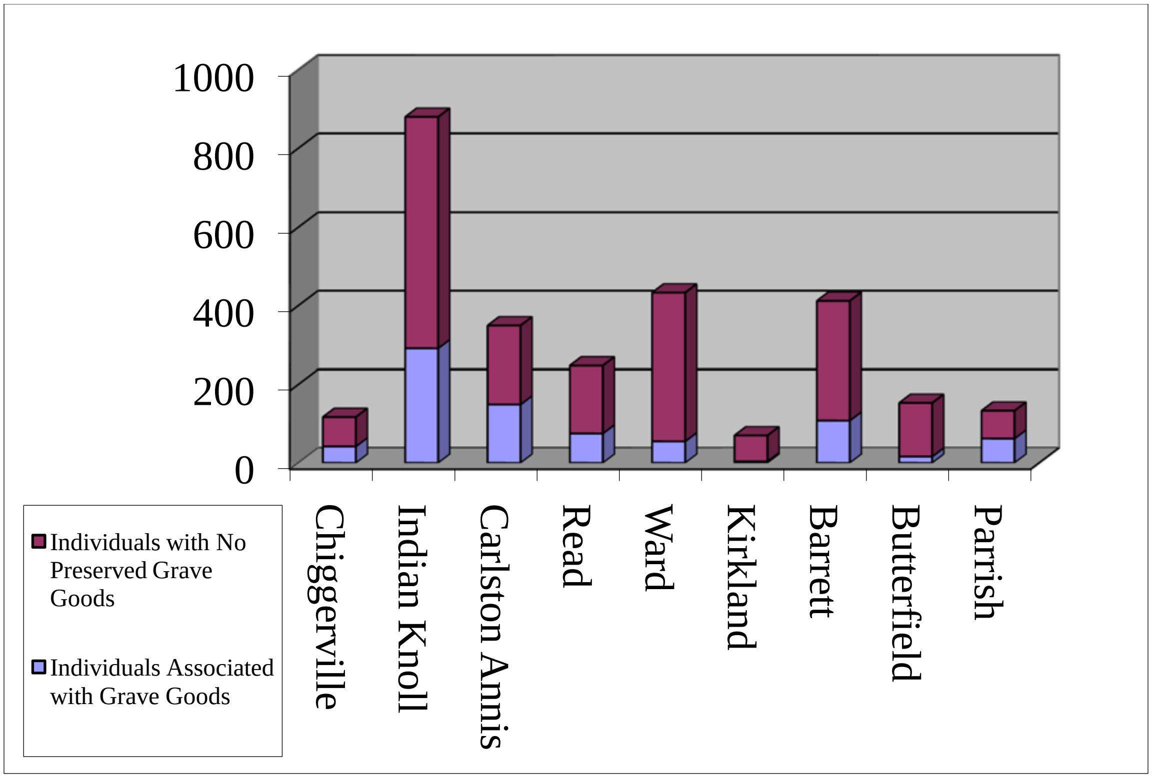


Figure 8-15. Proportions of Burials with Grave Associations at Major Green River Sites.

and/or utilized while living. Additionally, no single Green River Archaic interment was found accompanied by large numbers of artifacts indicating that his or her grave was provisioned by other members of the community, as was the case with later Hopewell burials (Carr et al. 2006). These data suggest, then, that the mortuary assemblages recovered from the Green River Archaic shell middens reflect the roles and statuses (social personae) of the individuals with whom they were found and support the hypothetical identifications of social identities and status positions provided above.

Based upon the similarity in the location of burials within sites, the types of burials found, and the kinds and ubiquity of grave goods associated with individuals, it seems that mortuary practices were similar at each of the Green River sites. Although some degree of temporal and/or geographic variation is indicated by differences between Baker and Chiggerville, that variation is not such that any of the large shell midden sites stand out with respect to any others. The one exception to this may be the presence of a formal cemetery area at Barrett. Unfortunately, the lack of a detailed site report or bioarchaeological assessment of this site and the fact that the possible cemetery area was not completely excavated render any such conclusions tentative.

Archaic Social Identity outside the Green River Region

As Wobst (1977) and others have pointed out, material culture is a medium through which identity, ownership, and other forms of information are conveyed. The utility of material culture as a messaging system, however, decreases with decreasing social distance such that communicative media are most valuable in sending messages to groups at an intermediate social distance from the messaging group. Based on this theoretical insight, it is expected that many of the messages conveyed through the material culture utilized along the Green River were designed to be used as a communicative medium in interactions with nearby groups rather than among individuals living in the Green River valley. An understanding of the social identities expressed by these groups can facilitate interpretation of Green River material culture and, ultimately, the cultural complexity of the individuals living at the Baker and Chiggerville sites relative to those living in adjacent regions.

In utilizing data from the Ervin site and other Middle to Late Archaic sites in Tennessee and surrounding areas, Hofman (1986) developed a model of hunter-gatherer mortuary variability based upon ethnographic examples of mortuary processing. According to Hofman (1986), free wandering hunter-gatherers, since they are not attached to a place, bury their dead in dispersed sites across the landscape. Logistically organized groups operating within restricted territories, however, tend to bury their dead in special places (particularly places of aggregation) and cremate and bundle individuals for transport to these locations. Finally, sedentary populations have formal disposal areas as well, but these are not characterized by a high frequency of secondary burials and cremations. In this way, Hofman was able to distinguish between potential aggregation sites and smaller family sized camps on the basis of mortality profiles.

Based upon these distinctions, the large number of cremation burials found at Middle to Late Archaic sites in the Midsouth distinguishes them from sites along the Green River where no cremations have been discovered to date. Analysis of burial associations indicates that cremations are less likely to contain burial goods, so the higher energy expended in cremating individuals cannot be explained, *a priori*, by differences in status. Therefore, Hofman (1986) interprets the cremation burials at Ervin as indicative of use of the site by groups occupying a large economic territory but who aggregated at predetermined places at specific times of the year, bringing their dead with them. Although few individuals were buried with grave goods at Ervin, those who were possessed oversized bifaces, *Leptoxis* beads, atlatl weights, marine shell beads and projectile points (Hofman 1986), suggesting that trader-diplomats, clan or lineage leaders, and hunters were represented.

Magennis (1977) studied Midsouthern mortuary practices at the Middle to Late Archaic Eva site and the Late Archaic Cherry site, both in Tennessee. Excavated by Lewis and Lewis (1961), the Eva site produced 198 burials distributed throughout three major Archaic components. In general, these burials were very similar to those excavated by Webb along the Green River in that the majority was fully flexed in small, round pits in the midden or subsoil. Proportionally, very few individuals were associated with grave goods (n = 57, 29 percent) (Lewis and Lewis 1961:144). Those who did have associations, however, were found with projectile points, atlatl weights, turtle shell rattles, a rattlesnake vertebrae necklace, yellow and red ochre, over-sized bifaces, bone awls and needles, and stone gorgets (Lewis and Lewis 1961), suggesting that clan and lineage leaders, hunters, ritual specialists, and, perhaps, trader-diplomats were represented.

Dividing these individuals by component, Magennis (1977) found much uniformity in both the Middle Archaic (Eva I and II) and Late Archaic (Eva III) components in terms of burial treatment. In the Middle Archaic components, grave goods were found to be distributed among individuals of all ages and both sexes, although females (45 percent) were more often associated with artifacts than males (25 percent) (Magennis 1977:62). Like at Baker, exotic goods were not included in these burials, and females were found to have been "afforded the same proportion of hunting and fishing equipment as males but more domestic and ornamental type goods," suggesting an absence in a clear division of labor (Magennis 1977). Although the ornamental goods may be primarily decorative, the association of these items with women may indicate they were important in expressing gender differences or that women held important philosophical-religious roles in the society.

During the Late Archaic Eva III component, however, individuals under the age of twenty were not typically afforded grave goods, and greater numbers of males (67 percent) than females (41 percent) were associated with artifacts (Magennis 1977:71). This period also marked the advent of the first cremation burials and of the burial of exotic goods with individuals at the site (a green slate gorget with an adult male). As in the Middle Archaic, both males and females were buried with hunting and domestic artifacts. This distinction between the Eva I and II and the Eva III components is interesting in that it is the Eva III component that is most nearly contemporary with the Chiggerville shell midden. The presence of exotic goods and an increase in burial associations at Eva at this time may suggest that aspects of social identity beyond age, sex, and localized ritual specializations were being expressed in this population. This conclusion is only tentative, however, since the Eva III burial population is marked by a sampling bias in that more than half of the burials are over forty years of age (Magennis 1977:78). It is noteworthy that, although some evidence of extra-local exchange is present, its relative absence compared to other late Middle to Late Archaic sites may be related to the lack of interpersonal violence noted at Eva (Dye 1996).

In contrast to the ‘old’ population represented by Eva III, 60 percent of the 69 individuals at the Late Archaic Cherry site died before the age of thirty (Magennis 1977:125), suggesting the differential burial of a younger population at this site. Cherry is also distinct from Eva in that, while the majority of the burials are fully flexed inhumations, proposed habitation areas are spatially segregated from the midden and burial area. This may indicate the presence of a formal cemetery (Magennis 1977:18). Unlike at Eva III, grave goods were distributed randomly by age and sex at Cherry, although males tended to be associated with far greater proportions of utilitarian items than females (62.5 percent versus 12.5 percent with females) (Magennis 1977:83). Finally, a total of sixteen exotic artifacts were associated with four individuals at Cherry (one adult male and three subadults), suggesting, but not demonstrating, greater participation in extra-local exchange than at Eva III (Magennis 1977:84-85).

Similar trends toward increasing participation in extra-local exchange through time can be found at other sites throughout the Midsouth. At Anderson, for instance, 22 percent of the sixty-two burials contained shell beads, with 75 percent of these occurring in the upper three levels (Dye 1996:144). It is noteworthy that none of these sites rivals those in the Green River in terms of the quantities of artifacts recovered. Exceptions to this, however, might be found in the as yet under-studied Pickwick Basin sites in Tennessee and Alabama (Webb and DeJarnette 1942). Finally, by the later Late Archaic in this region, cremation burials in upland areas away from midden sites began to appear. This isolation of these individuals away from habitation sites in a formal cemetery area, the increased processing required in their burial, and their lack of burial associations (Chapman 1990, Myster 1990) may indicate a shift in importance from material culture to the location and form of one's burial in expressing identity in the mortuary domain.

In Illinois, a similar process of increasing complexity from the Middle to Late Archaic can be discerned through mortuary practices. During the Middle Archaic at Koster, for instance, individuals were buried in midden contexts in or near habitation areas. By the late Middle Archaic Helton phase, however, midden burials at both Koster and Modoc Rock Shelter were restricted to the very old, very young, or crippled members of society, while younger, healthier individuals were buried in special facilities at the bluff-top Gibson Mounds site (Buikstra 1981, Charles and Buikstra 1983, Cook 1976). A similar dichotomy is noted between the Napoleon Hollow site and the bluff-top cemetery at Elizabeth, although the burials at Napoleon Hollow also included healthier individuals (Charles and Buikstra 1983). Finally, a third type of Archaic mortuary site consists of floodplain aggregation loci like Bullseye, which contain individuals buried with atlatl weights and other symbols of identity (Farnsworth 1987) and that are thought to have provided the contexts for alliance building and trade negotiations among corporate groups (Charles and Buikstra 2002).

These three burial site types are incredibly important for interpreting the Green River Archaic sites because they reinforce the potential for certain of the social personae hypothesized above. The burials at Koster and Napoleon Hollow, for instance, were placed in midden contexts like the burials found along the Green River. The distinction made between age and health at Koster and Modoc Rock Shelter is reminiscent of the distinctions noted at Eva and may be replicated at Chiggerville. The burials at Bullseye, Koster, Elizabeth, and Gibson, on the other hand, are thought to indicate a process of cycling between upland bluff-top burials and floodplain aggregation sites (Charles and Buikstra 2002). These floodplain sites, located along major waterways like the Green River middens, may have provided the contexts for interactions between lineage or sodality leaders and/or trader-diplomats who would have exchanged material goods, information, and possibly mates in the negotiation of alliances.

The Illinois bluff-top cemeteries are interpreted by Charles and Buikstra (1983, 2002; Buikstra and Charles 1999) to represent formal cemeteries belonging to emerging sedentary corporate groups organized at the village level. According to these authors, placement of artifacts in corporate burial areas without clear association with specific individuals suggests that it was membership in the corporate group that was important for one's identity, not the role of the individual or his or her status within that society. One possible exception to this rule is the elaborate burial of select individuals in Feature 4 at the Elizabeth site. This latter feature consisted of five individuals directly dated to 4390

B.C., four of whom were encircled with *Leptoxis* shell bead belts and had two to three Early to Middle Archaic points pressed into their chests post-mortem. All five were wearing *Leptoxis* shell bracelets and two had bear canine earrings (Charles and Buikstra 1983: 134, Albertson and Charles 1988: 33-36, Charles et al. 1988). The association of these young, otherwise healthy individuals with *Leptoxis* belts, similar in many respects to those found in Green River sites, and projectile point types arranged in such a fashion as to indicate prolonged mortuary processing, suggests that these individuals represent lineage leaders, trader-diplomats, or some other revered social personae. Their burial with otherwise limited access goods in a conspicuous burial location may even indicate emergent status differentiation among these groups.

Investigations at late Middle Archaic sites in the Carrier Mills Archaeological District in the Saline River valley of Illinois provides a significantly different picture of complexity among groups living in this part of the state. Lynch's (1982) study of the best represented Middle Archaic component (Area A at the Black Earth site) indicates a population characterized by egalitarian social relations and differential burial treatment based on age, sex, and special abilities, not status or prestige. Very few individuals at Black Earth (17 males, 10 females, and 7 subadults out of a burial population of 154 individuals) were associated with any kinds of burial goods (Lynch 1982:1148) and only one special status position (a ritual specialist or shaman) was identified. The one probable ritual specialist (Burial No. 137) was buried with a bundle of goods that included eagle talons, worked bear phalanges, a miniature grooved axe, banded slate, pieces of worked stone, a possible plummet, and two gorgets. Eight individuals were buried with clay caps over their burial pits, possibly indicating nascent status differentiation based upon the increased energy expenditure invested in these burials. Other possible markers of social identity include *Leptoxis* beads found with Burial No. 32; fluorspar crystals with Burial Nos. 33 and 192, shell pendants with Burial Nos. 62, 116, and 209; and bone pins with Burial Nos. 35 and 66 (Lynch 1982:1146-1148).

Finally, although the data are more limited, some evidence for emerging social complexity and the advent of individuals possessing intra-community social standing can be discerned at late Middle to Late Archaic sites in Indiana. For instance, at the McCain site in Dubois County, a total of twenty burials were recovered from midden contexts similar to those found along the Green River. Of these, only three contained burial associations (including axes and a turtle shell), but the presence of numerous decorated bone pins at the site suggests interaction with other groups in the region (Miller 1941, Jefferies 1997).

Evidence for social interaction and emerging complexity is even better represented at the Crib Mound site in Spencer County. Although most of the information derived from this important site is from collectors and not from professional excavations, the presence of numerous Archaic burials containing atlatl weights, engraved bone pins, and at least one individual who was buried with four engraved and perforated conch shells that are nearly identical to those found at Chiggerville, Indian Knoll and other Green River sites indicate that Crib Mound held an important role in late Middle to Late Archaic social interactions (Champion 1965, Scheidegger 1962).

This limited comparison of late Middle to Late Archaic burials in Tennessee, Illinois, and Indiana has served to identify the presence of important social personae at numerous sites throughout the Midwest and Midsouth. Furthermore, this literature review has illustrated the nature of emerging complexity during the late Middle and Late Archaic time periods represented at the Baker and Chiggerville sites. The distribution of artifacts and differential mortuary treatments of members of Archaic groups to the north and south of the Green River sites suggests the presence of trader-diplomats, lineage or clan leaders, and other social personae among these groups. Data from Koster, Gibson, Eva, and Cherry suggest that age, gender, and personal accomplishments were important aspects of identity commonly expressed in Archaic mortuary behaviors.

Comparison of the Baker and Chiggerville mortuary assemblages to this admittedly limited sample of Middle and Late Archaic sites indicates that these two sites are part of a general pattern of highly variable mortuary behaviors throughout the Midwest and Midsouth. Although it is generally accepted that Middle to Late Archaic mortuary practices are distinct from Early Archaic and earlier Middle Archaic practices in terms of an increase in complexity of burial rites and value of burial associations (e.g., Jefferies 2008), a high degree of variability is present across space and, likely, across time. Furthermore, assessing the complexity of Green River burial practices relative to burial practices in other regions is complicated by the differential preservation of burials, reporting of data, and size of excavations. Based on numbers of exotic and special status burial goods, however, it can be proposed that Chiggerville is equal in complexity to Ervin, Anderson, Crib Mound, and sites in the Pickwick Basin and more complex than Eva, Black Earth, Cherry and McCain. Baker, on the other hand, is less complex than all of the site's discussed above. Based upon complexity in intra-site spatial patterning, however, Chiggerville is less complex than Cherry, while Baker seems comparable in complexity given the possible presence of distinct cemetery areas at both sites. Helton phase burial practices were likely the most complex of all in that these sites are characterized by the differential placement of individuals within and among sites, with some individuals placed in corporate burial areas, and the differential association of high status individuals with high value burial goods.

On the Ubiquity of Marine Shell and Copper Artifacts along the Green River

Having established the possible presence of community leaders and trader-diplomats at Chiggerville and the other Green River sites, the question remains as to how important these individuals and their social and political maneuverings were in the day-to-day lives of Archaic hunter-gatherers. Although answering this question is extremely difficult, one way to begin doing so is by examining the numbers of exotic artifacts represented at these sites as a proxy for the degree to which extra-local social interactions were routine.

Having tallied the number of marine shell and copper artifacts recovered by the WPA from all of the Green River sites, Marquardt and Watson (2005c) and Watson (2005:550) have concluded that "marine shell is far more abundant than either copper or the remains of northerly fur-bearing animals." Indeed, a total of more than 23,000 marine shell artifacts have been recovered from the Green River sites, compared to only thirteen items of copper (Marquardt and Watson 2005c:634). Extrapolating from these data, Marquardt and Watson (2005c:634) estimate that a total of 30,000 shell beads manufactured from as many as 750 to 1000 whelk shells may have been buried in the Green River shell middens.

According to Watson (2005:561), "the quantity of disk shell beads and other artifacts of conch/whelk shell… and of portions of conch/whelk shell is such that local manufacture from imported whole shells seems plausible." As a result of this inference, Marquardt and Watson (2005c) conclude that as many as fifty to one hundred trips to the Gulf coast of Florida by individuals carrying between ten and fifteen large whelk shells over a period of 2000 to 3000 years are represented by these artifacts. However, given the likelihood that systems of down-the-line exchange existed during the late Middle to Late Archaic period (Wright and Zeder 1977), the lack of evidence for Green River visitors to the Gulf Coast, and the absence of marine shell debitage recovered from decades of excavations in the Green River region, it seems much more likely that whole necklaces, bracelets, and other artifacts were being directed into the region by trader-diplomats operating between the Green River valley and areas to the south (e.g., the Pickwick Basin). The presence of small numbers of complete or nearly complete whelks in some burials does indicate that some whole shells were traded into the region and later reduced into locally specific artifact forms (e.g., perforated conch sections).

Based upon the hypothesis that finished artifacts and not raw marine shell were being imported into the Green River region, the original Chiggerville WPA photographs were consulted to estimate the minimum and maximum numbers of whole objects (as opposed to individual beads) represented at the site. Estimates were based upon the numbers of different kinds of beads (e.g., shell disk versus *Leptoxis*) present in each burial and on the distributions of beads within burials (clusters of beads were considered as one artifact). Additionally, paired shell objects other than beads (e.g., ear plugs) were counted as single artifacts in the total. Unfortunately, photographs were not available for all burials. As a result, both a maximum and a minimum number of shell objects were derived for the site, with the maximum representing the total number of shell beads provided by Webb and Haag (1939:14-15), field burial forms, and/or the Webb Museum catalog. Appendix 8 lists each burial used to tabulate these data, along with the objects included in the totals.

Table 8-4. Estimated Number of Marine Shell and Freshwater *Leptoxis* Artifacts at Chiggerville.

	Total # of Shell Artifacts	Estimated Min. # of Shell Objects	Estimated Max. # of Shell Objects
Marine Shell	1273	32	92
Leptoxis sp.	1063	3	3

As can be seen in Table 8-4, the 1273 marine shell objects from Chiggerville represent as few as 32 actual artifacts, although the true count of objects, including marine shell beads found throughout the midden, probably falls somewhere between thirty and fifty. Extrapolating this ratio to the total number of marine shell objects represented by the estimated 30,000 shell beads found in the Green River region, a total of 750 to 1250 complete marine shell objects are present at these sites. Providing that each individual trader-diplomat could have carried 10 to 15 objects in a single trip, between 50 and 125 trips from the Gulf Coast are represented. This is considerably more trips than the single voyage necessary to obtain the 13 to 15 copper objects found at Green River Archaic sites (Marquardt and Watson 2005c:634).

Adjusting these estimates for population and time, however, diminishes the impact of the estimates even more. According to Haskins and Herrmann (1996:110), a total of 2720 Archaic individuals were excavated by the WPA in the Green River region. This indicates that only about half of the Green River population could have owned a single marine shell object were they distributed to individuals and not exchanged within the group. Assuming that marine shell was being transported into the region throughout the 3000 years that the sites were intensively utilized, a maximum of one marine shell object was being imported every 2 ½ years. If these objects were being imported in groups of 10 to 15, then the number of marine shell importation episodes represented by the estimated 30,000 artifacts at these sites is 1 every 24 to 60 years. Considering that each of these objects was likely exchanged down-the-line between trading partners and not carried very long distances at any one time, it would seem that very few such exchanges occurred within the lifetime of individuals at these sites. The position of trader-diplomat, then, was probably situational, with single individuals or corporate groups developing the social networks necessary to obtain this distinction only once every few generations.

Evidence for exchange is much more limited at Baker. No exotic goods of any kind were recovered from burials at the site, although this may be a sampling bias as only a very small number of human burials were recovered from Baker. Additionally, no marine shell objects were recovered from general midden contexts. However, while no copper artifacts were recovered from Chiggerville, a single copper pin or awl measuring approximately 7.5 cm in length and 2 mm in width was recovered from a depth of 3 feet in Unit 70L4 at Baker. This object weighed 1.8 g and was round in cross-section (Figure 7-25j).

A Hypothetical Model of Green River Archaic Marine Shell Use

Evidence from Middle to Late Archaic Gulf coast sites like Useppa Island in southern Florida can provide some additional insights into the nature of marine shell exchange. As demonstrated by Torrence (1996, 1999), evidence for localized Middle to

Late Archaic marine shell reduction at coastal sites does exist. Although the production of shell beads was apparently not conducted at Useppa, Torrence (1996, 1998) argues that lightning whelk columellae were extracted from this location and moved to chert outcrops to the north to be manufactured into beads. It is likely that Archaic bands in Florida extracted columellae and the broad outer whorls of whelks during their normal subsistence rounds at sites like Useppa. These raw materials were then transported north to chert outcrop locations where they were reduced first into blanks and then into shell beads by part-time specialists (*sensu* Cross 1993). The shell beads and some shell bead columella blanks entered into a widespread system of reciprocal down-the-line exchange from these sites.

It seems likely, based upon preliminary sourcing by Claassen and Sigmann (1993), that the majority (if not all) of the conch artifacts found at the Green River sites originated from Gulf coast locations. The *Marginella* beads that are found in more limited numbers (Claassen 1996), however, may have been obtained from groups on the Atlantic coast (see Hammett and Sizemore 1989). The sources of the *Olivella* beads along the Green River and *Dentalia* shells found in Pickwick basin shell middens, on the other hand, are currently unknown (Claassen 1996). It seems likely that all of these beads were obtained through exchange with groups on the Atlantic or Gulf coasts.

Even if this generalized model proves accurate, the question of who had access to these materials remains. A model of generalized reciprocal exchange, for instance, implies that marine shell artifacts should be widespread at sites throughout the eastern United States and found in burials of individuals of all ages and both sexes. While the latter is certainly the case, there does appear to be a limited distribution of these goods at larger shell midden sites in major river valleys (Claassen 1996). This suggests two possibilities. The first is that the midden sites along the Green River and elsewhere acted as the burial areas of most Archaic bands in the Southeast at this time and that the lack of shell ornaments in burials elsewhere (and the fewer number of burials per site) is due to the fact that the dead were being transported over long distances to these larger aggregation sites. This hypothesis seems highly unlikely, however, due to the distances involved and the lack of large numbers of imported artifacts other than marine shell at these sites.

The more likely scenario, then, is that, close to the coast, marine shell necklaces and bracelets and decorated articles of clothing, baskets, mats, etc. were traded widely among individuals. Farther from the coast among the interior hunter-gatherers of the Green, Tennessee, and Ohio River valleys, these artifacts increased in value due to their limited supply. In fact, it is possible that the Green River peoples were so far removed from the production of these artifacts that they were ultimately unaware of their marine origin, not unlike the aboriginal peoples of the Australian interior (Safer and Gill 1982:124). Among these interior groups, ties with outside groups were not maintained so much through mobility but through the maintenance of trading partnerships by trader-diplomats and lineage leaders, who were then in a position to control the flows of marine shell artifacts into the region, perhaps resulting in increased status differentiation (Brown 1985, Jefferies 1996b, Marquardt 1985). The concentration of marine shell artifacts in the shell middens and their unique distributions were not due to the position of the Green River sites between the northern copper and southern shell exchange spheres (Goad 1980), but the result of the increased value of the shell artifacts so far from their sources.

Additionally, the exotic nature of shell necklaces, gorgets, and other valued objects may have increased the likelihood that they would become individually or communally owned inalienable possessions (Mills 2004), further increasing their value.

Finally, it seems likely that the consumption of these objects was slow and was reserved for the burial ceremonies performed for special individuals (such as trader-diplomats, lineage leaders, or shamans) or those who were especially grieved (i.e., children and young adults). The fact that greater than 95 percent of the marine shell found at Shell Mound Archaic sites is from burial contexts (Claassen 1996) suggests that the only means of disposing of these artifacts was in burial ceremonies. Those isolated artifacts recovered from middens were probably associated with burials disturbed through the digging of additional burial pits, a well-documented practice at many sites (e.g., Webb 1974). This ritual use of shell by the Middle and Late Archaic shell midden peoples may have directly translated into similar ritual uses observed among the later Adena, Hopewell, and Mississippian cultures. Of course, this model for the production, exchange, and consumption of marine shell artifacts by Archaic cultures in eastern North America is currently based upon limited data and is highly speculative. Additional data are needed to test and refine the model.

Possible Evidence for Interpersonal Violence at Chiggerville

Having discussed the roles of hunters and/or warriors above, it is important to note the possible evidence for interpersonal violence (i.e., raiding) at Chiggerville (no evidence for violence was recorded at Baker). As Mensforth (2001, 2005) has pointed out, one consequence of increasing population densities and territoriality (correlates of increasing complexity) is the advent of organized raiding and increased incidences of conflict. Although evidence for violence among Archaic groups has been well known since Moore's (2002) original excavation at Indian Knoll, this phenomenon has received little discussion until recently (e.g., Milner 1999, Smith 1996). Although no direct evidence of interpersonal violence has been noted at Chiggerville to date (in the form of projectile points embedded in bones, cutmarks, or blunt force traumata), the high percentage of group burials that exhibit such evidence at other sites like Ward and Carlston Annis (Mensforth 2001), suggests that multiple burials at Chiggerville also may be the victims of violence. These and other possible evidence for conflict at Chiggerville are discussed in this section.

The multiple burial containing Burial Nos. 8A, 8B, 8C, and possibly 9 may have been the victims of violence. In addition to being buried in a group, suggesting that all individuals died at or near the same time, Burial No. 8A is missing its skull and is associated with a projectile point. Determining whether the point was embedded in the individual's body at the time of burial and whether the skull was removed peri-mortem or by post-depositional disturbance requires additional research. Burial No. 9, which may be part of the Burial No. 8 multiple burial or intrusive into it (removing Burial No. 8A's head), was associated with three projectile points, one of which was suspiciously located under the individual's left arm, between its ribs.

Single burials missing limbs, possibly indicating trophy removal, but with no other evidence in support of prehistoric violence include Burial Nos. 19, 30, 36, 108, 113, and 124. Individuals that were associated with projectile points but that need additional study to determine whether these points were embedded at the time of burial include Burial Nos. 23, 29, 73, and 104. Burial Nos. 48, 49, and 50 were buried together in a multiple burial, but no other evidence was recorded to suggest these individuals were the victims of violence.

Burial Nos. 20 and 21 were buried together, suggesting these two individuals were the victims of violence. This assertion is supported by Burial No. 21, which is missing limbs and its skull. Likewise, Burial Nos. 63 and 64 were buried together, and both individuals are missing limbs. Burial Nos. 105 and 106 were buried together and Burial No. 106 is missing its skull. Whether these missing limbs were removed as trophies or are absent due to post-depositional disturbance or poor preservation requires additional research.

Burial Nos. 26, 27, and 28 were buried close together and represent a possible multiple burial. Supporting the idea that these individuals were victims of violence is the fact that Burial No. 26 was interred with a projectile point exhibiting an impact fracture, suggesting it was embedded in the individual at the time of interment. Additionally, Burial No. 28 is missing limbs and its skull.

Burial Nos. 68, 69, and 72 were also buried close together, suggesting a multiple burial. Other evidence in support of violence includes a stone projectile point associated with Burial No. 69 and an antler point buried with Burial No. 72. Burial Nos. 91, 92, and 93 are a multiple burial, but only Burial No. 93 is associated with a projectile point. Whether these six individuals were the victims of violence requires additional research.

Four additional single burials exhibit evidence suggesting they were the victims or perpetrators of prehistoric violence. Burial No. 53 is associated with a second mandible that may be a raiding trophy. Burial No. 94 was placed on its stomach and its legs appear to have been separated from its pelvis before burial, suggesting either that this individual was killed and dismembered prior to burial or that removal of the legs was a form of specialized mortuary treatment. Burial No. 98 was associated with a projectile point and missing a leg.

The one burial at Chiggerville that seems to exhibit unequivocal evidence for prehistoric violence is Burial No. 114. This individual was interred with two dogs and is missing its lower legs. Interestingly, although the skull is present with the burial, examination of the burial photograph indicates that the skull had been removed at the neck but interred at the individual's feet. This kind of perfect removal of the skull and replacement at the individual's feet is unlikely to result from post-depositional processes affecting the midden. Although direct comparison with Baker is not possible given the gross differences in sample size between the two sites, the presence of at least one, and likely many other, cases of prehistoric violence at Chiggerville supports the hypothesis that Chiggerville's population was undergoing change in demography and land ownership that are consistent with increasing cultural complexity (Brown 1986).

The Relative Complexity of Baker and Chiggerville as Evidenced by Mortuary Behaviors

Direct comparison of the relative complexity of the Baker and Chiggerville mortuary assemblages is difficult due to the significant differences between the two assemblages. Burials at Chiggerville exhibit evidence for several status positions and social personae potentially including trader-diplomats, lineage leaders, and successful hunters. Also present are over 30 items manufactured from exotic and rare marine shell from the Gulf or Atlantic coasts. Baker, on the other hand, has no burials with evidence for status positions and no exotic goods save for a single copper awl/pin recovered from general midden contexts. It is possible that this pin and the lack of copper at Chiggerville indicates that, during the Middle Archaic, groups living in the Green River valley were interacting with Helton phase groups north of the Ohio River while, during the Late Archaic, interaction was more intensive and focused to the south. It is just as probable that the few individuals at Baker are not representative of the Baker population overall and that evidence for interaction, exchange, and social personae are present at some other, larger burial site in the Green River region (possibly Barrett).

Comparison between the two sites is also made problematic by the fact that Baker seems to exhibit a more complex pattern of burial placement. Whereas both sites exhibit a preference for burial near water, individuals at Chiggerville were seemingly haphazardly placed intermingled and overlapping one another in the southeastern portion of the site near what was likely a slough or some other aquatic feature. At Baker, however, the four humans, which may be secondary burials, were placed in a single row along the bluff's edge and surrounded by an arcuate pattern of three dogs. This pattern is accentuated by the identification of a much more clearly arcuate distribution of dogs surrounding humans at the nearby Middle Archaic Jackson Bluff site and suggests a more prescribed set of mortuary rules than at Chiggerville, possibly even indicating that Baker and Jackson Bluff were true cemeteries (*sensu* Milner and Jefferies 1998).

Reanalysis of the burial goods, original field burial forms, and burial photographs from Chiggerville indicates that 36 percent of the burials at the site were associated with some form of non-perishable burial good. Of these burials with burial associations, 47.6 percent were younger than 20 years of age, indicating that age, and possibly grieving, was an important factor in determining whether goods were placed with individuals.

Certain burial goods like marine shell beads were much more commonly associated with sub-adults than adults, suggesting that these items were unrestricted in their distribution, although obviously highly valued given their esoteric origins and the fact that they were nearly always disposed of in emotionally charged mortuary settings.

Of those individuals over the age of 20, 37.5 percent of males and 27.6 percent of females were associated with grave goods, indicating a bias in favor of males. However, socially valued goods were found with burials of both sexes, and the most ornately adorned individual (Burial No. 44) with the largest variety of highly valued goods was a female. Only utilitarian goods and turtle carapaces were recovered with the burials of older females, suggesting that age limited the leadership roles of women at Chiggerville. Three atlatl weights, which may have been inalienable possessions or that may indicate one's status as an accomplished hunter, were found buried, one each, with a female, a male, and an infant. If the burial of atlatl weights, projectile points, bifaces, drilled teeth, dogs, and/or antlers with individuals reflects the identity of accomplished hunter, then the Chiggerville data indicates that males were much more likely than females to obtain this role. However, the burial of some of these items with women suggests that gender roles along the Green River were negotiable and not fixed.

The burial of gorget/masks and trianguloid shell pendants, both of which were likely components of headdresses or other kinds of head and face wear, may be indicative of one's identity as a trader-diplomat. This is based upon the exotic nature of the raw material and the high visibility of placement of these items near the head. Alternatively, the freshwater *Leptoxis* bead belts, sashes, and collars may indicate one's position as a lineage leader or ritual specialist. Regardless of the specific meanings these items held, their burial with a limited number of individuals in a large burial population does indicate that they had some kind of meaning and that these meanings likely related to the roles these individuals played in life. Whether the specific interpretations provided above are correct or not, the data do indicate that Chiggerville is more complex than Baker in terms of the number of social personae and status positions expressed in the mortuary domain.

Chiggerville is also more complex in terms of the number of individuals with evidence of prehistoric violence. If Brown (1986), Mensforth (2001), and others are correct in asserting that decreasing mobility, increasing population densities, and increasing territoriality all lead to increasing conflict, then the presence of at least one individual who was the victim of violence and several others who may have been supports the complexity hypothesis for this site. Unfortunately, the impact of this assessment is limited by the small numbers of individuals recovered from the Baker site.

It seems, then, that data from the Baker and Chiggerville mortuary assemblages indicates that Chiggerville is comparable to other nearby Middle and Late Archaic populations in terms of the overall complexity indicated by numbers of potential status positions and social personae represented in the mortuary domain. Chiggerville was also participating in long-distance networks of exchange, directed toward the importation of southern or eastern derived marine shell necklaces, headdresses, and other items, although the intensity of this exchange was likely not as marked as some would suggest (e.g., Winters 1968). Finally, it seems that individuals at Chiggerville may have been periodically participating in raids and other small-scale violent episodes characteristic of populations under demographic or geographic stress.

Baker, on the other hand, is much less complex than Chiggerville in all of these categories. Burials at Baker do not contain evidence for distinct status positions, and no burials are elaborately adorned with high value exotic goods. Baker does exhibit complexity in terms of its burial patterning, however. The placement of all human burials in a single row surrounded by dogs is indicative of a burial plan that was much more formal than that exhibited at Chiggerville. Therefore, while available data indicate that Chiggerville is the more complex of the two sites, a more complete picture of the Middle Archaic mortuary pattern might drastically change this interpretation. If, on the other hand, Baker is representative of the overall Middle Archaic mortuary pattern in the Green River region, then such a pattern of small numbers of burials placed at many sites across the landscape would likely indicate a pattern of high mobility and a lack of investment in persistent places. Such a pattern would support Chiggerville as the more complex of the two sites.

Chapter Nine

Discussion and Conclusion

Archaeological research in the middle Green River valley of western Kentucky began in the early 1900s with amateur-quality excavations performed by Clarence B. Moore, William D. Funkhouser, and William S. Webb. These initial explorations were followed several years later by large-scale investigations by the Works Progress Administration, with Chiggerville excavations being the first Green River WPA site published and assigned to the Archaic Pattern of eastern North American prehistory. Since the 1930s, smaller-scale investigations by Patty Jo Watson and her students have been aimed at addressing a series of important questions concerning the nature of midden occupations and site formation in this region. The analyses described in this dissertation are part of this ongoing intellectual tradition, which represents a longitudinal effort to better contextualize and interpret the Shell Mound Archaic.

This study draws upon previous research and detailed reanalyses of the WPA artifact and bioarchaeological collections curated at the William S. Webb Museum of Anthropology at the University of Kentucky to address the relative complexity of the prehistoric hunter-gatherers who inhabited the Baker and Chiggerville shell middens, located in Muhlenberg and Ohio Counties, Kentucky, respectively. The WPA collections from these sites were excavated in the late 1930s and are generally in good condition. The Baker and Chiggerville sites are considered amenable to comparison due to their ages and geographic locations. Both sites are situated adjacent to mussel shoals on opposing banks of the same stretch of the Green River, and analysis of the artifact assemblages and radiocarbon dates from the two sites indicate that each midden accumulated largely during a single time period. Baker yielded large quantities of Large Side Notched Cluster points indicating a Middle Archaic age, and the Chiggerville assemblage consists primarily of Late Archaic stemmed point types. Adapting the taxonomy developed by Webb and DeJarnette (1942), these sites are assigned to the Indian Knoll and Baker phases, respectively.

As described in chapter 2, this study adopts a materialist, evolutionary framework rooted in a Western model of progressive human developments and considers current perspectives on cultural complexity and culture change to be directly traceable to the work of Louis Henry Morgan, Karl Marx, Leslie White, V. Gordon Childe, Julian Steward, Elman Service, and Morton Fried. The advent of complexity among hunter-gatherer societies is conceived of herein as an evolutionary process that should be problematized and investigated at different scales and with different datasets depending upon the specific research question of each analyst. That is to say, there is no absolute definition of complexity that can be applied to all human groups in all times and all places, and evolutionary change in one aspect of society does not always correspond with changes in other aspects. Likewise, the rate of change in differing aspects of society is likely to be highly variable.

As part of the problematization process, it is important for any study of complexity to first explicitly state how that study is defining the term ‘complexity’ and how changes in the specific microscalar aspects of complexity being studied (i.e., material correlates) can be used to make broader (macroscalar) interpretations of culture change. As should be obvious from the earlier chapters in this dissertation, hunter-gatherer societies are not a homogenous unit of ‘simple’ societies, and the study and interpretation of hunter-gatherer complexity is, well, complex. As used in this study, complexity is a relative concept that involves both an increase in the number of parts present in a given system and/or an increase in the interrelationships among those parts. The specific subject of this dissertation is the relative complexity of the socio-political and economic organization of the hunter-gatherers who lived at the Baker and Chiggerville sites. At this scale of analysis, hunter-gatherer social complexity is considered to begin when egalitarian societies integrate from a loosely organized series of individual families or bands into more structurally differentiated tribal-like social formations.

Previous studies of hunter-gatherer complexity have been plagued not only with difficulties in interpreting various uses of complexity as a concept but also by what is meant by the term 'hunter-gatherer'. Generally, this confusion has arisen out of a conflation of hunting and gathering as a mode of subsistence, which involves the ways in which societies obtain their food, with a hunter-gatherer mode of production, which explicitly deals with the various interrelationships among individuals within the structure of the political economy. The hunter-gatherer mode of production, as defined herein, is one that is based on 1) individuals maintaining widespread access to the means and forces of production, 2) individual autonomy within the structure of the sexual and age-based divisions of labor, and 3) a generalized system of sharing and reciprocity predicated on a socially and logistically induced lack of personal accumulation of goods. Relations of production within a hunter-gatherer mode of production are kin-based, and surplus labor is collectively appropriated and distributed. Political relations are generally egalitarian and access to the means of production is generally communal. The hunter-gatherer mode of production is further subdivided into a foraging mode of production practiced by band level societies and a lineage mode of production practiced by groups integrated at a tribal level (Figure 2-4).

To address these higher level questions of changing trends in hunter-gatherer social organization and complexity at Baker and Chiggerville, six microscalar aspects of complexity were selected for more direct analysis – technological organization, subsistence, specialization, leadership, communication networks, and exchange. The relative complexity of the technological organization of the Baker and Chiggerville groups is addressed through study of the curation of chipped stone, bone, and antler tools at the two sites, typological analysis of the diversity of tool forms, and study of debitage and cores from the 2009 excavations to determine the extent to which raw material was being stockpiled and the kinds of reduction that were being practiced. A technological organization indicative of decreased mobility and higher levels of curation was considered more complex than one characterized by high mobility and the use of primarily expedient or opportunistic tool forms.

Although botanical remains were recovered from both sites during the 2009 excavations and faunal remains recovered from Chiggerville, study of these remains was not possible as part of this project. Instead, the relative complexity of subsistence behaviors at Baker and Chiggerville was addressed through analysis of ground and pecked stone plant processing gear. The site with the highest frequencies and greatest diversity of plant processing equipment, reflecting increased labor input in subsistence pursuits, was considered the most complex.

Specialization at Baker and Chiggerville was addressed through study of the chipped stone assemblages at the two sites. A wide range of both metric and non-metric traits were recorded to determine whether production was separated into a series of spatially and temporally distinct stages, if different individuals were participating in reduction at each of these stages, and if different raw materials were being exploited. The site with the most evidence for the specialized production of some chipped stone tool forms was considered the most complex.

The complexity of leadership roles was addressed through a thorough analysis of the mortuary assemblages at Baker and Chiggerville. Grave good associations were interpreted to determine whether special identities were discernible in the mortuary domain, and variation in the distribution of burials within each site was evaluated to address the relationship between mortuary patterning and social organization. The site with the greatest number of discernible status positions and most structured intra-site organization was considered most complex.

Evaluation of the relative complexity of the Baker and Chiggerville communication networks and exchange practices involved study of the bone and antler assemblages and the marine shell objects recovered from mortuary contexts. Specifically, artifacts were analyzed to determine raw material and the degree to which they exhibited similarities in style and decoration indicative of participation in long distance communication networks. The site with the greatest evidence for symbolic messaging through material culture styles and with the highest frequency of exotic goods present was considered the most complex.

Rather than address each of these different microscalar aspects of complexity in individual chapters, a more traditional materials-based organization was followed. Comparison of the antler WPA assemblages from Baker and Chiggerville indicated that more finished tools were present at Chiggerville, particularly finished antler tine projectile points. Additionally, atlatl hooks and handles and drifts were present only at Chiggerville, while billets and other antler tine flaking tools were much more common at Baker. Analysis of antler components present at the two sites indicated that whole antlers were brought to Baker and reduced by a refined groove and snap technique, while cruder slicing and hacking techniques were employed at Chiggerville. Only certain sections of antler were present in any quantities at Chiggerville, indicating that initial reduction occurred away from the site. Antler tools at Baker were shaped via a longitudinally oriented lithic shaving technique, while an obliquely oriented lithic shaving technique was dominant at Chiggerville.

The bone tool assemblages at the two sites also differed markedly from one another. Bone projectile points of various forms were numerous at Chiggerville and rare at Baker, while Baker yielded several beveled spatulate tools that were absent from the Chiggerville assemblage. Most bone tools (e.g., modified splinter pointed implements) at both sites were manufactured from unprepared and expediently acquired bone blanks. At Baker, these blanks were shaped via a lithic shaving technique, while abrasion, likely with locally available sandstone, was the dominant reduction method practiced at Chiggerville. The differences in artifact types present and manufacturing techniques employed in the production of bone and antler implements at the two sites suggests that their inhabitants were not historically linked but practiced two distinct organic implement manufacturing traditions.

Interpretations of the relative complexity of the two sites based upon comparisons of the bone and antler assemblages were ambiguous. The recovery of large quantities of debitage from the manufacture of antler tine implements indicates that objects like projectile points were being manufactured in large quantities at both sites; however, the recovery of fewer antler tine implements at Baker suggests these objects were being curated. Evidence for recycling, re-use, and a high investment in shaping implements into various formal types is greater at Chiggerville. The higher frequency of decorated bone objects at Baker suggests this group was more active in stylistic messaging, indicating a greater complexity of communication networks, but the decorations at Baker are faint and would have been difficult to use in such a manner.

Analysis of the chipped stone tool assemblages from the two sites provided better evidence for the relative complexity of these two groups. The presence of unmodified cobbles and greater numbers of cores at Chiggerville suggest the presence of stockpiling that may be evidence for reduced mobility, while the presence of bipolar and blade cores at Baker and bipolar and blade-like flakes in the Baker debitage assemblage both suggest a greater need to conserve raw material. Furthermore, chert type data from the two sites suggest that the Baker site inhabitants were obtaining raw material of varying quality from a larger variety of sources. Combined, these data suggest that the Baker site inhabitants were practicing an embedded procurement strategy that was likely associated with greater residential mobility, while the inhabitants of Chiggerville were supplying the site with chert procured directly by logistical task groups.

Although no differences were observed in the number of recycled tool forms present on Large Side Notched and Saratoga Cluster points from the two sites, blade widths of Large Side Notched Cluster hafted bifaces at Baker were narrower relative to their hafting elements compared with Saratoga Cluster hafted bifaces at Chiggerville. This difference in relative size suggests that the Large Side Notched Cluster hafted bifaces were more heavily curated, consistent with higher residential mobility. By way of contrast, comparison of the frequencies of all tool forms from the 2009 excavations indicates that more curated tool forms are present at Chiggerville.

Evidence for relative complexity with regard to the specialized production of chipped stone implements is tentative. The fact that debitage from Chiggerville consists primarily of medium-sized flakes and that Chiggerville is characterized by high frequencies of biface thinning flakes suggest that a single stage of production is dominant at the site and that production of bifaces by the hunter-gatherers who inhabited Chiggerville was spatially and temporally divided. The presence of a high degree of variability in hafting element forms among Late Archaic stemmed hafted bifaces at Chiggerville, coupled with a uniformity in biface thicknesses, suggests that stemmed point hafting elements may have been produced by individuals other than the producers of the bifacial preforms on which they were made. Each of these pieces of evidence suggests a form of specialization was practiced at Chiggerville.

Analysis of the ground and pecked stone assemblages indicated no differences in the diversity of tool forms present. However, many more ground and pecked stone tools were recovered from Chiggerville, particularly pestles. This higher frequency of ground and pecked stone plant processing tools at Chiggerville indicates increased labor input indicative of a more complex subsistence economy. This increased labor input may reflect the reduced mobility of the Chiggerville inhabitants. The presence of decorated atlatl weights and weights that were manufactured from exotic raw materials like indurated shell at Baker is consistent with participation by these groups in long distance networks of communication and interaction.

The mortuary assemblages at Baker and Chiggerville are very distinct, but the degree to which these differences are the result of differing sample sizes is uncertain. No burial goods were found associated with the small number of burials from Baker, although a single copper pin was recovered in general midden context, indicating trade to the north. The greater frequency of exotic marine shell objects and other bone, antler, and stone implements with burials at Chiggerville suggests that more social personae, status/leadership positions, and exchange/interaction are represented at this site. The high frequencies of marine shell and lack of copper indicates that trade at Chiggerville was directed to the south. Circumstantial evidence of interpersonal violence is also present.

Although the Chiggerville mortuary assemblage is apparently more complex with regard to trade and number of social identities represented, the Baker mortuary pattern is the more complex. At Chiggerville, human and dog burials are intermixed with the dominant pattern being one of burial toward water. At Baker, on the other hand, a Middle Archaic pattern of human burials placed in a row toward water and surrounded by an arc of dogs is evident. It is possible that these differences in intra-site burial distribution patterns indicates that the Baker burials are arranged in a true cemetery, possibly indicating a corporate group structure and a sense of land ownership, while the

Chiggerville site is more akin to a persistent place. While the Chiggerville pattern is similar to that seen at other large midden sites in the region, the Baker pattern has been identified only at the Middle Archaic Jackson Bluff site. It is possible that Baker is just one component of a more complex pattern of inter-site mortuary behaviors, with differing site types indicating differing social statuses, age grades, circumstances of death, etc.

Table 9-1. Relative Complexity of Various Aspects of the Baker and Chiggerville Material Assemblages.

Aspect of Complexity	Test	More Complex
Technological Organization	Curation of antler tools through analysis of antler parts present.	Baker - ambiguous
Technological Organization	Curation of bone and antler tools based on evidence for recycling, re-use, and degree of shaping.	Chiggerville - ambiguous
Technological Organization	Diversity of recycled tool forms on Large Side Notched and Saratoga Cluster hafted bifaces.	Neither - ambiguous
Technological Organization	Curation of chipped stone tools based on relative sizes of hafted biface blades and hafting elements.	Chiggerville
Technological Organization	Procurement strategy practiced based on variation in chert types present in chipped stone tool assemblages.	Chiggerville - ambiguous
Technological Organization	Procurement strategy practiced based on raw material conservation inferred from core reduction strategies.	Chiggerville
Technological Organization	Diversity of tool forms in the 2009 assemblage and the degree to which these are formal (curated) or informal (expedient) types.	Chiggerville
Technological Organization	Debitage analysis assessing the degree to which recycling, rejuvenation, and raw material conservation was being practiced.	Baker
Subsistence	Typological analysis of ground and pecked stone tools addressing diversity of tool forms.	Neither
Subsistence	Analysis of frequencies of plant processing tools present indicating degree of labor input in subsistence pursuits.	Chiggerville
Specialization	Variation in hafting element forms relative to blade thinning techniques indicating bifaces and hafts were produced by different individuals.	Chiggerville - ambiguous
Specialization	Debitage analysis indicating stages of reduction present at the two sites.	Chiggerville

Table 9-1 (continued)

Leadership	Analysis of burial goods to determine the number of identity roles and status positions present.	Chiggerville
Leadership	Study of intra-site mortuary patterning to determine the degree to which burial sites were organized into cemeteries or indicative of the use of sites as persistent places.	Baker
Communication Networks	Frequency of decorated bone and antler tools present.	Baker - ambiguous
Communication Networks	Study of decoration and atlatl weight forms to address the degree to which stylistic messaging was being practiced.	Baker
Exchange	Study of burial goods to determine the frequency of exotic raw materials present.	Chiggerville

Table 9-1 summarizes each of these tests of the relative complexity of Baker and Chiggerville based upon the six different microscalar aspects of complexity addressed in this study. As can be seen, Chiggerville appears to be the more complex of the two sites in all microscalar aspects of complexity, with the exception of communication networks. This apparent ambiguity in assessing the relative complexity of these two sites illustrates well the fact that various aspects of a culture evolve at differing rates. The task remains to determine which of these microscalar aspects of complexity best reflect hunter-gatherer socio-political and economic organization to answer the primary research question of this dissertation.

Components of a hunter-gatherer mode of production were outlined in chapter 2, with variation among groups practicing a hunter-gatherer mode of production explained as reflecting their degree of socio-political and economic differentiation and integration. That is, hunter-gatherers practicing a hunter-gatherer mode of production were subdivided into those practicing a foraging mode of production, characterized by social fluidity and open access to resources, individual autonomy in decision making, and territoriality based on ideology, and those practicing a lineage mode of production, characterized by access to resources restricted to the group, decision making weighted by social statuses like age and gender, and corporate ownership of land and property. Insofar as specialization, leadership, and exchange all deal directly with relations of production and organization of the economic system, these microscalar aspects of complexity are considered directly relevant to interpretations of the Baker and Chiggerville modes of production. Considering only these three aspects of complexity, the socio-political and economic organization of the inhabitants of the Chiggerville site is clearly more complex than that of the inhabitants of Baker. The one confounding factor is the possible cemetery area present at the Baker site. If the arrangement of burials at the site is indicative of a corporate cemetery area and the interpretation of Chiggerville as a persistent place is correct, then it would appear that corporate groups have formed among the Baker site inhabitants before other aspects of complexity discussed herein and that corporate group identity ceased to be expressed in intra-site mortuary patterning by the Late Archaic. Insofar as the relative complexity of subsistence behaviors included in this study addressed mobility rather than actual subsistence practices, this aspect of complexity supports the hypothesis that the Chiggerville site inhabitants were more complexly organized in that it supports a model of the Chiggerville hunter-gatherers as logistically organized and less mobile.

Technological organization and complexity of communication networks, as addressed in this study, likely have little bearing on the relative complexity of the Baker and Chiggerville modes of production. The material correlates of these two microscalar aspects of complexity dealt directly with individual responses to needs rather than with interdependencies among individuals in a group. Based upon the outline of eastern North

American culture history provided in chapter 3, it seems reasonable to conclude that those aspects of Baker's technological organization that were more complex than Chiggerville (curation and raw material conservation) are explainable as products of a more mobile lifestyle characterized by reduced predictability of raw material availability. Likewise, the complexity of the Baker site communication networks is explainable as a product of an open and widespread system of individualistic trading partnerships similar to those held by the !Kung. The more directed and sustained trading relationships evident at Chiggerville indicate that by the Late Archaic trade was no longer as open as it once had been, but that certain aspects of exchange were being controlled, in part, by trader-diplomats or lineage leaders.

Based upon the available evidence, the prehistoric hunter-gatherers who inhabited the Baker site were most likely highly mobile foragers characterized by an embedded system of raw material procurement, low labor input into resource procurement (i.e., an immediate return economy), and situational leadership roles that only rarely were marked by status indicators. Specialization was apparently not practiced by this group, with everyone or each family making their own bifaces from blanks struck from large cores. The high residential mobility practiced by the Baker site inhabitants led to unpredictability in resource procurement, leading group members to practice techniques of bipolar and, possibly, blade reduction to conserve toolstone. Exchange among these groups was likely down-the-line, situational, and unsustained, although the presence of communicative media hint at the presence of some structured interactions like trading partnerships similar to the *hxaro*. The presence of a single copper artifact and no marine shell artifacts at Baker may mean that this trade was directed to the north. Those communication networks that were in effect, whether based on a system of trade or not, were likely widespread and based on loosely interpreted bonds of kinship. These groups were more similar with regard to socio-political and economic complexity to the preceding Early Archaic and early Middle Archaic hunter-gatherers than they were to the hunter-gatherers who lived at Chiggerville one to two thousand years later. Based on the low numbers of burials present at Baker and most earlier sites, it is likely that these groups were unconstrained by population pressures or territorial circumscription. However, if the Baker site mortuary pattern does represent a corporate kin group, then it is possible that the inhabitants of Baker practiced a lineage mode of production.

The prehistoric inhabitants of the Chiggerville site, on the other hand, were likely less mobile and more complexly organized hunter-gatherers. Increased numbers of burials at Chiggerville may indicate increasing population pressures as these high resource diversity zones became persistent places and important aggregation loci, leading to an increased sense of land ownership and territorial circumscription. As a result of these pressures, groups at Chiggerville began spending more time extracting and bulk processing lower yield resources like mussels and hickory nuts with ground and pecked stone food processing tools at their now logistically supplied base camps along the Green River. Leadership within these groups was likely situational but was more likely to be marked by burial associations upon a person’s death. The selection of certain skilled flintknappers to make up logistical task groups who traveled to quarries to obtain bifacial blanks for the manufacture of projectile points and other tool types and the increased influence of trader-diplomats in the establishment and direction of exchange relationships created economic inter-dependencies among individuals, further reducing mobility options. While most raw material was transported to the site as bifaces, some unmodified cobbles were also stockpiled for use as cores in the manufacture of flake tools like Chiggerville hafted endscrapers; nevertheless, raw material conservation continued to be practiced. Although it is possible that stone was traded, the best evidence for exchange is in the form of marine shell objects found in mortuary contexts and likely transported as finished ornaments through down-the-line transactions directed to the south. Communication networks related to these trading partners were likely widespread, but symbolic messaging was apparently less important, possibly indicating that interactions were more sustained. This interaction is possibly indicated by the presence of quantities of penecontemporaneous non-Saratoga projectile point types at Chiggerville (e.g., Ledbetter and Benton points). Regional diversification in bone and stone tool styles suggests that at least some groups were beginning to integrate into regionally distributed corporate groups like hunting sodalities or possibly even clans. If this is the case, then it suggests that the inhabitants of the Chiggerville site were beginning to organize into tribal-like social formations and that they were more similar in terms of socio-political and economic organization to Early and Middle Woodland tribes than to their ancestors.

This interpretation of the differences between the Baker and Chiggerville assemblages is based largely on the assumption of historical connections between the two Green River Shell Mound Archaic groups. As discussed in chapter 6, however, differences in technological styles employed in the manufacture of bone and antler tools by these groups indicate that the two may not be historically related and that the Baker site, while preceding Chiggerville, is not ancestral to it. If this is the case then it disrupts one of the major assumptions of this dissertation and precludes any developmental interpretations of these data. In this case, the conclusion that the Chiggerville site inhabitants were more organizationally complex than the inhabitants of the Baker site would stand, but no conclusions about eastern North American evolutionary change could be made. More detailed studies of Archaic material culture, mortuary patterning, and settlement patterns from throughout the Midcontinent are required to more fully resolve questions of complexity among the Shell Mound Archaic.

APPENDIX A

ARTIFACT TABLES FROM THE 2009 EXCAVATIONS AT CHIGGERVILLE

Table A-1. Artifacts Recovered from Surface and Units 1, 2, and 3 Plowzone.

Provenience	Material	Count
Surface	Bifaces and Fragments	11
Surface	Cores and Fragments	6
Surface	Debitage	78
Surface	Drills and Fragments	2
Surface	Endscrapers and Fragments	3
Surface	Flake Tools	10
Surface	Graver	1
Surface	Hafted Endscraper	1
Surface	UID Projectile Point Fragment	1
Surface	Saratoga Cluster Projectile Point Base	1
Surface	Saratoga Expanding Stem Projectile Points and Fragments	4
Surface	Scrapers and Fragments	1
Surface	Shell Tempered, Plain Pottery	1
Surface	UID Groundstone Tool Fragment	1
Surface	UID Hafted Tool Base	1
Units 1, 2, 3 Zone A	Amethyst Glass	1
Units 1, 2, 3 Zone A	Bifaces and Fragments	3
Units 1, 2, 3 Zone A	Bifacial Core	1
Units 1, 2, 3 Zone A	Bone	51
Units 1, 2, 3 Zone A	Bone Flake	1
Units 1, 2, 3 Zone A	Cores and Fragments	1
Units 1, 2, 3 Zone A	Cut Nail	1
Units 1, 2, 3 Zone A	Debitage	90
Units 1, 2, 3 Zone A	Endscrapers and Fragments	1
Units 1, 2, 3 Zone A	Limestone Fragments	2
Units 1, 2, 3 Zone A	Saratoga Cluster Hafted Scraper	1
Units 1, 2, 3 Zone A	Siderite Concretion Fragments	7
Units 1, 2, 3 Zone A	Spokeshave	1

Table A-2. Artifacts Recovered from Units 2 and 3 Zones B and C, 1/4 and 1/2 inch mesh screens.

Zone/Depth	Material	Count
Feature No. 1	Gastropods	6
Feature No. 1	Bone	3
Feature No. 1	Debitage	3
Feature No. 1	Pebbles	3
Feature No. 1	Siderite Concretion Fragments	1
B1	Antler Tool Production Debitage	2
B1	Bone	579
B1	Bone Implement Fragment	8
B1	CaCO3 Concretions	32
B1	Cut Bone	1
B1	Debitage	110
B1	Fired Clay	68
B1	Flake Tool	1
B1	Gastropods	-
B1	Historic Ceramic	1
B1	Leptoxis Bead	1
B1	Limestone Flakes	1
B1	Limestone Fragments	36
B1	Modified Splinter, Pointed Implement	1
B1	Modified Tooth	2
B1	Mortar Fragment	1
B1	Nutshell/Charcoal	-
B1	Pebbles	167
B1	Perforated, Shaped Pointed Implement	1
B1	Pestle Fragment	1
B1	Shell-tempered, Plain Pottery	1
B1	Siderite Concretion Fragments	159
B1	UID Prehistoric Pottery	2
B1	UID Projectile Point Fragment	2
B1	UID Shell Tempered Pottery	2
B1	UID Worked Turtle Shell Fragments	9
B2	Antler Implement Fragment	1
B2	Antler Tool Production Debitage	1
B2	Biface Fragment	4
B2	Bipointed Implement, Unidirectionally Forked/Pronged	1
B2	Bone	682
B2	Bone Implement Fragment	5
B2	Bone Tool Production Debitage	1
B2	CaCO3 Concretions	46
B2	Cut Bone	1
B2	Debitage	114
B2	Endscraper	1
B2	Fired Clay	46
B2	Gastropods	-
B2	Limestone Fragments	28
B2	Nutshell/Charcoal	-
B2	Pebbles	102
B2	Piece Esquillée	1

Table A-2 (continued)

B2	Saratoga Expanding Stem Projectile Point	1
B2	Siderite Concretion Fragments	181
B2	UID Prehistoric Pottery	1
B2	UID Worked Turtle Shell Fragments	8
B3	Biface Fragment	1
B3	Bone	494
B3	Bone Implement Fragment	3
B3	Bone Tool Production Debitage	1
B3	CaCO3 Concretions	40
B3	Cut Bone	2
B3	Debitage	95
B3	Fired Clay	50
B3	Flake Tool	2
B3	Gastropods	-
B3	Incised Bone Object	1
B3	Leptoxis Bead	3
B3	Limestone Fragments	11
B3	Modified Splinter, Pointed Implement	1
B3	Nutshell/Charcoal	-
B3	Pebbles	94
B3	Shaped, Pointed Implement	3
B3	Siderite Concretion Fragments	166
B3	UID Groundstone Tool Fragment	1
B3	UID Prehistoric Pottery	2
B3	UID Projectile Point Fragment	2
B3	UID Worked Turtle Shell Fragments	4
B4	Bifaces and Fragments	2
B4	Bone	591
B4	Bone Implement Fragment	3
B4	CaCO3 Concretions	30
B4	Crinoid Stem	1
B4	Cut Bone	2
B4	Debitage	143
B4	Drill	1
B4	Fired Clay	46
B4	Gastropods	-
B4	Graver	1
B4	Groundstone Implement Fragment	1
B4	Historic Ceramic	1
B4	Hollow/Reamed Antler Implement	1
B4	Leptoxis Bead	1
B4	Limestone Flake	2
B4	Limestone Fragments	18
B4	Nutshell/Charcoal	-
B4	Pebbles	155
B4	Saratoga Expanding Stem Projectile Point	1
B4	Shell Tempered, Plain Pottery	1
B4	Siderite Concretion Fragments	200
B4	UID Late Archaic Stemmed Projectile Point Fragment	1
B4	UID Prehistoric Pottery	8
B4	UID Projectile Point Fragment	1
B4	UID Shell Tempered Pottery	3

Table A-2 (continued)

B4	UID Worked Turtle Shell Fragments	8
B5	Bone	369
B5	Bone Flake	1
B5	Bone Implement Fragment	2
B5	CaCO3 Concretions	15
B5	Cut Nail	1
B5	Debitage	94
B5	Drill Tip	1
B5	Fired Clay	37
B5	Flake Tool	1
B5	Gastropods	-
B5	Limestone Flake	1
B5	Limestone Fragments	2
B5	Nutshell/Charcoal	-
B5	Pebbles	133
B5	Siderite Concretion Fragments	149
B5	UID Historic Ceramics	2
B5	UID Pointed Implement	3
B5	UID Prehistoric Pottery	5
B5	UID Shell Tempered Pottery	1
B5	UID Worked Turtle Shell Fragments	3
B6	Biface Fragment	2
B6	Bone	409
B6	Bone Implement Fragment	2
B6	CaCO3 Concretions	6
B6	Cut Bone	3
B6	Debitage	103
B6	Fired Clay	25
B6	Flake Tool	2
B6	Gastropods	-
B6	Groundstone Fragment	1
B6	Limestone Fragments	17
B6	Mortar Fragment	1
B6	Nutshell/Charcoal	-
B6	Pebbles	136
B6	Siderite Concretion Fragments	173
B6	Turtle Shell Implement Fragment	1
B6	UID Historic Ceramics	1
B6	UID Prehistoric Pottery	6
B6	Uniface Fragment	1
C1	Antler Tool Production Debitage	1
C1	Biface Fragments	2
C1	Bone	158
C1	Core	1
C1	Cut Bone	1
C1	Debitage	47
C1	Drill Fragment	1
C1	Fired Clay	5
C1	Flaked Bone	1
C1	Gastropods	-
C1	Leptoxis Bead	1
C1	Limestone Fragments	1

Table A-2 (continued)

C1	Nutshell/Charcoal	-
C1	Pebbles	56
C1	Siderite Concretion Fragments	63
C1	UID Shell Tempered Pottery	1
C1	UID Siderite Implement Fragment	1
C1	UID Worked Turtle Shell Fragments	2
C2	Bone	3
C2	CaCO3 Concretions	1
C2	Debitage	2
C2	Gastropods	1
C2	Nutshell/Charcoal	-
C2	Pebbles	31

Table A-3. Artifacts Recovered from Unit 2 Flotation.

Zone/Depth	Material	Count	Weight (g)
B2	Bone	143	15.1
B2	Bone Implement Fragment	2	1.4
B2	CaCO3 Concretions	44	2.3
B2	Debitage	11	1.5
B2	FCR/Unmodified Sandstone	-	1000
B2	Fired Clay	18	4.2
B2	Freshwater Mussel Shell (Bivalves)	-	2280
B2	Gastropods	-	54.8
B2	Limestone Fragments	4	2.3
B2	Nutshell/Charcoal	-	1.5
B2	Pebbles	24	30.8
B2	Siderite Concretion Fragments	60	18.3
B2	UID Prehistoric Pottery	3	0.6
B2	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	411.4
B2	Unsorted Heavy Fraction, x < 2 mm	-	366.5
B2	Unsorted Light Fraction	-	17.1
B3	Bone	123	14.4
B3	CaCO3 Concretions	46	2.7
B3	Debitage	12	1.3
B3	FCR/Unmodified Sandstone	-	640
B3	Fired Clay	20	2.4
B3	Freshwater Mussel Shell (Bivalves)	-	1580
B3	Gastropods	-	45.7
B3	Limestone Fragments	2	0.3
B3	Nutshell/Charcoal	-	1.5
B3	Pebbles	13	29.7
B3	Siderite Concretion Fragments	28	4.8
B3	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	260.3
B3	Unsorted Heavy Fraction, x < 2 mm	-	221.5
B3	Unsorted Light Fraction	-	15
B4	Bone	197	22.1
B4	CaCO3 Concretions	34	3.1
B4	Debitage	16	1.4
B4	FCR/Unmodified Sandstone	-	1020
B4	Fired Clay	20	6.4
B4	Freshwater Mussel Shell (Bivalves)	-	1900
B4	Gastropods	-	68.7
B4	Limestone Fragments	4	0.7
B4	Nutshell/Charcoal	-	1.8
B4	Pebbles	19	4.2
B4	Siderite Concretion Fragments	58	6.5
B4	UID Prehistoric Pottery	1	0.1
B4	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	345.8
B4	Unsorted Heavy Fraction, x < 2 mm	-	335.5
B4	Unsorted Light Fraction	-	10
B5	Bone	70	12.9
B5	CaCO3 Concretions	5	0.6
B5	Debitage	7	0.6
B5	FCR/Unmodified Sandstone	-	380
B5	Fired Clay	14	1.8
B5	Freshwater Mussel Shell (Bivalves)	-	800

Table A-3 (continued)

B5	Gastropods	-	38.9
B5	Limestone Fragments	2	0.8
B5	Nutshell/Charcoal	-	0.5
B5	Pebbles	17	10
B5	Siderite Concretion Fragments	36	8.8
B5	UID Prehistoric Pottery	3	0.2
B5	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	245.9
B5	Unsorted Heavy Fraction, x < 2 mm	-	167.6
B5	Unsorted Light Fraction	-	5.3
B6	Bone	104	21.1
B6	CaCO3 Concretions	27	1.7
B6	Debitage	12	1.6
B6	FCR/Unmodified Sandstone	-	460
B6	Fired Clay	12	2.4
B6	Freshwater Mussel Shell (Bivalves)	-	1120
B6	Gastropods	-	40.9
B6	Limestone Fragments	7	9.8
B6	Nutshell/Charcoal	-	1.1
B6	Pebbles	7	4.7
B6	Siderite Concretion Fragments	36	7.5
B6	UID Prehistoric Pottery	2	0.2
B6	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	250.2
B6	Unsorted Heavy Fraction, x < 2 mm	-	188.5
B6	Unsorted Light Fraction	-	7
C1	Bone	31	3.6
C1	CaCO3 Concretions	12	1.3
C1	FCR/Unmodified Sandstone	-	140
C1	Fired Clay	2	0.5
C1	Freshwater Mussel Shell (Bivalves)	-	140
C1	Gastropods	-	4.3
C1	Nutshell/Charcoal	-	0.1
C1	Pebbles	3	0.4
C1	Siderite Concretion Fragments	11	2.1
C1	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	59.7
C1	Unsorted Heavy Fraction, x < 2 mm	-	62.7
C1	Unsorted Light Fraction	-	5.6
C2	Bone	3	0.3
C2	CaCO3 Concretions	33	3.5
C2	Debitage	1	<0.1
C2	Freshwater Mussel Shell (Bivalves)	1	0.2
C2	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	30.8
C2	Unsorted Heavy Fraction, x < 2 mm	-	49.2
C2	Unsorted Light Fraction	-	0.5

Table A-4. Artifacts Recovered from Unit 1 Zones B and C, 1/4 and 1/2 inch mesh screens.

Zone/Depth	Material	Count	Weight (g)
Rodent Disturbance	Bone	16	6
Rodent Disturbance	Siderite Concretion Fragments	2	1.1
Rodent Disturbance	Freshwater Mussel Shell (Bivalves)	-	300
B1	Biface Fragment	1	1.6
B1	Bipointed Implement, Unidirectionally Forked/Pronged	1	0.2
B1	Bone	457	165.3
B1	CaCO3 Concretions	32	7.7
B1	Debitage	83	34.6
B1	FCR/Unmodified Sandstone	-	7550
B1	Fired Clay	63	29.3
B1	Freshwater Mussel Shell (Bivalves)	-	23280
B1	Gastropods	-	720
B1	Limestone Fragments	12	30.9
B1	Nutshell	-	8.1
B1	Pebbles	103	229.8
B1	Shell Tempered, Plain Pottery	1	1.6
B1	Siderite Concretion Fragments	183	84.2
B1	UID Antler Implement Fragment, Reamed	1	0.9
B1	UID Bone Implement Fragment	1	0.6
B1	UID Pointed Implement	2	0.8
B1	UID Pointed Implement, Concave Cross-section	1	0.5
B1	UID Spatulate	1	6.6
B2	Antler Tool Production Debitage	1	0.4
B2	Bipointed Implement, Unidirectionally Forked/Pronged	1	1.9
B2	Bone	494	169.2
B2	Bone Implement Fragment	4	4.7
B2	CaCO3 Concretions	37	7.5
B2	Charcoal/Nutshell	-	8.3
B2	Cut Bone	1	0.8
B2	Debitage	90	29.7
B2	FCR/Unmodified Sandstone	-	7740
B2	Fired Clay	64	24.1
B2	Freshwater Mussel Shell (Bivalves)	-	23950
B2	Gastropods	-	720
B2	Knife Fragment	1	4.4
B2	Leptoxis Beads	2	0.7
B2	Limestone Fragments	31	36.7
B2	Pebbles	101	187.4
B2	Sandstone Flake	1	1.3
B2	Siderite Concretion Fragments	163	60
B3	Biface Fragment	2	11.9
B3	Bone	588	208.5
B3	Bone Implement Fragment	2	5.7
B3	CaCO3 Concretions	35	7.2

Table A-4 (continued)

B3	Charcoal Sample	-	76.6
B3	Debitage	103	35
B3	Drill Fragments	2	17.7
B3	FCR/Unmodified Sandstone	-	14140
B3	Fired Clay	66	20.7
B3	Freshwater Mussel Shell (Bivalves)	-	28940
B3	Gastropods	-	830
B3	Groundstone Implement Fragment	1	1.9
B3	Limestone Flakes	2	0.9
B3	Limestone Fragments	13	22.4
B3	Nutshell/Charcoal	-	11.7
B3	Pebbles	98	184.6
B3	Perforated Fish Centrum	1	5
B3	Siderite Concretion Fragments	180	87.1
B3	Turtle Shell Implement Fragment	1	0.1
B3	UID Shell Tempered Pottery	1	0.3
B4	Antler Tool Production Debitage	2	1.9
B4	Biface Fragments	7	28.2
B4	Bone	412	170.3
B4	Bone Hooked Implement	1	0.1
B4	Bone Implement Fragment	3	2.1
B4	CaCO3 Concretions	58	10.8
B4	Core	1	114.3
B4	Debitage	90	27.7
B4	FCR/Unmodified Sandstone	-	14900
B4	Fired Clay	52	22.4
B4	Freshwater Mussel Shell (Bivalves)	-	22910
B4	Gastropods	-	730
B4	Limestone Fragments	15	64.3
B4	Modified Splinter, Pointed Implement	1	2.1
B4	Nutshell/Charcoal	-	8
B4	Pebbles	85	185
B4	Siderite Concretion Fragments	166	87
B4	Spatulate	1	1
B4	UID Turtle Shell Implement Fragments	5	2.6
B4	UID Chipped Stone Tool Fragment	1	0.7
B4	UID Pointed Implement	1	0.2
B4	UID Shell Tempered Pottery	1	0.4
B5	Biface Fragments	3	1.4
B5	Bipointed Implement, Unidirectionally Forked/Pronged	1	0.4
B5	Bone	473	188.6
B5	Bone Implement Fragment	3	1.7
B5	Bone Tool Production Debitage	1	0.9
B5	CaCO3 Concretions	83	18
B5	Cut Bone	1	0.4
B5	Debitage	134	56.5
B5	FCR/Unmodified Sandstone	-	9250
B5	Fired Clay	61	24.6
B5	Freshwater Mussel Shell (Bivalves)	-	25590
B5	Gastropods	-	650
B5	Leptoxis Beads	2	0.4
B5	Limestone Flakes	2	5

Table A-4 (continued)

B5	Limestone Fragments	26	37
B5	Modified Splinter, Pointed Implement	1	1.2
B5	Nutshell/Charcoal	-	43.9
B5	Pebbles	98	204.8
B5	Siderite Concretion Fragments	142	65
B5	UID Pointed Implements	3	2.3
B5	UID Prehistoric Pottery	1	0.1
B5	UID Turtle Shell Implement Fragments	2	1.5
B6	Biface Fragment	1	1.1
B6	Bone	507	161.3
B6	Bone Implement Fragments	2	0.7
B6	CaCO3 Concretions	131	34.3
B6	Ceramic Node or Foot	1	6.1
B6	Cut Bone	1	0.5
B6	Debitage	78	35.7
B6	Endscraper	1	6.5
B6	FCR/Unmodified Sandstone	-	6610
B6	Fired Clay	33	10.1
B6	Flake Tool	1	11.8
B6	Freshwater Mussel Shell (Bivalves)	-	21990
B6	Gastropods	-	520
B6	Limestone Fragments	41	44.9
B6	Nutshell/Charcoal	-	7.9
B6	Pebbles	98	200.7
B6	Perforated Bone Implement Fragment	1	0.3
B6	Saratoga Expanding Stem Hafted Scraper	1	5.7
B6	Saratoga Expanding Stem Projectile Point	1	8.2
B6	Siderite Concretion Fragments	126	73.4
B6	UID Projectile Point Fragment	1	1.1
B6	UID Turtle Shell Implement Fragments	1	2.1
C1	Bone	259	306.9
C1	CaCO3 Concretions	36	8.2
C1	Debitage	23	29.9
C1	FCR/Unmodified Sandstone	-	7360
C1	Fired Clay	6	3.2
C1	Freshwater Mussel Shell (Bivalves)	-	10660
C1	Gastropods	-	170
C1	Limestone Fragments	3	4
C1	Nutshell/Charcoal	-	1.7
C1	Pebbles	26	99.1
C1	Siderite Concretion Fragments	64	50.9
C1	UID Turtle Shell Implement Fragments	1	0.4
C2	Bone	8	1.5
C2	CaCO3 Concretions	44	11.3
C2	Degraded Manganese/Fired Clay	47	15.1
C2	FCR/Unmodified Sandstone	-	380
C2	Freshwater Mussel Shell (Bivalves)	-	100
C2	Gastropods	1	0.1
C2	Limestone Fragments	2	0.9
C2	Siderite Concretion Fragments	1	0.4

Table A-5. Artifacts Recovered from Unit 1 Flotation

Zone/ Depth	Material	Count	Weight (g)
B1	Bone	71	18.5
B1	CaCO3 Concretions	2	0.1
B1	Cut Bone	2	0.6
B1	Debitage	9	0.7
B1	FCR/Unmodified Sandstone	-	560
B1	Fired Clay	16	2
B1	Freshwater Mussel Shell (Bivalves)	-	880
B1	Gastropods	-	69.8
B1	Limestone Fragments	1	0.9
B1	Nutshell/Charcoal	-	0.6
B1	Pebbles	19	31
B1	Siderite Concretion Fragments	27	4.3
B1	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	233.1
B1	Unsorted Heavy Fraction, x < 2 mm	-	160.2
B1	Unsorted Light Fraction	-	7.8
B2	Antler Tool Production Debitage	1	0.8
B2	Bone	121	26.1
B2	CaCO3 Concretions	20	1.9
B2	Daub with Impressions	1	0.4
B2	Debitage	15	1.5
B2	FCR/Unmodified Sandstone	-	420
B2	Fired Clay	55	11.9
B2	Freshwater Mussel Shell (Bivalves)	-	2340
B2	Gastropods	-	77.8
B2	Limestone Fragments	3	1.6
B2	Nutshell/Charcoal	-	2.9
B2	Pebbles	11	13
B2	Siderite Concretion Fragments	21	5.2
B2	UID Prehistoric Pottery	2	0.8
B2	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	363.8
B2	Unsorted Heavy Fraction, x < 2 mm	-	168.4
B2	Unsorted Light Fraction	-	16
B3	Bone	206	43.3
B3	Bone Implement Fragment	1	0.4
B3	CaCO3 Concretions	62	6
B3	Charcoal	1	<0.1
B3	Debitage	22	3.8
B3	FCR/Unmodified Sandstone	-	912.6
B3	Fired Clay	33	6.1
B3	Freshwater Mussel Shell (Bivalves)	-	3814.6
B3	Gastropods	-	116.4
B3	Limestone Fragments	5	0.7
B3	Nutshell/Charcoal	-	2.9
B3	Pebbles	19	7.8
B3	Shell Tempered, Plain Pottery	1	4.9
B3	Siderite Concretion Fragments	37	7
B3	UID Prehistoric Pottery	1	0.2
B3	UID Worked Turtle Shell Fragments	2	0.7
B3	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	435.5
B3	Unsorted Heavy Fraction, x < 2 mm	-	353.1

Table A-5 (continued)

B3	Unsorted Light Fraction	-	20.8
B4	Biface Fragment	1	0.3
B4	Bone	94	14.6
B4	CaCO3 Concretions	160	15.6
B4	Debitage	33	13.6
B4	FCR/Unmodified Sandstone	-	540
B4	Fired Clay	20	3.5
B4	Freshwater Mussel Shell (Bivalves)	-	1940
B4	Gastropods	-	126.8
B4	Limestone Fragments	5	2.6
B4	Nutshell/Charcoal	-	2.2
B4	Pebbles	10	3.2
B4	Siderite Concretion Fragments	39	8.2
B4	UID Worked Turtle Shell Fragments	1	0.5
B4	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	248.4
B4	Unsorted Heavy Fraction, x < 2 mm	-	204.1
B4	Unsorted Light Fraction	-	7.3
B5	Bone	130	15.9
B5	CaCO3 Concretions	223	18.1
B5	Debitage	35	25.4
B5	FCR/Unmodified Sandstone	-	1600
B5	Fired Clay	13	2.3
B5	Freshwater Mussel Shell (Bivalves)	-	3600
B5	Gastropods	-	89.4
B5	Limestone Fragments	10	2
B5	Nutshell/Charcoal	-	6.5
B5	Pebbles	10	3
B5	Siderite Concretion Fragments	35	6.5
B5	UID Projectile Point Fragment	1	0.4
B5	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	420.8
B5	Unsorted Heavy Fraction, x < 2 mm	-	287.3
B5	Unsorted Light Fraction	-	31.8
B6	Biface Fragments	2	2
B6	Bone	110	18.9
B6	CaCO3 Concretions	111	9.9
B6	Charcoal/Nutshell	-	2
B6	Debitage	23	11.3
B6	FCR/Unmodified Sandstone	-	440
B6	Fired Clay	9	1.1
B6	Freshwater Mussel Shell (Bivalves)	-	2520
B6	Gastropods	-	52.2
B6	Limestone Fragments	5	2.1
B6	Nutshell/Charcoal	-	1.6
B6	Pebbles	15	12.3
B6	Siderite Concretion Fragments	31	9
B6	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	208.5
B6	Unsorted Heavy Fraction, x < 2 mm	-	184
B6	Unsorted Light Fraction	-	11.5
C1	Bone	74	7
C1	CaCO3 Concretions	66	6.5
C1	Debitage	5	2.5
C1	FCR/Unmodified Sandstone	-	560

Table A-5 (continued)

C1	Freshwater Mussel Shell (Bivalves)	-	880
C1	Gastropods	-	18.8
C1	Limestone Fragments	1	0.1
C1	Nutshell/Charcoal	-	0.2
C1	Pebbles	3	0.9
C1	Siderite Concretion Fragments	4	0.4
C1	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	84.4
C1	Unsorted Heavy Fraction, x < 2 mm	-	90.7
C1	Unsorted Light Fraction	-	3.9
C2	Bone	4	0.4
C2	CaCO3 Concretions	97	13.8
C2	FCR/Unmodified Sandstone	-	69.4
C2	Freshwater Mussel Shell (Bivalves)	-	5.6
C2	Nutshell	2	<0.1
C2	Unsorted Heavy Fraction, 2 mm < x < 4 mm	-	44.9
C2	Unsorted Heavy Fraction, x < 2 mm	-	74
C2	Unsorted Light Fraction	-	0.8

APPENDIX B

NON-SARATOGA CHIGGERVILLE HAFTED BIFACE MEASUREMENTS

Table B-1. Non-Saratoga Chiggerville Hafted Biface Measurements.

Cat #	Unit	Depth	Functional Type	Justice's Cluster	Justice's Type	Max Length	Max Width	Max Thickness
1	190R4	1.5	projectile point	Late Archaic Stemmed	UID	Broken	26	10
4.2	90R0	1.5	projectile point	Dalton	Dalton	Broken	20	8
8	110L4	2	projectile point	Kirk Corner Notched	Kirk Corner Notched	48	25	7
9	110L4	2	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
14	90L4	2	projectile point	Terminal Archaic Barbed	Wade	Broken	26	7
15	90L4	2	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	6
17	100 4	3	projectile point	Ledbetter	Ledbetter	Broken	Broken	11
18	80R4	2	projectile point	Ledbetter	UID	Broken	Broken	Broken
20	130R4	1	projectile point	Terminal Archaic Barbed	Buck Creek Barbed	Broken	32	Broken
23	70L8	9	projectile point	Matanzas	Matanzas Side Notched	47	18	10
24	170L4	1.5	projectile point	Kirk Corner Notched	Pine Tree Corner Notched	55	Broken	8
26	130R2	1.5	projectile point	Thebes	UID	Broken	34	9
27	130R2	1.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	8
31	100	2.5	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
32	100	2.5	projectile point	Etley	Etley	Broken	Broken	9
34	90L6	1	projectile point	Motley	Motley	Broken	30	Broken
38	90L2	1.5	projectile point	Etley	Etley	Broken	36	9
39	40L2	4.5	projectile point	Large Side Notched	Godar/Raddatz	Broken	23	8
43	80L2	3	hafted microperforator	Late Archaic Stemmed	UID	Broken	23	9
46	100	3.5	projectile point	Large Side Notched	Godar/Raddatz	Broken	23	8
50	80R4	2.5	projectile point	Large Side Notched	Godar/Raddatz	45	25	7
56	120L4	2.5	projectile point	Snyders	UID	61	37	9
59	130	2	projectile point	Benton	Benton Stemmed	Broken	30	9
60	130	2	projectile point	Terminal Archaic Barbed	UID	Broken	32	Broken
68	100L4	2	projectile point	Terminal Archaic Barbed	Wade	Broken	29	Broken
72	130L2	0.5	projectile point	Thebes	Thebes	Broken	Broken	Broken
77	80L4	0.5	projectile point	Ledbetter	Pickwick	66	32	9
79	80L4	0.5	projectile point	Rice Lobed	MacCorkle	Broken	38	8
81	80L4	0.5	projectile point	Large Side Notched	Godar/Raddatz	45	Broken	6
88	90R2	0.5	projectile point	Ledbetter	Ledbetter	89	39	9
93	140L6	4	projectile point	Lowe	Lowe Flared Base	Broken	24	8
95	130L8	1	projectile point	Benton	Elk River Stemmed	62	25	6
97	130L8	1	projectile point	Hardin Barbed	Hardin Barbed	48	Broken	7
104	General		projectile point	Wadlow	Wadlow	Broken	Broken	9
105	180R2	1	projectile point	Ledbetter	Pickwick	56	35	8
106	180R2	1	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	9
108	100L4	0.5	projectile point	UID	Provisional Type I	48	19	12

Table B-1 (continued)

113	90L6	7.5	hafted scraper	Kirk Corner Notched	Kirk Corner Notched	46	Broken	7
123	90R2	1	projectile point	Kirk Corner Notched	Pine Tree Corner Notched	Broken	Broken	Broken
128	150L8	0.5	projectile point	UID	Provisional Type I	55	24	8
131	150L8	0.5	projectile point	Kirk Corner Notched	UID	Broken	Broken	7
132	150L8	0.5	projectile point	Matanzas	Matanzas Side Notched	37	22	8
137	150L8	2	projectile point	Thebes	Calf Creek	Broken	35	Broken
140	100L4	0.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	66	30	8
141	140L4	2	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
146	150L8	1	projectile point	Late Archaic Stemmed	McWhinney	Broken	19	9
152	120L10	0.5	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
153	120L10	0.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	23	6
157	110L4	0.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	28	12
162	General		projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
166	100L6	1	projectile point	Benton	Elk River Stemmed	Broken	Broken	10
172	90	0.5	projectile point	Benton	Elk River Stemmed	Broken	27	9
175	130L4	2.5	projectile point	Late Archaic Stemmed	UID	Broken	21	7
176	130L4	4.5	projectile point	Dalton	Greenbrier	43	26	9
177	130L4	2.5	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken
179	130L4	2.5	projectile point	Dalton	Dalton	Broken	Broken	8
185	General		projectile point	Benton	Elk River Stemmed	Broken	Broken	Broken
186	General		projectile point	Benton	Benton Stemmed	68	31	7
189	General		projectile point	Motley	Motley	Broken	21	Broken
192	190R2	1.5	projectile point	Late Archaic Stemmed	McWhinney	83	29	11
196	General		projectile point	LW/MS Triangular	UID	Broken	26	8
198	General		projectile point	Turkey-Tail	UID	Broken	25	Broken
199	General		projectile point	Matanzas	Matanzas Side Notched	Broken	21	10
200	General		projectile point	Ledbetter	UID	Broken	29	Broken
206	90L8	0.5	projectile point	Benton	Elk River Stemmed	51	24	8
208	80R4	0.5	projectile point	Dickson	UID	Broken	Broken	Broken
209	80R2	3.5	projectile point	Dickson	UID	Broken	Broken	Broken
210	100	1.5	projectile point	Turkey-Tail	UID	Broken	23	6
212	100L4	0.5	projectile point	Late Archaic Stemmed	UID	57	21	9
213	100L4	0.5	projectile point	Kirk Corner Notched	UID	58	23	8
221	130L2	4.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
228	General		projectile point	Kirk Corner Notched	Pine Tree Corner Notched	40	Broken	6
232	General		projectile point	Kirk Corner Notched	Charleston Corner Notched	Broken	28	7
233	General		projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	7

Table B-1 (continued)

237	General		projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	7
240	60	0.5	projectile point	Benton	Elk River Stemmed	Broken	Broken	9
241	60	0.5	projectile point	Snyders	UID	41	32	8
245	70	0.5	projectile point	Benton	Benton Stemmed	Broken	29	8
248	70	0.5	projectile point	White Springs	White Springs	Broken	Broken	Broken
256	150R6	1	projectile point	Late Archaic Stemmed	McWhinney	70	25	12
262	70L4	1	projectile point	Dickson	Adena Stemmed	Broken	Broken	Broken
263	160R8	0.5	projectile point	Merom	Merom	32	19	8
264	160R8	0.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	31	10
270	60L4	0.5	projectile point	Ledbetter	Ledbetter	Broken	33	10
274	60L6	0.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	Broken
276	60L6	0.5	projectile point	Late Archaic Stemmed	Karnak	64	27	8
278	General		projectile point	Ledbetter	Pickwick	Broken	Broken	Broken
280	150R8	2.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	8
281	70R2	0.5	projectile point	Etley	Etley	69	27	9
284	70R2	0.5	projectile point	Late Archaic Stemmed	UID	Broken	27	10
295	150R8	1.5	projectile point	Late Archaic Stemmed	UID	76	Broken	9
296	150R8	1.5	projectile point	Kirk Corner Notched	Pine Tree Corner Notched	52	Broken	6
297	160R6	2	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
301	Surface	0	projectile point	Terminal Archaic Barbed	Buck Creek Barbed	Broken	Broken	Broken
305	70	4	projectile point	Benton	Elk River Stemmed	Broken	22	8
307	120R6	1	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	10
309	120R6	1	projectile point	Ledbetter	UID	Broken	Broken	Broken
310	200L4	4.5	projectile point	Matanzas	Matanzas Side Notched	43	Broken	6
312	70L6?	4.5	projectile point	Late Archaic Stemmed?	McWhinney?	Broken	21	Broken
313	70L6?	4.5	projectile point	Ledbetter	Ledbetter	65	33	10
314	70L6?	4.5	projectile point	Benton	UID	Broken	Broken	Broken
318	70L4	0.5	projectile point	Benton	Benton Stemmed	Broken	30	10
324	200R2	0.5	projectile point	Late Archaic Stemmed	UID	73	29	12
327	70R4	2.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	21	10
330	100R6	1	projectile point	Benton	Elk River Stemmed	Broken	27	8
334	70L2	2	projectile point	Terminal Archaic Barbed	UID	85	35	9
339	16R8	2.5	projectile point	Late Archaic Stemmed	UID	Broken	28	9
342	60L2	0.5	projectile point	Late Archaic Stemmed	UID	Broken	34	Broken
344	60L2	0.5	projectile point	Terminal Archaic Barbed	Buck Creek Barbed	58	40	7

Table B-1 (continued)

348	60L2	0.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
349	60L2	0.5	projectile point	Benton	Benton Stemmed	Broken	29	Broken
350	14R6	0.5	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
351	14R6	0.5	projectile point	Ledbetter	Ledbetter	Broken	30	10
365	70L6	0.5	projectile point	Ledbetter	UID	Broken	28	9
368	150R8	1	projectile point	Late Archaic Stemmed	UID	Broken	28	Broken
371	70L6	3.5	projectile point	Ledbetter	Ledbetter	79	40	12
377	120R4	0.5	projectile point	UID	Provisional Type I	Broken	26	8
385	16R8	2.5	drawknife	Benton	Elk River Stemmed	Broken	Broken	Broken
387	120R6	2	projectile point	Etley	Etley	57	23	9
395	110L4	0.5	projectile point	Dalton	Dalton	42	21	8
396	130L2	3	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
398	130L2	3	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
404	80	2	projectile point	Ledbetter	Ledbetter	Broken	34	10
407	70L4	1.5	projectile point	Stanly Stemmed	Stanly Stemmed	Broken	Broken	Broken
408	70L4	1.5	projectile point	Ledbetter	Pickwick	Broken	35	12
409	70L4	1.5	projectile point	Late Archaic Stemmed	UID	Broken	41	Broken
410	130L8	2	hafted scraper	Benton	Benton Stemmed	27	32	8
412	80	2	projectile point	Benton	Elk River Stemmed	Broken	Broken	8
418	100	1	projectile point	Late Archaic Stemmed	UID	Broken	22	9
420	120L4	3	projectile point	Late Archaic Stemmed	McWhinney	58	Broken	Broken
424	190L4	1	projectile point	Late Archaic Stemmed	UID	Broken	23	9
428	70L6	5	projectile point	Ledbetter	Ledbetter	Broken	35	10
430	70	1	projectile point	UID	Provisional Type I	Broken	22	8
431	180R6	0.5	projectile point	Matanzas	Matanzas Side Notched	Broken	Broken	Broken
433	110L4	2	projectile point	Kirk Corner Notched	Charleston Corner Notched	Broken	Broken	8
435	110L4	2	projectile point	Motley	Motley	42	24	8
440	100	0.5	projectile point	Matanzas	Matanzas Side Notched	58	24	7
442	130R2	2	projectile point	Large Side Notched	Godar/Raddatz	44	Broken	6
444	130	3	hafted scraper	Large Side Notched	Godar/Raddatz	32	26	6
447	130L4	0.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	23	6
458	70	2.5	projectile point	Matanzas	Matanzas Side Notched	Broken	Broken	8
460	160L4	0.5	projectile point	Merom	Merom	Broken	16	8
466	140R6	2.5	hafted scraper	Motley	Motley	40	27	11
475	70L2	3.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	22	10
476	100R2	2	projectile point	Late Archaic Stemmed	UID	63	28	9
481	60L2	3	projectile point	Benton	Elk River Stemmed	58	22	8
482	100R2	4.5	projectile point	Benton	Elk River Stemmed	95	26	13
486	90R4	1	projectile point	Ledbetter	Ledbetter	57	28	10

Table B-1 (continued)

489	160R6	2.5	projectile point	Benton	Elk River Stemmed	Broken	20	6
491	180L4	2.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	8
497	90R4	0.5	projectile point	Late Archaic Stemmed	UID	46	21	7
498	90L2	0.5	projectile point	UID	Provisional Type I	53	21	8
505	120L8	2	projectile point	Benton	Elk River Stemmed	Broken	23	10
521	100L4	2	projectile point	Benton	Elk River Stemmed	Broken	Broken	Broken
523	70R2	1	projectile point	Large Side Notched	Godar/Raddatz	42	23	9
524	100R4	2.5	projectile point	Ledbetter	Ledbetter	57	33	8
529	70	2	projectile point	Benton	Elk River Stemmed	61	26	7
534	120L8	2.5	projectile point	Large Side Notched	Godar/Raddatz	42	Broken	8
535	80	2	projectile point	Kirk Corner Notched	Charleston Corner Notched	Broken	30	Broken
538	140L4	0.5	projectile point	Benton	Benton Stemmed	Broken	29	Broken
541	100L2	3	projectile point	Benton	Elk River Stemmed	71	22	9
560	70L4	2	projectile point	Large Side Notched	Godar/Raddatz	56	Broken	8
562	80	0.5	projectile point	LW/MS Triangular	Madison	28	16	6
563	80	0.5	projectile point	Dickson	Dickson Contracting Stemmed	72	25	10
564	120L4	3	projectile point	Thebes	Thebes	Broken	28	7
576	General		projectile point	Late Archaic Stemmed	UID	Broken	Broken	10
578	120L4	4	projectile point	UID	Provisional Type I	Broken	Broken	Broken
581	12		projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken
584	90L2	3	projectile point	Merom	Merom	Broken	Broken	6
590	100L2	0.5	hafted scraper	Terminal Archaic Barbed	UID	43	22	6
592	200L2	3	projectile point	Late Archaic Stemmed	McWhinney	66	21	10
596	Surface	0	projectile point	Eva	Eva	Broken	Broken	7
598	Surface	0	projectile point	Ledbetter	Pickwick	Broken	Broken	11
601	160L8	1.1	projectile point	Etley	Etley	55	25	8
602	100L8	1.6	projectile point	Benton	Elk River Stemmed	Broken	28	9
603	100L8	1.6	projectile point	Etley	Etley	Broken	30	8
604	120L4	2.9	projectile point	Benton	Elk River Stemmed	Broken	24	8
606	80L6	1	projectile point	Thebes	Lost Lake	Broken	39	8
607	80L6	2.5	projectile point	Benton	Elk River Stemmed	79	24	11
618	200R2	1.5	projectile point	Late Archaic Stemmed	McWhinney	Broken	Broken	Broken
620	100L6	2	projectile point	Thebes	Calf Creek	61	Broken	8
622	140L6	1	projectile point	Terminal Archaic Barbed	Wade	Broken	Broken	9
624	140L6	1	projectile point	Late Archaic Stemmed	UID	Broken	33	8
640	180R6	1	projectile point	Ledbetter	Ledbetter	43	31	12

Table B-1 (continued)

642	130L6	2	projectile point	Benton	Elk River Stemmed	Broken	Broken	Broken
643	130L6	2	projectile point	Brewerton	Brewerton Corner Notched	44	24	8
648	70R6	2	projectile point	Late Archaic Stemmed	UID	Broken	27	11
657	70L8	6	projectile point	Matanzas	Matanzas Side Notched	Broken	24	8
658	60L2	2.5	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	25	Broken
660	60L4		projectile point	Ledbetter	Ledbetter	Broken	33	Broken
664	70R6	1	projectile point	Benton	Elk River Stemmed	Broken	Broken	Broken
666	150L8	2	projectile point	Thebes	Lost Lake	60	29	6
668	60	2.5	projectile point	Rice Lobed	MacCorkle	65	Broken	7
671	70R3	1	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
672	140R8	0.5	projectile point	Late Archaic Stemmed	UID	Broken	26	11
675	General		projectile point	Late Archaic Stemmed	McWhinney	61	23	8
678	General		projectile point	Etley	Etley	Broken	26	8
680	60R4	1	projectile point	Late Archaic Stemmed	UID	Broken	28	10
682	60L6	1	projectile point	Kirk Corner Notched	Kirk Corner Notched	Broken	Broken	Broken
684	70L8	5	projectile point	Ledbetter	Pickwick	Broken	31	11
687	60R6	2.5	projectile point	Motley	Motley	34	19	Broken
689	200R4	0.5	projectile point	Late Archaic Stemmed	UID	Broken	21	12
694	110R8	3	projectile point	Ledbetter	Ledbetter	73	33	12
696	180R6	0.5	projectile point	Late Archaic Stemmed	UID	45	21	11
701	100L6	2	projectile point	Late Archaic Stemmed	UID	Broken	Broken	Broken
705	140L6	0.5	projectile point	Etley	Etley	71	22	7
706	70R6	0.5	projectile point	Ledbetter	Ledbetter	47	25	9
707	70R6	0.5	projectile point	Ledbetter	Ledbetter	Broken	Broken	10
711	60L2	1	hafted scraper	Benton	Benton Stemmed	Broken	28	9
714.1	Test Pit		projectile point	Terminal Archaic Barbed	Wade	70	29	7
714.11	Test Pit		projectile point	Matanzas	Matanzas Side Notched	40	25	7
714.12	Test Pit		projectile point	Matanzas	Matanzas Side Notched	36	22	7
714.2	Test Pit		projectile point	Large Side Notched	Faulkner	Broken	20	7
714.4	Test Pit		projectile point	Dickson	Cypress Stemmed	66	31	9
714.5	Test Pit		projectile point	Benton	Elk River Stemmed	62	27	8
714.7	Test Pit		projectile point	Matanzas	Matanzas Side Notched	Broken	24	Broken
736	130R4	1	projectile point	LW/MS Triangular	Madison	Broken	Broken	6
742	80R2	1.5	hafted drill	Large Side Notched	Godar/Raddatz	Broken	18	8
762	90L8	0.5	projectile point	LW/MS Triangular	Hamilton Incurvate	Broken	20	6
775	160R6	0.5	hafted drill	Matanzas	Matanzas Side Notched	Broken	17	Broken
783	Surface	0	hafted drill	Kirk Corner Notched	Kirk Corner Notched	57	21	7
801	70L6	5	hafted drill	Ledbetter	UID	Broken	34	9

Table B-1 (continued)

856	70R3	1	hafted drill	Late Archaic Stemmed	UID	Broken	23	8
969	190L2	0.5	hafted scraper	Late Archaic Stemmed	UID	30	Broken	Broken
992	110R6	1	projectile point	Late Archaic Stemmed	UID	Broken	30	Broken
1018	13L2	3.5	hafted scraper	Late Archaic Stemmed	McWhinney	Broken	22	9
1101	140R8	2	hafted scraper	Late Archaic Stemmed	UID	49	25	7
1111	60L6	0.5	hafted scraper	Late Archaic Stemmed	UID	66	23	9
1115	100R8	2.5	hafted scraper	Terminal Archaic Barbed	Wade	32	24	10
1120	140R8	0.5	hafted scraper	Late Archaic Stemmed	UID	44	33	11
1124	60R4	1.5	hafted scraper	White Springs	Sykes	35	30	9
1125	200R4	0.5	hafted scraper	Motley	Motley	55	27	Broken
1127	General		hafted scraper	Brewerton	Brewerton Corner Notched	38	30	8
1135	70L4	0.5	hafted scraper	Terminal Archaic Barbed	Wade	35	27	7
1136	100L2	0.5	hafted scraper	Brewerton	Brewerton Corner Notched	42	29	9
1140	General		hafted scraper	Late Archaic Stemmed	Karnak	53	25	8
1141	70L6	3.5	projectile point	Ledbetter	Ledbetter	Broken	28	11
1150	190	2	hafted scraper	Late Archaic Stemmed	UID	42	29	10
1151	100L4	0.5	projectile point	Late Archaic Stemmed	UID	Broken	Broken	9
1153	110L4	3.5	hafted scraper	Etley	Etley	44	23	8
1157	190R4	3	hafted scraper	Late Archaic Stemmed	UID	29	27	9
1171	100L4	2.6	hafted scraper	Late Archaic Stemmed	McWhinney	51	24	9
1172	General		hafted scraper	Benton	Benton Stemmed	39	32	8
1174	110L4	2	hafted scraper	Late Archaic Stemmed	UID	41	24	6
1179	100	2.5	hafted scraper	Late Archaic Stemmed	UID	Broken	Broken	11
1181	90L6	1	hafted drill	Ledbetter	UID	Broken	30	10
1182	190L4	1	hafted scraper	Large Side Notched	Godar/Raddatz	52	26	9
1183	180	1.5	hafted scraper	Brewerton	Brewerton Corner Notched	37	30	8
1192	General		hafted scraper	Late Archaic Stemmed	UID	32	24	9
1357	70R8	0.5	hafted scraper	Late Archaic Stemmed	UID	Broken	Broken	Broken
1358	70L8	2	projectile point	LW/MS Triangular	Madison	Broken	Broken	8
1465	70L6	0.5	projectile point	Merom	Merom	35	15	6
1555	General		hafted scraper	Late Archaic Stemmed	UID	35	21	8
1803	80L4	2	projectile point	Benton	Benton Stemmed	69	33	7
1804	90R2	1	projectile point	Etley	Etley	62	33	9
1806	90R2	1	projectile point	Terminal Archaic Barbed	Buck Creek Barbed	Broken	31	Broken
1808	190L4	2	projectile point	Etley	Etley	77	31	8
1809	70L4	0.5	projectile point	Kirk Stemmed	Kirk Stemmed	92	31	8

Table B-1 (continued)

1810	100	2	projectile point	Motley	Motley	77	30	12
1811	90L2	2	projectile point	Motley	Motley	76	32	10
1812	80	0.5	projectile point	Dickson	Cypress Stemmed	Broken	31	8
1814	General		hafted scraper	Matanzas	Matanzas Side Notched	29	22	8
1815	General		hafted scraper	Matanzas	Matanzas Side Notched	30	24	6
1819	General		hafted scraper	Large Side Notched	Godar/Raddatz	42	30	8
1850	General		hafted scraper	Late Archaic Stemmed	UID	33	26	10

APPENDIX C

NON-LARGE SIDE NOTCHED BAKER HAFTED BIFACE MEASUREMENTS

Table C-1. Non-Large Side Notched Baker Hafted Biface Measurements.

Cat. #	Functional type	Justice's Cluster	Justice's Type	Max Length	Max Width	Max Thickness
93	hafted scraper	Kirk	Kirk Corner Notched	31	28	7
98	projectile point	Kirk	Kirk Corner Notched	Broken	25	7
104	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	Broken
131	projectile point	Late Archaic Stemmed	UID	Broken	20	8
207	projectile point	Kirk	UID	37	Broken	6
246	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	Broken
320	projectile point	Clovis	Clovis	Broken	Broken	Broken
406	projectile point	Benton	Benton Stemmed	Broken	29	8
429	projectile point	Saratoga	Saratoga Expanding Stem	Broken	Broken	Broken
441	hafted scraper	Kirk	Kirk Corner Notched	Broken	Broken	Broken
497	projectile point	Thebes	Lost Lake	Broken	Broken	Broken
500	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	Broken
545	projectile point	Kirk Stemmed	Kirk Stemmed	Broken	24	8
554	projectile point	Kirk	Kirk Corner Notched	46	Broken	7
616	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	Broken
622	projectile point	Late Archaic Stemmed	Jakie Stemmed	44	19	8
626	projectile point	Thebes	Thebes	Broken	35	8
627	projectile point	Thebes	Thebes	Broken	Broken	Broken
639	projectile point	Thebes	Thebes	Broken	Broken	Broken
654	projectile point	Late Archaic Stemmed	Karnak	Broken	23	Broken
709	projectile point	Snyders	UID	Broken	Broken	Broken
742	projectile point	Susquehanna	Perkiomen	Broken	32	6
769	projectile point	Kirk Stemmed	Kirk Stemmed	Broken	28	7
820	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	Broken
837	projectile point	Thebes	Thebes	Broken	Broken	Broken
869	projectile point	Late Archaic Stemmed	Jakie Stemmed	47	21	8
873	projectile point	Thebes	Thebes	Broken	Broken	Broken
909	projectile point	Matanzas	Matanzas Side Notched	Broken	22	7
1012	projectile point	Kirk	Kirk Corner Notched	48	23	7
1015	hafted drill	Turkey-tail	UID	Broken	24	6
1019	projectile point	Kirk	Kirk Corner Notched	Broken	Broken	6
1020	projectile point	Kirk	Kirk Corner Notched	Broken	22	6
1028	projectile point	Saratoga	Saratoga Expanding Stem	55	26	7

APPENDIX D

LARGE SIDE NOTCHED CLUSTER HAFTED BIFACE MEASUREMENTS - BAKER

Table D-1. Large Side Notched Cluster Hafted Biface Measurements from Baker, Part I

Cat. #	Functional type	Justice's Cluster	Justice's Type	Max Length	Blade Length	Max Length - Blade Length	Max Width	Max Thickness	Max Thick of Blade	Width Blade Midsection
101	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
107	hafted scraper	Large Side Notched	Godar/Raddatz	39	28	11	30	7	7	29
110	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
111	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
122	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	29	Broken	Broken	Broken
123	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
124	hafted scraper	Large Side Notched	Godar/Raddatz	25	12	13	26	7	7	25
127	projectile point	Large Side Notched	Godar/Raddatz	51	37	14	27	7	7	22
128	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
133	hafted scraper	Large Side Notched	Godar/Raddatz	41	27	14	26	7	7	24
135	projectile point	Large Side Notched	Godar/Raddatz	49	38	11	25	6	6	19
140	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
144	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	29	7	7	Broken
148	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	6	Broken
149	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
151	projectile point	Large Side Notched	Godar/Raddatz	Broken	42	Broken	Broken	Broken	5	27
153	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
154	projectile point	Large Side Notched	Godar/Raddatz	41	28	13	28	7	7	22
159	projectile point	Large Side Notched	Godar/Raddatz	46	Broken	Broken	Broken	6	6	Broken
180	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
190	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	28	Broken	Broken	Broken
191	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
194	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
196	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
201	projectile point	Large Side Notched	Godar/Raddatz	54	42	12	30	8	8	26
203	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
206	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	6	6	Broken
208	projectile point	Large Side Notched	Godar/Raddatz	52	Broken	Broken	31	6	6	Broken
213	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
214	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	29	8	8	Broken
222	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
223	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
228	hafted drill	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	30	6	Broken	Broken
236	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
245	hafted scraper	Large Side Notched	Godar/Raddatz	32	22	10	24	5	5	20
252	projectile point	Large Side Notched	Godar/Raddatz	51	40	11	26	9	9	20
257	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	8	8	Broken
268	hafted scraper	Large Side Notched	Godar/Raddatz	22	9	13	30	7	7	27
269	projectile point	Large Side Notched	UID	Broken	Broken	Broken	29	8	7	Broken
271	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	7	7	Broken
279	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	19	Broken	29	7	7	28

Table D-1 (continued)

280	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	28	Broken	Broken	Broken
285	projectile point	Large Side Notched	UID	Broken	Broken	Broken	Broken	Broken	Broken	Broken
291	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
293	projectile point	Large Side Notched	Godar/Raddatz	40	30	10	23	7	7	21
302	hafted scraper	Large Side Notched	Godar/Raddatz	35	20	15	29	8	8	28
308	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	31	Broken	Broken	Broken	5	27
314	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	7	7	Broken
324	projectile point	Large Side Notched	UID	Broken	Broken	Broken	28	7	7	Broken
330	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
332	projectile point	Large Side Notched	Godar/Raddatz	36	23	13	28	8	8	24
347	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
348	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
351	hafted scraper	Large Side Notched	Godar/Raddatz	23	7	16	27	7	7	26
375	hafted scraper	Large Side Notched	Godar/Raddatz	22	9	13	27	7	7	21
378	projectile point	Large Side Notched	UID	Broken	Broken	Broken	23	7	7	Broken
400	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
405	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	25	6	6	Broken
409	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	30	Broken	Broken	9	9	25
422	hafted scraper	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	33	8	8	Broken
423	projectile point	Large Side Notched	Godar/Raddatz	49	Broken	Broken	25	8	7	Broken
433	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
440	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
444	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
452	hafted scraper	Large Side Notched	Godar/Raddatz	22	11	11	26	7	7	25
457	hafted microperforator	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	22	7	7	Broken
464	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	30	6	6	Broken
466	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
481	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
514	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
516	projectile point	Large Side Notched	Godar/Raddatz	43	28	15	27	7	7	15
526	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
530	hafted scraper	Large Side Notched	Godar/Raddatz	27	16	11	28	6	6	24
531	projectile point	Large Side Notched	Godar/ Raddatz	50	40	10	25	6	6	21
533	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	22	7	7	Broken
537	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	33	Broken	Broken	8	8	24
543	projectile point	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
547	projectile point	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
557	projectile point	Large Side Notched	Godar/Raddatz	39	30	9	25	6	6	17
558	projectile point	Large Side Notched	Godar/Raddatz	38	25	13	23	7	7	19
559	projectile point	Large Side Notched	Godar/Raddatz	37	27	10	25	7	7	21
560	hafted scraper	Large Side Notched	Godar/Raddatz	19	7	12	28	6	6	27
565	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken

Table D-1 (continued)

577	hafted scraper	Large Side Notched	Godar/Raddatz	25	9	16	31	8	8	24
579	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
584	hafted drill	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	7	Broken	Broken
587	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	27	Broken	Broken	Broken
590	projectile point	Large Side Notched	Godar/Raddatz	Broken	33	Broken	Broken	7	7	20
606	hafted scraper	Large Side Notched	Godar/Raddatz	31	16	15	29	8	8	25
607	projectile point	Large Side Notched	Godar/Raddatz	51	Broken	Broken	29	6	6	Broken
610	hafted scraper	Large Side Notched	Godar/Raddatz	26	12	14	30	9	9	27
612	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	25	7	7	Broken
613	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	25	7	7	Broken
618	projectile point	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
619	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	28	7	7	Broken
625	hafted scraper	Large Side Notched	Godar/Raddatz	32	Broken	Broken	Broken	5	5	Broken
646	hafted scraper	Large Side Notched	Godar/Raddatz	27	15	12	27	6	6	26
649	hafted scraper	Large Side Notched	Godar/Raddatz	33	20	13	29	6	6	26
655	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
661	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	6	6	Broken
663	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
674	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
687	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
691	hafted scraper	Large Side Notched	Godar/Raddatz	22	13	9	26	6	6	26
697	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
702	projectile point	Large Side Notched	Godar/ Raddatz	36	23	13	24	7	7	18
708	projectile point	Large Side Notched	Godar/Raddatz	33	19	14	24	7	7	21
711	hafted scraper	Large Side Notched	Godar/Raddatz	18	5	13	26	7	7	23
719	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
720	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
723	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
724	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	7	7	Broken
728	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
731	projectile point	Large Side Notched	Godar/Raddatz	49	38	11	22	9	9	18
735	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
743	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
748	hafted scraper	Large Side Notched	Godar/Raddatz	34	Broken	Broken	28	6	6	Broken
752	hafted scraper	Large Side Notched	Godar/Raddatz	39	23	16	31	7	7	23
753	projectile point	Large Side Notched	Godar/Raddatz	44	Broken	Broken	27	7	7	Broken
763	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
773	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
774	projectile point	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
777	hafted scraper	Large Side Notched	Godar/Raddatz	30	Broken	Broken	Broken	Broken	Broken	Broken
781	hafted scraper	Large Side Notched	Godar/Raddatz	32	20	12	30	5	5	27
783	hafted scraper	Large Side Notched	Godar/Raddatz	36	Broken	Broken	27	8	8	Broken
784	hafted scraper	Large Side Notched	Godar/Raddatz	21	5	16	29	7	7	20

Table D-1 (continued)

787	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
788	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
790	hafted scraper	Large Side Notched	Godar/Raddatz	22	13	9	Broken	6	6	24
798	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
801	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
802	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
809	projectile point	Large Side Notched	UID	Broken	Broken	Broken	Broken	Broken	Broken	Broken
815	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	26	Broken	Broken	7	7	25
816	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	27	6	6	Broken
818	projectile point	Large Side Notched	Godar/Raddatz	41	29	12	27	7	7	22
824	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
831	projectile point	Large Side Notched	Godar/Raddatz	39	Broken	Broken	28	6	6	Broken
834	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	23	Broken	Broken	9	9	26
835	hafted scraper	Large Side Notched	Godar/Raddatz	29	14	15	25	7	7	22
839	hafted scraper	Large Side Notched	Godar/Raddatz	32	Broken	Broken	Broken	6	6	Broken
847	hafted scraper	Large Side Notched	Godar/Raddatz	40	29	11	26	9	9	25
850	hafted scraper	Large Side Notched	Godar/Raddatz	23	11	12	29	7	7	28
855	hafted scraper	Large Side Notched	Godar/Raddatz	32	20	12	27	7	7	26
857	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
859	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
887	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
888	hafted scraper	Large Side Notched	Godar/ Raddatz	34	Broken	Broken	Broken	6	6	Broken
895	hafted scraper	Large Side Notched	Godar/Raddatz	22	10	12	29	6	6	24
897	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	7	Broken
898	projectile point	Large Side Notched	UID	Broken	Broken	Broken	Broken	6	6	Broken
899	projectile point	Large Side Notched	Godar/Raddatz	51	Broken	Broken	Broken	8	8	Broken
906	hafted drill	Large Side Notched	Godar/ Raddatz	Broken	Broken	Broken	30	7	7	Broken
907	hafted scraper	Large Side Notched	Godar/ Raddatz	30	20	10	Broken	7	7	24
916	projectile point	Large Side Notched	Godar/Raddatz	38	27	11	26	7	7	18
928	projectile point	Large Side Notched	Godar/Raddatz	37	23	14	27	6	6	20
945	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
951	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
955	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	25	8	8	Broken
963	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
965	projectile point	Large Side Notched	Godar/Raddatz	36	24	12	Broken	6	6	19
974	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
977	hafted drill	Large Side Notched	Godar/Raddatz	41	33	8	24	8	8	13
983	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
985	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	8	8	Broken
993	projectile point	Large Side Notched	Godar/Raddatz	Broken	42	Broken	Broken	7	7	23
994	hafted scraper	Large Side Notched	Godar/Raddatz	Broken	23	Broken	31	6	6	30
997	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
1000	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken

Table D-1 (continued)

1002	projectile point	Large Side Notched	Godar/ Raddatz	38	25	13	29	8	8	17
1004	hafted scraper	Large Side Notched	Godar/Raddatz	43	31	12	29	7	7	26
1008	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	7	7	Broken
1030	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
1035	hafted scraper	Large Side Notched	Godar/Raddatz	27	16	11	28	6	6	27
1040	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken
1042	projectile point	Large Side Notched	Godar/Raddatz	50	40	10	27	7	7	Broken
1071	projectile point	Large Side Notched	Godar/Raddatz	Broken	Broken	Broken	Broken	Broken	Broken	Broken

Table D-2. Large Side Notched Cluster Hafted Biface Measurements from Baker, Part II

Thick Blade Midsection	Width 1/3 Blade Length	Thick 1/3 Blade Length	Width 2/3 Blade Length	Thick 2/3 Blade Length	Max Width of Haft Element	Min Width of Haft Element	Min Notch Width	Max Thick of Haft Element	Max Thick of Notches	Base Width
Broken	Broken	Broken	Broken	Broken	22	12	12	7	7	21
6	28	5	30	7	26	17	17	6	6	24
Broken	Broken	Broken	Broken	Broken	Broken	19	19	Broken	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	29	Broken	Broken	Broken	Broken	27
Broken	Broken	Broken	Broken	Broken	35	Broken	Broken	Broken	Broken	34
7	24	7	26	7	24	15	15	7	7	23
6	17	6	24	6	27	18	18	6	6	26
Broken	Broken	Broken	Broken	Broken	26	19	19	6	6	25
6	22	6	24	6	20	16	16	6	6	14
5	14	4	22	6	25	18	18	6	6	25
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	29	18	18	6	6	29
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	31	Broken	Broken	Broken	Broken	29
5	23	4	30	5	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	27	21	21	6	6	27
7	17	6	25	7	28	19	19	6	6	26
Broken	Broken	Broken	Broken	Broken	25	15	15	5	5	23
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	23	17	17	6	6	23
Broken	Broken	Broken	Broken	Broken	Broken	20	20	6	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	26	18	18	Broken	Broken	25
7	22	8	29	6	Broken	18	18	6	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	29	20	20	5	5	27
Broken	Broken	Broken	Broken	Broken	31	19	19	6	6	27
Broken	Broken	Broken	Broken	Broken	26	17	17	5	5	26
Broken	Broken	Broken	Broken	Broken	Broken	19	19	6	6	Broken
Broken	Broken	Broken	Broken	Broken	29	20	20	5	5	28
Broken	Broken	Broken	Broken	Broken	Broken	19	19	6	6	Broken
Broken	Broken	Broken	Broken	Broken	30	24	24	6	6	28
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
5	17	5	22	5	22	15	15	5	5	20
9	17	7	22	9	26	17	17	7	7	26
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	7	Broken
7	20	7	29	7	30	17	17	6	6	28
Broken	Broken	Broken	Broken	Broken	29	Broken	23	8	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	17	17	6	6	Broken
7	27	7	28	7	Broken	17	17	7	7	Broken

Table D-2 (continued)

Broken	Broken	Broken	Broken	Broken	28	19	19	6	6	25
Broken	Broken	Broken	Broken	Broken	Broken	21	21	Broken	5	Broken
Broken	Broken	Broken	Broken	Broken	Broken	15	15	6	6	Broken
6	20	6	22	7	18	14	16	5	5	14
7	28	7	28	8	25	16	16	7	7	23
5	26	5	29	5	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	17	7	7	Broken
Broken	Broken	Broken	Broken	Broken	26	20	20	7	7	24
Broken	Broken	Broken	Broken	Broken	Broken	19	19	Broken	Broken	Broken
7	19	6	26	8	27	20	20	7	7	26
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	25	17	17	6	6	24
7	24	7	26	7	27	19	19	7	7	Broken
7	20	6	22	7	27	20	20	6	6	26
Broken	Broken	Broken	Broken	Broken	23	19	19	5	5	22
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	25	19	19	6	6	24
8	21	8	27	9	Broken	17	17	7	7	Broken
Broken	Broken	Broken	Broken	Broken	31	19	19	7	7	30
Broken	Broken	Broken	Broken	Broken	25	17	17	8	8	N/A
Broken	Broken	Broken	Broken	Broken	Broken	15	15	6	6	Broken
Broken	Broken	Broken	Broken	Broken	29	Broken	Broken	Broken	Broken	28
Broken	Broken	Broken	Broken	Broken	25	19	19	5	5	25
7	25	7	26	7	24	18	18	6	6	23
Broken	Broken	Broken	Broken	Broken	Broken	15	15	5	5	20
Broken	Broken	Broken	Broken	Broken	30	19	19	6	6	28
Broken	Broken	Broken	Broken	Broken	27	18	18	6	6	27
Broken	Broken	Broken	Broken	Broken	26	18	18	6	6	24
Broken	Broken	Broken	Broken	Broken	23	Broken	Broken	6	6	22
6	11	5	19	6	27	18	18	7	7	25
Broken	Broken	Broken	Broken	Broken	22	15	15	5	5	22
6	23	7	25	6	28	19	19	5	5	27
6	17	5	23	5	25	16	16	5	5	24
Broken	Broken	Broken	Broken	Broken	22	18	18	6	6	22
7	24	6	22	7	Broken	18	18	7	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
6	13	6	20	5	25	17	17	5	5	24
6	15	6	22	7	23	15	15	7	7	20
6	17	6	24	6	Broken	18	18	5	5	Broken
6	25	5	28	6	25	19	19	6	6	20
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
8	22	7	27	7	31	20	20	7	7	30

Table D-2 (continued)

Broken	Broken	Broken	Broken	Broken	26	Broken	Broken	Broken	Broken	25
Broken	Broken	Broken	Broken	Broken	Broken	21	21	7	7	Broken
Broken	Broken	Broken	Broken	Broken	27	19	19	7	7	25
7	18	6	21	6	Broken	16	16	5	5	Broken
8	24	8	26	8	29	18	18	6	6	28
Broken	Broken	Broken	Broken	Broken	29	19	19	6	6	27
8	24	7	28	9	30	21	21	9	9	26
Broken	Broken	Broken	Broken	Broken	25	18	18	6	6	23
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	6	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	25	20	20	6	6	23
Broken	Broken	Broken	Broken	Broken	27	20	20	5	5	Broken
6	25	6	26	6	26	17	17	6	6	22
6	25	6	27	6	29	19	19	6	6	28
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	18	6	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	17	17	8	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
6	24	6	26	5	24	20	20	5	5	22
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
6	15	6	20	7	24	19	19	6	6	22
7	17	6	23	7	24	16	16	7	7	22
7	16	4	26	7	26	19	19	6	6	24
Broken	Broken	Broken	Broken	Broken	Broken	18	18	6	6	Broken
Broken	Broken	Broken	Broken	Broken	29	17	17	5	5	28
Broken	Broken	Broken	Broken	Broken	29	20	20	8	8	25
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	6	6	Broken
8	16	8	20	9	22	17	17	8	8	15
Broken	Broken	Broken	Broken	Broken	24	17	17	6	6	24
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	28	18	18	6	6	Broken
7	22	7	25	7	31	20	20	7	7	28
Broken	Broken	Broken	Broken	Broken	27	19	19	6	6	25
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	31	21	21	6	6	30
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	7	Broken
Broken	Broken	Broken	Broken	Broken	28	21	21	6	6	28
5	25	5	28	5	30	20	20	4	4	29
Broken	Broken	Broken	Broken	Broken	27	17	17	7	7	24
7	14	6	23	7	29	17	17	7	7	27
Broken	Broken	Broken	Broken	Broken	29	Broken	Broken	Broken	Broken	26

Table D-2 (continued)

Broken	Broken	Broken	Broken	Broken	23	18	18	7	7	22
6	23	6	24	6	Broken	18	18	5	5	Broken
Broken	Broken	Broken	Broken	Broken	29	Broken	Broken	Broken	Broken	26
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	26	15	15	5	5	25
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	6	6	Broken
7	23	6	26	7	Broken	19	19	7	7	Broken
Broken	Broken	Broken	Broken	Broken	26	17	17	6	6	25
7	19	5	25	7	25	18	18	6	6	24
Broken	Broken	Broken	Broken	Broken	Broken	20	20	6	6	Broken
Broken	Broken	Broken	Broken	Broken	28	20	20	5	5	26
9	25	9	26	9	Broken	16	16	8	8	Broken
7	21	7	25	7	24	18	18	7	7	24
Broken	Broken	Broken	Broken	Broken	29	21	21	6	6	Broken
8	22	8	26	8	21	16	16	8	8	19
7	25	6	29	7	28	21	21	7	7	26
8	26	7	27	7	26	19	19	7	7	24
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	27	16	16	Broken	Broken	27
Broken	Broken	Broken	Broken	Broken	29	18	18	6	6	26
Broken	Broken	Broken	Broken	Broken	36	19	19	5	5	34
6	20	6	27	6	29	18	18	5	5	28
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	13	13	5	5	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	18	7	7	Broken
Broken	Broken	Broken	Broken	Broken	30	20	20	5	5	30
6	23	7	25	6	Broken	17	17	5	5	Broken
7	14	7	20	7	26	19	19	6	6	25
6	17	6	23	7	27	17	17	6	6	25
Broken	Broken	Broken	Broken	Broken	27	Broken	Broken	Broken	Broken	25
Broken	Broken	Broken	Broken	Broken	25	14	14	5	5	Broken
Broken	Broken	Broken	Broken	Broken	25	18	18	7	7	24
Broken	Broken	Broken	Broken	Broken	25	20	20	7	7	24
5	16	6	21	5	Broken	18	18	5	5	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
8	11	7	14	7	24	19	19	6	6	24
Broken	Broken	Broken	Broken	Broken	28	18	18	6	6	25
Broken	Broken	Broken	Broken	Broken	Broken	14	14	7	7	Broken
7	21	6	26	5	Broken	17	17	5	5	Broken
6	29	6	31	6	Broken	19	19	5	5	Broken
Broken	Broken	Broken	Broken	Broken	27	18	18	6	6	26
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
8	13	6	20	8	29	16	16	7	7	27

Table D-2 (continued)

7	24	7	27	7	29	21	21	6	6	28
Broken	Broken	Broken	Broken	Broken	Broken	20	20	5	5	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
6	25	6	28	6	25	18	18	6	6	24
Broken	Broken	Broken	Broken	Broken	28	Broken	Broken	Broken	Broken	22
7	Broken	6	23	7	27	20	20	5	5	27
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken

APPENDIX E

SARATOGA CLUSTER HAFTED BIFACE MEASUREMENTS - CHIGGERVILLE

Table E-1. Saratoga Cluster Hafted Biface Measurements from Chiggerville, Part I.

Cat #	Functional Type	Justice's Cluster	Justice's Type	Max Length	Blade Length	Max Length - Blade Length	Max Width	Max Thickness	Max Thick of Blade
3	projectile point	Saratoga	Saratoga Expanding Stemmed	59	41	18	25	9	9
4.1	projectile point	Saratoga	Saratoga Expanded Stemmed	49	35	14	22	10	10
10	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	26	12	12
12	projectile point	Saratoga	Saratoga Expanding Stemmed	64	49	15	24	7	7
13	projectile point	Saratoga	Saratoga Expanding Stemmed	70	53	17	26	8	8
19	projectile point	Saratoga	Saratoga Expanding Stemmed	56	Broken	Broken	Broken	9	9
21	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
28	projectile point	Saratoga	Saratoga Expanding Stemmed	48	33	15	25	9	9
29	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	34	10	10
33	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	10	9
35	hafted scraper	Saratoga	Saratoga Expanding Stemmed	58	40	18	31	12	12
44	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	10	10
45	projectile point	Saratoga	Saratoga Straight Stemmed	58	42	16	22	10	10
53	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
54	hafted scraper	Saratoga	Saratoga Straight Stemmed	38	19	19	25	Broken	Broken
58	projectile point	Saratoga	Saratoga Expanding Stemmed	77	60	17	23	10	10
62	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	9	9
63	projectile point	Saratoga	Saratoga Expanding Stemmed	37	Broken	Broken	Broken	9	9
66	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	12	12
71	projectile point	Saratoga	Saratoga Expanding Stemmed	42	28	14	Broken	8	8
76	projectile point	Saratoga	Saratoga Expanding Stemmed	66	51	15	Broken	9	9
78	projectile point	Saratoga	UID	Broken	Broken	Broken	26	10	10
80	hafted scraper	Saratoga	Saratoga Straight Stemmed	42	23	19	29	9	9
82	hafted scraper	Saratoga	Saratoga Straight Stemmed	47	34	13	32	9	9
83	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	29	10	10
84	projectile point	Saratoga	Saratoga Straight Stemmed	86	68	18	28	11	11
90	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	29	10	10
91	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	8	8
92	projectile point	Saratoga	Saratoga Expanding Stemmed	60	47	13	26	8	8
96	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	29	8	8
98	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	24	9	9
99.1	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	10	10
99.2	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	11	11
100	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	32	Broken	22	7	7
101	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	28	10	10
103	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	21	9	9
114	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	23	9	9
118	projectile point	Saratoga	Saratoga Expanding Stemmed	54	Broken	Broken	29	8	8
119	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	8	8
120	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	19	10	10
124	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	31	8	8

Table E-1 (continued)

125	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	28	8	8
126	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	27	Broken	Broken
129	projectile point	Saratoga	Saratoga Expanding Stemmed	56	36	20	22	12	12
130	hafted scraper	Saratoga	Saratoga Expanding Stemmed	47	34	13	23	9	9
133	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	6	6
145	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
154	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
156	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	24	10	9
160	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	30	11	11
163	projectile point	Saratoga	UID	Broken	Broken	Broken	28	10	10
164	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	33	7	7
171	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	9	9
174	projectile point	Saratoga	UID	Broken	55	Broken	24	9	9
182	projectile point	Saratoga	Saratoga Expanding Stemmed	65	47	18	23	9	9
188	projectile point	Saratoga	Saratoga Expanding Stemmed	59	Broken	Broken	Broken	9	9
193	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	27	9	9
194	projectile point	Saratoga	UID	57	45	12	22	8	8
202	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	28	Broken	Broken
203	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
205	projectile point	Saratoga	UID	Broken	66	Broken	31	9	9
207	projectile point	Saratoga	Saratoga Expanding Stemmed	65	47	18	31	9	9
214	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	30	10	10
215	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
217	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
219	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
220	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
225	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	23	8	8
234	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	26	9	9
235	projectile point	Saratoga	Saratoga Expanding Stemmed	49	32	17	21	8	8
238	projectile point	Saratoga	Saratoga Expanding Stemmed	64	47	17	25	8	8
239	projectile point	Saratoga	UID	Broken	Broken	Broken	26	9	9
242	projectile point	Saratoga	Saratoga Straight Stemmed	53	43	10	27	7	7
265	projectile point	Saratoga	UID	62	49	13	30	15	15
266	projectile point	Saratoga	Saratoga Expanding Stemmed	50	34	16	Broken	8	8
268	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	9	9
269	projectile point	Saratoga	Saratoga Expanding Stemmed	54	40	14	28	11	11
283	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	27	9	9
285	projectile point	Saratoga	Saratoga Expanding Stemmed	61	48	13	28	10	10
294	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	27	7	7
298	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
299	projectile point	Saratoga	Saratoga Expanding Stemmed	57	40	17	26	12	12
302	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
304	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	10	10

Table E-1 (continued)

308	projectile point	Saratoga	Saratoga Expanding Stemmed	78	61	17	23	10	10
323	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	24	8	8
325	projectile point	Saratoga	Saratoga Expanding Stemmed	41	25	16	21	9	9
326	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	27	11	11
328	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	24	10	10
329	projectile point	Saratoga	Saratoga Expanding Stemmed	63	49	14	33	7	7
332	projectile point	Saratoga	Saratoga Expanding Stemmed	87	75	12	29	8	8
336	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	24	9	9
338	projectile point	Saratoga	Saratoga Expanding Stemmed	64	49	15	25	9	9
340	projectile point	Saratoga	Saratoga Expanding Stemmed	75	60	14	24	11	11
341	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	24	9	9
346	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	27	8	8
352	projectile point	Saratoga	Saratoga Expanding Stemmed	45	32	13	20	10	10
359	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
369	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	9	9
374	projectile point	Saratoga	Saratoga Expanding Stemmed	71	54	17	26	11	11
378	projectile point	Saratoga	Saratoga Straight Stemmed	55	31	24	22	9	9
379	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	24	10	10
380	projectile point	Saratoga	Saratoga Expanding Stemmed	53	37	16	19	8	8
381	projectile point	Saratoga	UID	Broken	Broken	Broken	25	9	9
386	projectile point	Saratoga	Saratoga Expanding Stemmed	69	57	12	28	10	10
391	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	24	8	8
393	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	30	9	9
406	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	10	10
413	projectile point	Saratoga	UID	Broken	Broken	Broken	28	10	10
419	projectile point	Saratoga	Saratoga Expanding Stemmed	54	39	15	22	7	7
422	projectile point	Saratoga	Saratoga Expanding Stemmed	54	40	14	23	Broken	Broken
423	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	27	Broken	Broken
425	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	21	8	7
434	projectile point	Saratoga	Saratoga Expanding Stemmed	62	47	15	26	8	8
436	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	28	8	8
439	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
445	projectile point	Saratoga	Saratoga Straight Stemmed	43	25	18	24	12	12
451	hafted scraper	Saratoga	Saratoga Expanding Stemmed	41	25	16	22	10	10
452	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	8	8
459	projectile point	Saratoga	UID	Broken	Broken	Broken	28	10	10
463	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	28	8	Broken
464	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	Broken	Broken
468	projectile point	Saratoga	Saratoga Expanding Stemmed	64	50	14	28	10	10
472	projectile point	Saratoga	Saratoga Expanding Stemmed	68	50	18	29	16	16
473	projectile point	Saratoga	UID	Broken	69	Broken	29	12	12
477	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	20	9	9
479	projectile point	Saratoga	Saratoga Expanding Stemmed	66	Broken	Broken	Broken	10	10

Table E-1 (continued)

492	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
499	hafted scraper	Saratoga	Saratoga Straight Stemmed	37	24	13	26	9	9
503	projectile point	Saratoga	UID	Broken	Broken	Broken	27	11	11
507	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
512	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
515	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	9	Broken
517	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
519	projectile point	Saratoga	UID	Broken	Broken	Broken	34	11	11
522	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	28	10	10
530	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	7	6
539	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
544	projectile point	Saratoga	Saratoga Expanding Stemmed	50	Broken	Broken	Broken	Broken	Broken
546	projectile point	Saratoga	Saratoga Expanding Stemmed	55	42	13	23	8	8
547	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	9	9
549	hafted scraper	Saratoga	Saratoga Expanding Stemmed	49	35	14	25	8	8
554	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	11	11
556	projectile point	Saratoga	Saratoga Expanding Stemmed	75	58	17	Broken	12	12
557	projectile point	Saratoga	Saratoga Expanding Stemmed	49	32	17	23	9	9
558	projectile point	Saratoga	Saratoga Expanding Stemmed	78	60	18	26	8	8
567	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
571	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	20	6	6
573	hafted scraper	Saratoga	Saratoga Expanding Stemmed	37	22	15	25	8	8
589	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	29	10	10
594	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	29	8	8
599	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	9	9
600	projectile point	Saratoga	Saratoga Expanding Stemmed	50	36	14	31	8	8
609	projectile point	Saratoga	UID	Broken	Broken	Broken	30	Broken	Broken
611	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	26	10	10
613	projectile point	Saratoga	UID	Broken	Broken	Broken	26	Broken	Broken
615	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	30	8	8
617	projectile point	Saratoga	Saratoga Expanding Stemmed	49	33	16	25	8	8
621	projectile point	Saratoga	UID	Broken	Broken	Broken	Broken	Broken	Broken
627	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	23	Broken	Broken
631	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	21	Broken	Broken
634	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	12	12
636	hafted scraper	Saratoga	Saratoga Expanding Stemmed	54	39	15	26	9	9
638	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
639	projectile point	Saratoga	Saratoga Expanding Stemmed	42	28	14	26	7	7
644	hafted scraper	Saratoga	Saratoga Expanding Stemmed	55	40	15	30	8	8
645	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	24	9	9
649	projectile point	Saratoga	Saratoga Expanding Stemmed	58	46	12	33	9	9
651	hafted scraper	Saratoga	Saratoga Expanding Stemmed	44	Broken	Broken	26	8	8
653	hafted scraper	Saratoga	Saratoga Expanding Stemmed	36	19	17	24	9	9

Table E-1 (continued)

655	projectile point	Saratoga	Saratoga Expanding Stemmed	55	38	17	28	12	12
659	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
665	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	30	9	9
667	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
673	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
674	projectile point	Saratoga	Saratoga Expanding Stemmed	50	33	17	26	12	12
679	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
688	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	7	7
700	projectile point	Saratoga	UID	Broken	Broken	Broken	Broken	9	9
703	projectile point	Saratoga	Saratoga Expanding Stemmed	39	25	14	22	8	8
709	hafted scraper	Saratoga	Saratoga Straight Stemmed	Broken	11	Broken	24	8	8
710	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	29	10	10
712	hafted drill	Saratoga	Saratoga Expanding Stemmed	69	50	19	20	9	9
714.6	projectile point	Saratoga	Saratoga Expanding Stemmed	62	45	17	27	11	11
714.8	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	7	7
721	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	20	9	9
727	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	17	8	Broken
739	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	23	Broken	Broken
757	hafted scraper	Saratoga	Saratoga Expanding Stemmed	59	40	19	21	11	11
764	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	9	9
813	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
815	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	20	9	9
823	hafted drill	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	18	9	9
832	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	22	11	10
851	hafted drill	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	21	9	Broken
852	hafted drill	Saratoga	Saratoga Straight Stemmed	56	40	16	19	11	11
854	hafted drill	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	19	14	14
874	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
875	hafted scraper	Saratoga	Saratoga Expanding Stemmed	25	10	15	25	9	9
884	hafted scraper	Saratoga	Saratoga Straight Stemmed	45	28	17	25	8	8
889	hafted scraper	Saratoga	Saratoga Expanding Stemmed	38	23	15	20	9	9
917	hafted scraper	Saratoga	Saratoga Expanding Stemmed	38	25	13	30	9	9
927	hafted scraper	Saratoga	Saratoga Expanding Stemmed	40	20	20	26	9	9
938	hafted scraper	Saratoga	Saratoga Straight Stemmed	60	37	23	30	10	8
940	hafted scraper	Saratoga	Saratoga Expanding Stemmed	28	13	15	23	8	8
958	hafted scraper	Saratoga	Saratoga Straight Stemmed	47	32	15	28	8	8
967	hafted scraper	Saratoga	Saratoga Straight Stemmed	46	26	20	27	17	17
972	hafted scraper	Saratoga	Saratoga Expanding Stemmed	37	24	13	30	8	8
976	hafted scraper	Saratoga	Saratoga Expanding Stemmed	49	30	19	24	9	9
985	hafted scraper	Saratoga	Saratoga Straight Stemmed	47	Broken	Broken	Broken	Broken	Broken
988	hafted scraper	Saratoga	Saratoga Expanding Stemmed	35	Broken	Broken	Broken	8	8
996	hafted scraper	Saratoga	Saratoga Expanding Stemmed	25	9	16	25	7	7
1002	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	Broken	Broken	Broken

Table E-1 (continued)

1026	hafted scraper	Saratoga	Saratoga Straight Stemmed	43	29	14	Broken	10	10
1029	hafted scraper	Saratoga	Saratoga Straight Stemmed	27	16	11	24	9	9
1042	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	25	9	9
1057	hafted scraper	Saratoga	UID	Broken	36	Broken	22	9	9
1068	hafted scraper	Saratoga	Saratoga Straight Stemmed	27	10	17	24	9	9
1098	hafted scraper	Saratoga	Saratoga Expanding Stemmed	Broken	17	Broken	22	10	10
1103	hafted scraper	Saratoga	Saratoga Expanding Stemmed	45	28	17	26	9	9
1107	hafted scraper	Saratoga	Saratoga Straight Stemmed	35	17	18	25	9	9
1108	hafted scraper	Saratoga	Saratoga Expanding Stemmed	21	8	13	24	9	9
1114	hafted scraper	Saratoga	Saratoga Straight Stemmed	40	20	20	30	9	9
1118	hafted scraper	Saratoga	Saratoga Straight Stemmed	47	27	20	Broken	10	10
1119	hafted scraper	Saratoga	Saratoga Expanding Stemmed	Broken	26	Broken	24	9	9
1121	hafted scraper	Saratoga	Saratoga Straight Stemmed	41	26	15	30	8	8
1122	hafted scraper	Saratoga	Saratoga Straight Stemmed	37	20	17	29	10	10
1123	hafted scraper	Saratoga	Saratoga Straight Stemmed	34	14	20	24	9	9
1126	hafted scraper	Saratoga	Saratoga Expanding Stemmed	46	31	15	27	8	8
1128	hafted scraper	Saratoga	Saratoga Expanding Stemmed	32	15	17	27	10	10
1129	hafted scraper	Saratoga	Saratoga Expanding Stemmed	41	Broken	Broken	29	9	9
1131	hafted scraper	Saratoga	Saratoga Expanding Stemmed	34	Broken	Broken	Broken	8	8
1134	hafted scraper	Saratoga	Saratoga Expanding Stemmed	42	26	16	22	10	10
1137	hafted scraper	Saratoga	UID	Broken	37	Broken	29	11	11
1138	hafted scraper	Saratoga	UID	40	27	13	33	8	8
1139	hafted scraper	Saratoga	Saratoga Expanding Stemmed	41	28	13	35	11	11
1142	hafted scraper	Saratoga	Saratoga Expanding Stemmed	32	14	18	25	9	9
1143	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	25	10	10
1144	hafted scraper	Saratoga	Saratoga Expanding Stemmed	39	20	19	22	10	10
1146	hafted scraper	Saratoga	Saratoga Straight Stemmed	49	31	18	27	11	11
1147	hafted scraper	Saratoga	Saratoga Expanding Stemmed	40	24	16	29	9	9
1148	projectile point	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	30	10	10
1149	hafted scraper	Saratoga	Saratoga Expanding Stemmed	34	17	17	25	8	8
1152	hafted scraper	Saratoga	Saratoga Expanding Stemmed	38	24	14	24	10	10
1154	hafted scraper	Saratoga	Saratoga Straight Stemmed	37	20	17	31	10	10
1155	hafted scraper	Saratoga	Saratoga Expanding Stemmed	36	18	18	25	11	10
1156	hafted scraper	Saratoga	Saratoga Expanding Stemmed	33	17	16	24	8	8
1158	hafted scraper	Saratoga	Saratoga Expanding Stemmed	41	28	13	30	10	10
1159	hafted scraper	Saratoga	Saratoga Straight Stemmed	46	25	21	26	10	10
1160	hafted scraper	Saratoga	Saratoga Straight Stemmed	47	30	17	30	10	10
1162	hafted scraper	Saratoga	Saratoga Expanding Stemmed	36	20	16	26	7	7
1163	hafted scraper	Saratoga	Saratoga Expanding Stemmed	36	21	15	29	8	8
1164	hafted scraper	Saratoga	Saratoga Straight Stemmed	45	30	15	22	11	11
1165	hafted scraper	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	28	10	10
1166	hafted scraper	Saratoga	UID	Broken	21	Broken	27	8	8
1167	hafted scraper	Saratoga	Saratoga Expanding Stemmed	52	Broken	Broken	Broken	Broken	Broken

Table E-1 (continued)

1168	hafted scraper	Saratoga	Saratoga Expanding Stemmed	Broken	21	Broken	34	10	10
1169	hafted scraper	Saratoga	Saratoga Expanding Stemmed	44	24	20	24	13	13
1170	hafted scraper	Saratoga	UID	38	20	18	25	7	7
1173	hafted scraper	Saratoga	Saratoga Straight Stemmed	43	26	17	29	10	10
1176	hafted scraper	Saratoga	Saratoga Straight Stemmed	36	17	19	23	8	8
1177	hafted drill	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	20	7	7
1178	hafted scraper	Saratoga	Saratoga Straight Stemmed	50	32	18	28	8	8
1185	hafted scraper	Saratoga	Saratoga Straight Stemmed	30	10	20	24	8	8
1186	hafted scraper	Saratoga	Saratoga Straight Stemmed	53	39	14	24	8	8
1187	hafted scraper	Saratoga	Saratoga Expanding Stemmed	48	36	12	34	8	8
1188	hafted scraper	Saratoga	Saratoga Expanding Stemmed	24	9	15	27	8	8
1189	hafted scraper	Saratoga	Saratoga Expanding Stemmed	28	12	17	24	8	8
1190	hafted scraper	Saratoga	Saratoga Expanding Stemmed	33	19	14	23	10	10
1204	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	23	10	10
1223	hafted scraper	Saratoga	Saratoga Straight Stemmed	44	28	16	21	8	8
1377	projectile point	Saratoga	Saratoga Straight Stemmed	Broken	Broken	Broken	Broken	Broken	Broken
1462	hafted scraper	Saratoga	Saratoga Expanding Stemmed	Broken	Broken	Broken	26	9	9
1816	hafted scraper	Saratoga	UID	42	23	19	28	11	11
1817	hafted scraper	Saratoga	Saratoga Expanding Stemmed	39	28	11	26	10	10
1820	hafted scraper	Saratoga	Saratoga Expanding Stemmed	34	19	15	27	9	9

Table E-2. Saratoga Cluster Hafted Biface Measurements from Chiggerville, Part II.

Width Blade Midsection	Thick Blade Midsection	Width 1/3 Blade Length	Thick 1/3 Blade Length	Width 2/3 Blade Length	Thick 2/3 Blade Length	Max Width of Haft Element	Min Width of Haft Element	Max Thick of Haft Element	Base Width
20	7	17	7	24	8	21	19	8	Broken
21	10	18	9	22	10	18	14	9	18
Broken	Broken	Broken	Broken	Broken	Broken	20	18	9	20
17	7	14	7	21	7	22	16	8	22
22	6	18	6	24	7	19	14	8	14
Broken	Broken	Broken	Broken	Broken	Broken	Broken	14	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
20	8	15	7	22	8	Broken	Broken	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	16	10	18
28	10	25	10	28	12	22	19	11	21
Broken	Broken	Broken	Broken	Broken	Broken	18	17	10	N/A
20	9	16	8	22	10	17	15	9	15
Broken	Broken	Broken	Broken	Broken	Broken	21	17	8	18
25	8	23	Broken	25	8	19	17	7	17
20	10	17	10	22	9	19	17	8	17
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	23	20	8	23
Broken	Broken	Broken	Broken	Broken	Broken	21	18	11	20
18	7	15	6	20	8	Broken	14	7	Broken
26	8	22	7	28	9	20	17	8	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
29	9	29	9	28	9	18	17	9	17
30	9	26	8	31	8	20	18	8	18
Broken	Broken	Broken	Broken	Broken	Broken	21	18	9	21
23	9	20	9	26	11	16	15	9	16
Broken	Broken	Broken	Broken	Broken	Broken	20	18	10	18
Broken	Broken	Broken	Broken	Broken	Broken	16	14	8	14
22	7	17	5	23	7	18	16	7	17
Broken	Broken	Broken	Broken	Broken	Broken	22	19	8	22
Broken	Broken	Broken	Broken	Broken	Broken	18	17	9	18
Broken	Broken	Broken	Broken	Broken	Broken	17	15	8	17
Broken	Broken	Broken	Broken	Broken	Broken	17	14	9	16
20	7	15	6	22	7	Broken	Broken	6	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	15	7	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	15	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	24	18	7	24
Broken	Broken	Broken	Broken	Broken	Broken	Broken	17	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	15	7	19
Broken	Broken	Broken	Broken	Broken	Broken	23	20	8	22

Table E-2 (continued)

Broken	Broken	Broken	Broken	Broken	Broken	17	15	8	17
Broken	Broken	Broken	Broken	Broken	Broken	18	16	6	16
18	12	14	11	19	12	Broken	18	11	Broken
21	9	18	7	22	9	20	15	7	19
Broken	Broken	Broken	Broken	Broken	Broken	16	14	6	14
Broken	Broken	Broken	Broken	Broken	Broken	21	Broken	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	18	7	19
Broken	Broken	Broken	Broken	Broken	Broken	19	18	10	19
Broken	Broken	Broken	Broken	Broken	Broken	19	13	9	13
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	21	18	7	18
Broken	Broken	Broken	Broken	Broken	Broken	17	16	8	17
22	8	21	8	24	8	Broken	Broken	Broken	Broken
19	8	16	7	20	9	Broken	19	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	26	21	7	26
Broken	Broken	Broken	Broken	Broken	Broken	20	17	8	N/A
17	8	15	8	19	8	20	19	8	20
Broken	Broken	Broken	Broken	Broken	Broken	Broken	17	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	17	9	Broken
27	8	23	7	29	8	Broken	Broken	Broken	Broken
24	9	18	8	29	8	18	16	8	18
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	19	7	N/A
Broken	Broken	Broken	Broken	Broken	Broken	20	17	8	17
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	18	7	N/A
Broken	Broken	Broken	Broken	Broken	Broken	21	20	8	21
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	8	Broken
18	8	17	7	20	8	18	16	7	18
18	7	15	7	21	8	18	15	7	15
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
21	7	17	7	24	7	19	19	7	19
26	13	22	9	27	16	20	18	11	20
14	8	11	7	16	8	Broken	14	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	16	15	9	16
23	11	17	8	26	10	20	16	9	20
Broken	Broken	Broken	Broken	Broken	Broken	17	16	8	17
22	9	17	9	24	10	Broken	14	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	21	18	6	21
Broken	Broken	Broken	Broken	Broken	Broken	16	14	7	16
21	12	16	9	24	12	23	15	10	21
Broken	Broken	Broken	Broken	Broken	Broken	21	18	8	21
Broken	Broken	Broken	Broken	Broken	Broken	24	19	9	24

Table E-2 (continued)

16	8	13	7	18	8	21	15	10	21
Broken	Broken	Broken	Broken	Broken	Broken	21	19	8	20
16	9	13	7	18	9	19	16	7	13
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	10	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	16	9	18
22	7	17	7	26	7	23	18	7	23
26	8	22	7	29	7	15	14	6	14
Broken	Broken	Broken	Broken	Broken	Broken	21	18	9	21
21	8	16	7	23	9	25	20	8	25
21	11	20	11	23	11	19	16	8	19
Broken	Broken	Broken	Broken	Broken	Broken	23	19	8	23
Broken	Broken	Broken	Broken	Broken	Broken	23	17	8	23
16	9	13	7	16	10	19	17	9	18
Broken	Broken	Broken	Broken	Broken	Broken	20	16	8	20
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	9	Broken
25	10	21	10	26	11	19	16	10	11
19	8	17	9	21	8	19	16	8	16
Broken	Broken	Broken	Broken	Broken	Broken	16	14	8	14
14	8	12	7	16	7	16	13	7	15
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	9	Broken
24	9	22	8	24	9	16	15	8	16
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	21	19	8	19
Broken	Broken	Broken	Broken	Broken	Broken	22	20	9	21
Broken	Broken	Broken	Broken	Broken	Broken	18	17	8	17
15	6	12	5	17	7	21	18	6	21
16	Broken	14	6	18	Broken	22	Broken	Broken	N/A
Broken	Broken	Broken	Broken	Broken	Broken	21	18	8	21
Broken	Broken	Broken	Broken	Broken	Broken	21	17	8	21
19	6	15	5	22	8	18	13	6	13
Broken	Broken	Broken	Broken	Broken	Broken	18	18	8	18
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	8	Broken
20	12	18	10	22	12	20	19	10	19
17	10	16	9	19	10	18	15	8	18
Broken	Broken	Broken	Broken	Broken	Broken	20	17	7	17
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	22	19	6	22
25	9	22	9	28	10	16	14	9	16
25	14	22	12	29	16	23	21	15	23
25	9	21	8	28	12	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	16	7	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	15	10	Broken

Table E-2 (continued)

Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
24	9	26	9	24	8	18	16	7	16
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	16	7	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	18	8	N/A
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	22	21	8	22
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	24	20	Broken	20
19	8	16	7	21	8	19	15	7	19
Broken	Broken	Broken	Broken	Broken	Broken	18	17	7	16
21	7	18	7	23	6	Broken	15	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	16	11	19
19	9	15	8	21	10	Broken	Broken	10	Broken
22	8	19	7	23	9	18	15	8	18
23	8	21	8	25	8	20	19	8	19
Broken	Broken	Broken	Broken	Broken	Broken	22	20	8	20
Broken	Broken	Broken	Broken	Broken	Broken	17	15	6	17
20	8	18	8	22	8	Broken	19	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	22	17	7	22
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	Broken
22	8	16	7	27	8	20	17	8	20
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	17	9	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	7	Broken
17	7	13	6	20	8	20	19	7	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	17	8	17
Broken	Broken	Broken	Broken	Broken	Broken	18	16	8	18
Broken	Broken	Broken	Broken	Broken	Broken	19	18	11	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	16	9	Broken
23	8	20	8	25	8	19	15	8	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
22	7	18	7	25	7	20	19	7	20
26	8	24	8	29	8	20	18	8	20
Broken	Broken	Broken	Broken	Broken	Broken	22	17	9	17
25	9	20	8	27	9	19	18	8	18
Broken	Broken	Broken	Broken	Broken	Broken	20	16	8	20
22	9	20	9	22	9	Broken	18	8	Broken

Table E-2 (continued)

24	11	18	10	27	11	21	17	9	21
Broken	Broken	Broken	Broken	Broken	Broken	18	17	7	18
Broken	Broken	Broken	Broken	Broken	Broken	17	15	8	N/A
Broken	Broken	Broken	Broken	Broken	Broken	21	19	8	21
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
21	11	15	10	24	12	Broken	20	11	Broken
Broken	Broken	Broken	Broken	Broken	Broken	17	16	Broken	17
Broken	Broken	Broken	Broken	Broken	Broken	21	19	7	21
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
16	8	12	8	18	8	21	19	6	22
23	8	22	6	24	8	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	19	16	8	19
15	8	11	7	17	9	19	18	8	19
24	11	19	11	26	11	20	18	9	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	16	7	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	17	9	20
Broken	Broken	Broken	Broken	Broken	Broken	18	17	8	18
Broken	Broken	Broken	Broken	Broken	Broken	23	18	8	N/A
20	11	18	11	21	10	19	16	10	16
Broken	Broken	Broken	Broken	Broken	Broken	Broken	16	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	20	17	8	20
Broken	Broken	Broken	Broken	Broken	Broken	18	18	9	18
Broken	Broken	Broken	Broken	Broken	Broken	19	16	11	12
Broken	Broken	Broken	Broken	Broken	Broken	21	18	9	18
11	10	10	8	14	11	19	18	9	18
Broken	Broken	Broken	Broken	Broken	Broken	18	14	11	16
Broken	Broken	Broken	Broken	Broken	Broken	19	Broken	Broken	19
23	8	22	7	25	9	Broken	18	8	Broken
25	7	25	7	25	7	17	17	8	17
20	9	17	8	19	8	Broken	Broken	7	Broken
28	8	24	8	30	8	24	21	8	20
25	8	26	8	26	9	21	19	9	N/A
29	8	28	7	30	7	22	17	10	17
20	8	17	8	23	8	Broken	20	7	Broken
26	8	25	7	27	7	16	16	7	16
26	17	25	16	26	17	21	20	13	N/A
25	8	21	8	27	8	21	17	8	17
23	9	23	9	23	9	22	19	8	22
Broken	Broken	Broken	Broken	Broken	Broken	20	16	10	16
Broken	Broken	Broken	Broken	Broken	Broken	19	16	8	19
25	7	22	7	25	7	21	20	7	21
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	8	Broken

Table E-2 (continued)

Broken	9	21	10	Broken	8	18	17	8	18
23	9	Broken	8	24	9	20	16	9	16
Broken	Broken	Broken	Broken	Broken	Broken	Broken	Broken	8	Broken
22	9	21	9	22	9	Broken	Broken	Broken	Broken
24	8	22	6	24	9	21	17	9	17
21	9	18	9	22	9	Broken	19	9	Broken
25	9	Broken	8	26	8	24	20	9	24
25	9	22	9	25	9	20	18	9	18
23	9	19	8	23	8	17	14	8	N/A
30	9	28	9	30	9	18	18	9	18
29	10	28	9	Broken	10	23	19	9	19
23	7	23	7	24	8	Broken	20	8	Broken
28	8	30	8	28	8	21	18	8	18
27	10	23	9	29	10	20	19	9	19
23	7	20	7	24	9	19	15	9	15
22	7	19	8	24	7	20	16	8	19
25	10	22	9	27	10	18	15	10	18
Broken	Broken	Broken	Broken	Broken	Broken	Broken	18	Broken	21
Broken	Broken	Broken	Broken	Broken	Broken	18	16	6	Broken
21	9	20	10	22	9	19	15	8	19
28	10	28	9	27	11	Broken	Broken	Broken	Broken
27	8	21	8	31	8	Broken	24	7	Broken
31	11	25	11	33	11	23	21	10	23
21	9	17	9	24	9	Broken	19	9	Broken
Broken	Broken	Broken	Broken	Broken	Broken	18	17	10	17
22	9	20	10	22	9	19	18	7	N/A
26	10	24	11	27	10	22	17	10	17
27	9	23	9	28	9	19	16	9	19
Broken	Broken	Broken	Broken	Broken	Broken	Broken	16	7	Broken
24	8	23	8	24	8	16	14	7	14
22	10	22	10	23	9	21	16	7	21
29	8	26	9	29	9	19	17	8	17
24	10	24	10	25	10	18	Broken	11	18
24	8	22	8	24	8	20	17	8	20
26	9	22	10	27	8	18	17	8	18
25	10	25	10	25	10	16	15	10	15
30	10	30	10	28	10	20	18	9	18
26	7	24	7	25	7	20	17	6	20
29	8	29	8	28	7	Broken	17	8	Broken
21	10	20	11	22	10	19	18	8	18
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	8	Broken
25	8	22	8	26	8	Broken	Broken	Broken	Broken
Broken	Broken	Broken	Broken	Broken	Broken	17	15	8	15

Table E-2 (continued)

30	10	29	10	32	10	Broken	21	10	Broken
23	11	24	10	23	12	20	18	13	20
24	7	24	7	24	7	21	15	7	15
27	10	27	10	29	10	22	17	10	17
23	8	20	8	22	8	17	14	7	14
Broken	Broken	Broken	Broken	Broken	Broken	20	20	7	20
24	8	23	7	27	8	19	18	8	Broken
22	8	21	8	24	8	21	18	8	N/A
22	8	21	8	23	8	17	16	7	16
32	8	29	8	33	8	Broken	19	8	Broken
24	8	22	8	27	8	19	17	8	19
23	8	19	8	24	8	19	16	8	19
23	9	21	10	22	9	22	15	9	22
Broken	Broken	Broken	Broken	Broken	Broken	20	14	9	14
21	8	21	8	20	8	Broken	20	8	Broken
Broken	Broken	Broken	Broken	Broken	Broken	Broken	19	Broken	19
Broken	Broken	Broken	Broken	Broken	Broken	19	16	6	12
27	11	27	11	27	10	21	14	8	14
24	9	23	10	25	9	Broken	15	6	Broken
27	9	27	8	27	9	23	19	9	20

APPENDIX F

NON-METRIC TRAITS – BAKER LARGE SIDE NOTCHED CLUSTER HAFTED BIFACES

Table F-1. Shape of Base

	Frequency	Percent
Side Notched	177	100.00
Total	177	100.00

Table F-2. Base Form

	Frequency	Percent
Slightly Concave	21	11.86
Concave	54	30.51
Straight	19	10.73
Slightly Convex	5	2.82
Convex	3	1.69
Notched	1	0.56
Platformed	2	1.13
Straight Angled	1	0.56
Irregular	31	17.51
Broken	40	22.60
Total	177	100.00

Table F-3. Base Modifications

	Frequency	Percent
Cortex Unmodified	1	0.56
Thinned	160	90.40
Broken	16	9.04
Total	177	100.00

Table F-4. Ear Form1

	Frequency	Percent
Acute Angled	5	2.82
Round	42	23.73
Square	21	11.86
Obtuse Angled	60	33.90
Flake Blank Striking Platform	1	0.56
Broken	48	27.12
Total	177	100.00

Table F-5. Ear Form2

	Frequency	Percent
Acute Angled	2	1.13
Round	36	20.34
Square	15	8.47
Obtuse Angled	79	44.63
Broken	45	25.42
Total	177	100.00

Table F-6. Basal Grinding

	Frequency	Percent
Absent	13	7.34
Slight	55	31.07
Heavy	86	48.59
Broken	23	12.99
Total	177	100.00

Table F-7. Lateral Haft Grinding1

	Frequency	Percent
Absent	21	11.86
Slight	80	45.20
Heavy	34	19.21
Broken	42	23.73
Total	177	100.00

Table F-8. Lateral Haft Grinding2

	Frequency	Percent
Absent	17	9.60
Slight	80	45.20
Heavy	37	20.90
Broken	43	24.29
Total	177	100.00

Table F-9. Basal Thinning Obverse

	Frequency	Percent
Intentional, Single Flake, Short	4	2.26
Intentional, Single Flake, Long	26	14.69
Intentional, Single Flake, Long and Intentional, Multiple Flakes, Short	1	0.56
Intentional, Multiple Flakes, Short	30	16.95
Intentional, Multiple Flakes, Long	28	15.82
Epiphenomenal, Single Flake, Short	2	1.13
Epiphenomenal, Single Flake, Long	10	5.65
Epiphenomenal, Multiple Flakes, Long	4	2.26
Epiphenomenal, Multiple Flakes, Short	23	12.99
Unmodified	9	5.08
Broken	40	22.60
Total	177	100.00

Table F-10. Basal Thinning Reverse

	Frequency	Percent
Fluted, Single Flute	1	0.56
Intentional, Single Flake, Short	3	1.69
Intentional, Single Flake, Short and Intentional, Single Flake, Long	2	1.13
Intentional, Single Flake, Long	23	12.99
Intentional, Single Flake, Long and Intentional, Multiple Flakes, Short	1	0.56
Intentional, Multiple Flakes, Short	21	11.86
Intentional, Multiple Flakes, Long	24	13.56
Epiphenomenal, Single Flake, Short	6	3.39
Epiphenomenal, Single Flake, Long	14	7.91
Epiphenomenal, Multiple Flakes, Long	15	8.47
Epiphenomenal, Multiple Flakes, Short	28	15.82
Unmodified	5	2.82
Broken	34	19.21
Total	177	100.00

Table F-11. Basal Retouch1

	Frequency	Percent
Present	84	47.46
Absent	31	17.51
Present - Unifacial Bevel	21	11.86
Broken	41	23.16
Total	177	100.00

Table F-12. Basal Retouch2

	Frequency	Percent
Present	97	54.80
Absent	22	12.43
Present - Unifacial Bevel	19	10.73
Broken	39	22.03
Total	177	100.00

Table F-13. Lateral Haft Trimming1

	Frequency	Percent
Bifacially Beveled, Pressure	82	46.33
Unifacially Beveled, Pressure	41	23.16
Unifacially Beveled, Percussion	2	1.13
Bifacially Beveled - Pressure on One Side and Percussion on the Other	1	0.56
None	8	4.52
Broken	43	24.29
Total	177	100.00

Table F-14. Lateral Haft Trimming2

	Frequency	Percent
Bifacially Beveled, Pressure	91	51.41
Unifacially Beveled, Pressure	38	21.47
Bifacially Beveled - Pressure on One Side and Percussion on the Other	1	0.56
None	7	3.95
Broken	40	22.60
Total	177	100.00

Table F-15. Notch Grinding1

	Frequency	Percent
Absent	6	3.39
Slight	61	34.46
Heavy	82	46.33
Broken	28	15.82
Total	177	100.00

Table F-16. Notch Grinding2

	Frequency	Percent
Absent	8	4.52
Slight	61	34.46
Heavy	84	47.46
Broken	24	13.56
Total	177	100.00

Table F-17. Barb Form1

	Frequency	Percent
Lanceolate Blade	1	0.56
Short Barbed	16	9.04
Square Shouldered	15	8.47
Acute Angle Shouldered	34	19.21
Obtuse Angle Shouldered	58	32.77
Broken	53	29.94
Total	177	100.00

Table F-18. Barb Form2

	Frequency	Percent
Lanceolate Blade	1	0.56
Short Barbed	16	9.04
Long Barbed, Wide	1	0.56
Square Shouldered	9	5.08
Acute Angle Shouldered	48	27.12
Obtuse Angle Shouldered	50	28.25
Broken	52	29.38
Total	177	100.00

Table F-19. Blade Thinning Obverse

	Frequency	Percent
Random, Shallow	83	46.89
Random, Deep	10	5.65
Unmodified	20	11.30
Completely Resharpened	4	2.26
N/A	2	1.13
Broken	58	32.77
Total	177	100.00

Table F-20. Blade Thinning Reverse

	Frequency	Percent
Random, Shallow	103	58.19
Random, Deep	7	3.95
Narrow, Parallel, Shallow	1	0.56
Unmodified	5	2.82
Completely Resharpened	4	2.26
N/A	2	1.13
Broken	55	31.07
Total	177	100.00

Table F-21. Blade Imperfections Obverse

	Frequency	Percent
Step	22	12.43
Step, Hinge	6	3.39
Step, Hinge, Cortex	1	0.56
Hinge	17	9.60
Absent	47	26.55
N/A	2	1.13
Broken	82	46.33
Total	177	100.00

Table F-22. Blade Imperfections Reverse

	Frequency	Percent
Step	25	14.12
Step, Hinge	15	8.47
Hinge	14	7.91
Absent	41	23.16
N/A	2	1.13
Broken	80	45.20
Total	177	100.00

Table F-23. Blade Cross-section

	Frequency	Percent
Lenticular	13	7.34
Flattened	3	1.69
Irregular	62	35.03
Hexagonal	12	6.78
Rhomboidal	8	4.52
Plano-Convex	6	3.39
Platformed	4	2.26
Platformed-Convex	2	1.13
Broken	67	37.85
Total	177	100.00

Table F-24. Blade Trimming/Resharpening Obverse1

	Frequency	Percent
Random Pressure	96	54.24
Parallel Pressure	1	0.56
Isolated Pressure	5	2.82
Absent	5	2.82
Completely Resharpened	7	3.95
N/A	1	0.56
Broken	62	35.03
Total	177	100.00

Table F-25. Blade Trimming/Resharpening Obverse2

	Frequency	Percent
Random Pressure	97	54.80
Parallel Pressure	1	0.56
Isolated Pressure	2	1.13
Absent	6	3.39
Completely Resharpened	7	3.95
N/A	1	0.56
Broken	63	35.59
Total	177	100.00

Table F-26. Blade Trimming/Resharpening Reverse1

	Frequency	Percent
Random Pressure	99	55.93
Isolated Percussion	1	0.56
Isolated Pressure	8	4.52
Completely Resharpened	7	3.95
N/A	1	0.56
Broken	61	34.46
Total	177	100.00

Table F-27. Blade Trimming/Resharpening Reverse2

	Frequency	Percent
Random Pressure	98	55.37
Parallel Pressure	1	0.56
Isolated Percussion	1	0.56
Isolated Pressure	6	3.39
Absent	1	0.56
Completely Resharpened	7	3.95
N/A	1	0.56
Broken	62	35.03
Total	177	100.00

Table F-28. Blade Trimming/Resharpening Method

	Frequency	Percent
Serrations and Left-hand Beveled, Shallow	1	0.56
Serrations and Mid-South Beveled	2	1.13
Left-hand Beveled, Shallow	1	0.56
Left-hand Beveled, Steep	1	0.56
Right-hand Beveled, Shallow	1	0.56
Right-hand Beveled, Steep	6	3.39
Mid-South Beveled	35	19.77
Unifacial Beveled, Shallow	2	1.13
Unifacial Beveled, Shallow and Unifacial Beveled, Steep	1	0.56
Unifacial Beveled, Steep	3	1.69
No Pattern	47	26.55
Completely Resharpened	7	3.95
N/A	1	0.56
Broken	69	38.98
Total	177	100.00

Table F-29. Blade Shape1

	Frequency	Percent
Slightly Excurvate	26	14.69
Excurvate	24	13.56
Slightly Incurvate	2	1.13
Incurvate	3	1.69
Slightly Recurved	7	3.95
Recurved	3	1.69
Straight, Triangular	5	2.82
Straight, Squared	3	1.69
Pentagonal	2	1.13
Irregular	14	7.91
Completely Resharpened	7	3.95
Broken	81	45.76
Total	177	100.00

Table F-30. Blade Shape2

	Frequency	Percent
Slightly Excurvate	25	14.12
Excurvate	18	10.17
Slightly Incurvate	3	1.69
Incurvate	3	1.69
Slightly Recurved	7	3.95
Recurved	1	0.56
Straight, Triangular	11	6.21
Pentagonal	2	1.13
Irregular	19	10.73
Completely Resharpened	7	3.95
Broken	81	45.76
Total	177	100.00

Table F-31. Point Shape

	Frequency	Percent
Acute, Pointed	10	5.65
Pointed	21	11.86
Rounded	4	2.26
Unifacial Transverse	49	27.68
Broken	93	52.54
Total	177	100.00

Table F-32. Damage

	Frequency	Percent
Impact Fracture	15	5.56
Lateral Snap Fracture	22	8.15
Incipient Fracture Plane	2	0.74
Crenated Fracture	35	12.96
Pot Lid	18	6.67
Haft Snap	6	2.22
Smashing Fracture	3	1.11
Excavation Breaks	37	13.70
Unknown	90	33.33
None	42	15.56
Total	270	100.00

APPENDIX G

NON-METRIC TRAITS – CHIGGERVILLE SARATOGA CLUSTER HAFTED BIFACES

Table G-1. Shape of Base

	Frequency	Percent
Constricting Stemmed	8	2.90
Constricting Stemmed, Straight Stemmed	2	0.72
Constricting Stemmed, Expanding Stemmed	3	1.09
Straight Stemmed	46	16.67
Straight Stemmed, Expanding Stemmed	7	2.54
Expanding Stemmed	187	67.75
Asymmetrical	5	1.81
Broken	18	6.52
Total	276	100.00

Table G-2. Base Form

	Frequency	Percent
Slightly Concave	14	5.07
Concave	2	0.72
Straight	38	13.77
Slightly Convex	85	30.80
Convex	49	17.75
Platformed	2	0.72
Straight Angled	19	6.88
Irregular	29	10.51
Broken	38	13.77
Total	276	100.00

Table G-3. Base Modifications

	Frequency	Percent
Platformed Unmodified	23	8.33
Cortex Unmodified	7	2.54
Snap Fracture	8	2.90
Thinned	212	76.81
Burinated	1	0.36
Flake Termination Unmodified	2	0.72
Broken	23	8.33
Total	276	100.00

Table G-4. Ear Form1

	Frequency	Percent
Acute Angled	64	23.19
Round	44	15.94
Square	10	3.62
Obtuse Angled	103	37.32
Flake Blank Striking Platformed	2	0.72
Broken	53	19.20
Total	276	100.00

Table G-5. Ear Form2

	Frequency	Percent
Acute Angled	64	23.19
Round	41	14.86
Square	8	2.90
Obtuse Angled	112	40.58
Flake Blank Striking Platform	1	0.36
Broken	50	18.12
Total	276	100.00

Table G-6. Basal Grinding

	Frequency	Percent
Absent	68	24.64
Slight	135	48.91
Heavy	44	15.94
Broken	29	10.51
Total	276	100.00

Table G-7. Lateral Haft Grinding1

	Frequency	Percent
Absent	32	11.59
Slight	149	53.99
Heavy	69	25.00
Broken	26	9.42
Total	276	100.00

Table G-8. Lateral Haft Grinding2

	Frequency	Percent
Absent	33	11.96
Slight	147	53.26
Heavy	69	25.00
Broken	27	9.78
Total	276	100.00

Table G-9. Basal Thinning Obverse

	Frequency	Percent
Intentional, Single Flake, Short	14	5.07
Intentional, Single Flake, Long	24	8.70
Intentional, Multiple Flakes, Short	29	10.51
Intentional, Multiple Flakes, Long	2	0.72
Epiphenomenal, Single Flake, Short	6	2.17
Epiphenomenal, Single Flake, Long	39	14.13
Epiphenomenal, Multiple Flakes, Long	14	5.07
Epiphenomenal, Multiple Flakes, Long and Epiphenomenal, Multiple Flakes, Short	1	0.36
Epiphenomenal, Multiple Flakes, Short	107	38.77
Unmodified	7	2.54
N/A	2	0.72
Broken	31	11.23
Total	276	100.00

Table G-10. Basal Thinning Reverse

	Frequency	Percent
Fluted, Single Flute	1	0.36
Intentional, Single Flake, Short	9	3.26
Intentional, Single Flake, Short and Intentional, Single Flake, Long	1	0.36
Intentional, Single Flake, Short and Epiphenomenal, Single Flake, Short	1	0.36
Intentional, Single Flake, Long	17	6.16
Intentional, Multiple Flakes, Short	40	14.49
Intentional, Multiple Flakes, Long	10	3.62
Epiphenomenal, Single Flake, Short	3	1.09
Epiphenomenal, Single Flake, Short and Epiphenomenal, Single Flake, Long	1	0.36
Epiphenomenal, Single Flake, Long	32	11.59
Epiphenomenal, Multiple Flakes, Long	19	6.88
Epiphenomenal, Multiple Flakes, Short	101	36.59
Unmodified	7	2.54
N/A	3	1.09
Broken	31	11.23
Total	276	100.00

Table G-11. Base Retouch1

	Frequency	Percent
Present	127	46.01
Absent	86	31.16
Present - Unifacial Bevel	31	11.23
Broken	32	11.59
Total	276	100.00

Table G-12. Base Retouch2

	Frequency	Percent
Present	137	49.64
Absent	73	26.45
Present - Unifacial Bevel	31	11.23
N/A	1	0.36
Broken	34	12.32
Total	276	100.00

Table G-13. Lateral Haft Trimming1

	Frequency	Percent
Bifacially Beveled, Pressure	81	29.35
Unifacially Beveled, Pressure	27	9.78
Bifacially Beveled, Percussion	54	19.57
Unifacially Beveled, Percussion	16	5.80
Bifacially Beveled - Pressure on One Side and Percussion on the Other	66	23.91
Broken	32	11.59
Total	276	100.00

Table G-14. Lateral Haft Trimming2

	Frequency	Percent
Bifacially Beveled, Pressure	74	26.81
Unifacially Beveled, Pressure	23	8.33
Bifacially Beveled, Percussion	50	18.12
Unifacially Beveled, Percussion	18	6.52
Bifacially Beveled - Pressure on One Side and Percussion on the Other	76	27.54
None	1	0.36
Broken	34	12.32
Total	276	100.00

Table G-15. Barb Form1

	Frequency	Percent
Lanceolate Blade	7	2.54
Short Barbed	17	6.16
Square Shouldered	9	3.26
Acute Angle Shouldered	31	11.23
Obtuse Angled Shouldered	186	67.39
Broken	26	9.42
Total	276	100.00

Table G-16. Barb Form2

	Frequency	Percent
Lanceolate Blade	10	3.62
Short Barbed	14	5.07
Square Shouldered	8	2.90
Acute Angle Shouldered	27	9.78
Obtuse Angle Shouldered	198	71.74
Broken	19	6.88
Total	276	100.00

Table G-17. Blade Thinning Obverse

	Frequency	Percent
Random, Shallow	180	65.22
Random, Deep	48	17.39
Wide, Parallel, Shallow	1	0.36
Unmodified	6	2.17
Completely Resharpened	7	2.54
N/A	12	4.35
Broken	22	7.97
Total	276	100.00

Table G-18. Blade Thinning Reverse

	Frequency	Percent
Random, Shallow	182	65.94
Random, Deep	46	16.67
Wide, Parallel, Shallow	4	1.45
Narrow, Parallel, Shallow	1	0.36
Completely Resharpened	7	2.54
N/A	12	4.35
Broken	24	8.70
Total	276	100.00

Table G-19. Blade Imperfections Obverse

	Frequency	Percent
Step	24	8.70
Step, Hinge	33	11.96
Hinge	60	21.74
Cortex	1	0.36
Absent	96	34.78
N/A	12	4.35
Broken	50	18.12
Total	276	100.00

Table G-20. Blade Imperfections Reverse

	Frequency	Percent
Step	25	9.06
Step, Hinge	32	11.59
Step, Cortex	1	0.36
Hinge	53	19.20
Absent	93	33.70
N/A	12	4.35
Broken	60	21.74
Total	276	100.00

Table G-21. Blade Cross-section

	Frequency	Percent
Lenticular	33	11.96
Diamond	5	1.81
Irregular	114	41.30
Triangular	1	0.36
Hexagonal	6	2.17
Rhomboidal	7	2.54
Plano-Convex	40	14.49
Bi-Convex	13	4.71
Platformed	10	3.62
Convex-Triangular	3	1.09
Platformed-Convex	1	0.36
Broken	43	15.58
Total	276	100.00

Table G-22. Blade Trimming/Resharpening Obverse1

	Frequency	Percent
Random Percussion	16	5.80
Random Percussion and Random Pressure	2	0.72
Random Percussion and Isolated Pressure	1	0.36
Random Pressure	149	53.99
Random Pressure and Isolated Percussion	6	2.17
Parallel Pressure	3	1.09
Isolated Percussion	5	1.81
Isolated Pressure	12	4.35
Absent	17	6.16
Completely Resharpened	11	3.99
N/A	13	4.71
Broken	41	14.86
Total	276	100.00

Table G-23. Blade Trimming/Resharpening Obverse2

	Frequency	Percent
Random Percussion	13	4.71
Random Percussion and Random Pressure	3	1.09
Random Percussion and Isolated Pressure	2	0.72
Random Pressure	159	57.61
Random Pressure and Isolated Percussion	3	1.09
Parallel Pressure	6	2.17
Parallel Oblique Pressure	1	0.36
Isolated Percussion	3	1.09
Isolated Percussion and Isolated Pressure	2	0.72
Isolated Pressure	16	5.80
Absent	13	4.71
Completely Resharpened	11	3.99
N/A	13	4.71
Broken	31	11.23
Total	276	100.00

Table G-24. Blade Trimming/Resharpening Reverse1

	Frequency	Percent
Random Percussion	10	3.62
Random Percussion and Random Pressure	3	1.09
Random Pressure	168	60.87
Random Pressure and Isolated Percussion	2	0.72
Parallel Pressure	4	1.45
Isolated Percussion	3	1.09
Isolated Pressure	17	6.16
Absent	10	3.62
Completely Resharpened	11	3.99
N/A	13	4.71
Broken	35	12.68
Total	276	100.00

Table G-25. Blade Trimming/Resharpening Reverse2

	Frequency	Percent
Random Percussion	6	2.17
Random Percussion and Random Pressure	3	1.09
Random Percussion and Isolated Pressure	1	0.36
Random Pressure	167	60.51
Random Pressure and Isolated Percussion	4	1.45
Parallel Pressure	3	1.09
Isolated Percussion	4	1.45
Isolated Percussion and Isolated Pressure	2	0.72
Isolated Pressure	14	5.07
Absent	13	4.71
Completely Resharpened	11	3.99
N/A	13	4.71
Broken	35	12.68
Total	276	100.00

Table G-26. Blade Trimming/Resharpening Method

	Frequency	Percent
Serrations	2	0.72
Left-hand Beveled, Shallow	2	0.72
Left-hand Beveled, Steep	6	2.17
Left-hand Beveled, Steep and Right-hand Beveled, Shallow	1	0.36
Right-hand Beveled, Shallow	3	1.09
Right-hand Beveled, Shallow and Right-hand Beveled, Steep	1	0.36
Right-hand Beveled, Steep	2	0.72
Mid-South Beveled	9	3.26
Unifacial Beveled, Shallow	9	3.26
Unifacial Beveled, Steep	28	10.14
No Pattern	144	52.17
Completely Resharpened	10	3.62
Little to No Resharpening	2	0.72
N/A	13	4.71
Broken	44	15.94
Total	276	100.00

Table G-27. Blade Shape1

	Frequency	Percent
Slightly Excurvate	54	19.57
Excurvate	53	19.20
Slightly Incurvate	3	1.09
Incurvate	7	2.54
Slightly Recurved	11	3.99
Recurved	4	1.45
Straight, Triangular	8	2.90
Straight, Squared	4	1.45
Pentagonal	3	1.09
Irregular	51	18.48
Straight, Expanding	2	0.72
Completely Resharpened	9	3.26
Broken	67	24.28
Total	276	100.00

Table G-28. Blade Shape2

	Frequency	Percent
Slightly Excurvate	56	20.29
Excurvate	50	18.12
Slightly Incurvate	6	2.17
Incurvate	5	1.81
Slightly Recurved	12	4.35
Recurved	2	0.72
Straight, Triangular	15	5.43
Straight, Squared	5	1.81
Pentagonal	1	0.36
Irregular	49	17.75
Straight, Expanding	4	1.45
Completely Resharpened	10	3.62
Broken	61	22.10
Total	276	100.00

Table G-29. Point Shape

	Frequency	Percent
Acute, Pointed	16	5.80
Pointed	35	12.68
Rounded	13	4.71
Unifacial Transverse	82	29.71
Bifacial Transverse	4	1.45
Absent	11	3.99
Broken	115	41.67
Total	276	100.00

Table G-30. Damage

	Frequency	Percent
Perverse Fracture	1	0.28
Impact Fracture	52	14.57
Lateral Snap Fracture	26	7.28
Incipient Fracture Plane	1	0.28
Crenated Fracture	21	5.88
Pot Lid	30	8.40
Haft Snap	13	3.64
Smashing Fracture	2	0.56
Excavation Break	47	13.17
Unknown	74	20.73
None	90	25.21
Total	357	100.00

APPENDIX H

CHIGGERVILLE MARINE SHELL ARTIFACTS

Table H-1. Chiggerville Marine Shell Artifacts.

Field Burial No.	Total Number of Marine Shell Artifacts	Total Number of *Leptoxis* Beads	Estimated Minimum Number of Marine Shell Artifacts	Estimated Maximum Number of Marine Shell Artifacts	Estimated Minimum Number of *Leptoxis* Artifacts	Estimated Maximum Number of *Leptoxis* Artifacts
8A	13	0	1	2	0	0
19	11	0	1	1	0	0
23	190	0	1	1	0	0
26	3	0	1	1	0	0
31	281	0	3	7	0	0
32	27	0	1	1	0	0
36	2	0	1	1	0	0
42	130	0	1	1	0	0
44	54	0	3	3	0	0
60	2	0	1	1	0	0
63	5	0	2	3	0	0
64	30	539	2	2	1	1
66	1	0	1	1	0	0
67	27	0	1	1	0	0
72	14	0	1	14	0	0
73	143	0	1	1	0	0
74	37	0	1	37	0	0
77	65	0	1	1	0	0
80	12	0	2	2	0	0
83	90	0	2	2	0	0
90	2	0	1	2	0	0
93	100	236	1	1	1	1
94	0	288	0	0	1	1
105	29	0	1	1	0	0
110	5	0	1	5	0	0
Total	1273	1063	32	92	3	3

References

Abel, Timothy J., David M. Stothers, and Jason M. Koralewski

2001 The Williams Mortuary Complex: A Transitional Archaic Regional Interaction Center in Northwestern Ohio. In *Archaic Transitions in Ohio & Kentucky Prehistory*, edited by Olaf H. Prufer, Sara E. Pedde, and Richard S. Meindl, pp. 290-327. Kent State University Press, Kent, Ohio.

Adams, Jenny L.

2002 *Ground Stone Analysis: A Technological Approach*. University of Utah Press, Salt Lake City.

Adovasio, J. M., J. Donahue, and R. Stuckenrath

1990 The Meadowcroft Rockshelter Radiocarbon Chronology 1975-1990. *American Antiquity* 55(2):348-354.

Adovasio, J. M., R. Fryman, A. G. Quinn, D. C. Dirkmaat, and D. R. Pedler

2001 The Archaic of the Upper Ohio Valley: A View from Meadowcroft Rockshelter. In *Archaic Transitions in Ohio & Kentucky Prehistory*, edited by Olaf H. Prufer, Sara E. Pedde, and Richard S. Meindl, pp. 141-182. Kent State University Press, Kent, Ohio.

Ahler, Steven Randolph

1984 *Archaic Settlement Strategies in the Modoc Locality, Southwest Illinois*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Wisconsin, Milwaukee.

1991 Modoc Matting and Beads: Cultural Complexity in the Early Archaic Period. *The Living Museum* 53(1):3-6.

1993 Stratigraphy and Radiocarbon Chronology of Modoc Rock Shelter, Illinois. *American Antiquity* 58(3):462-489.

Ahler, Steven R. and Brad Koldehoff

2009 Dated Projectile Point Sequence from Modoc Rock Shelter and Applications of Assemblage-Based Analysis. In *Archaic Societies: Diversity and Complexity across the Midcontinent*, edited by Tomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 199-277. State University of New York Press, Albany.

Albertson, Donald G. and Douglas K. Charles

1988 Archaic Mortuary Component. In *The Archaic and Woodland Cemeteries at the Elizabeth Site in the Lower Illinois Valley*, edited by Douglas K. Charles, Steven R. Leigh, and Jane E. Buikstra, pp. 29-40. Kampsville Archeological Center Research Series 7, Center for American Archeology, Kampsville Archeological Center, Kampsville, Illinois.

Albrecht, Gerd

1977 Testing of Materials as Used for Bone Points of the Upper Paleolithic. In *Méthodologie Appliquée a L'Industrie de L'Os Préhistorique*, edited by H. Camps Fabrer, pp. 119-123. Colloques Internationaux du C.N.R.S. 568.

Aldenderfer, Mark

1993 Ritual, Hierarchy, and Change in Foraging Societies. *Journal of Anthropological Archaeology* 12:1-40.

Alekshin, V. A.

1983 Burial Customs as an Archaeological Source. *Current Anthropology* 24(2):137-149.

Ames, Kenneth M.

1981 The Evolution of Social Ranking on the Northwest Coast of North America. *American Antiquity* 46(4):789-805.

1985 Hierarchies, Stress, and Logistical Strategies among Hunter-Gatherers in Northwestern North America. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 155-180. Academic Press, Orlando.

1991 Sedentism: A Temporal Shift or a Transitional Change in Hunter-Gatherer Mobility Patterns? In *Between Bands and States*, edited by Susan A. Gregg, pp. 108-134. Center for Archaeological Investigations Occasional Paper No. 9, Southern Illinois University, Carbondale.

Amick, Daniel S. and Philip J. Carr

1996 Changing Strategies of Lithic Technological Organization. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 41-56. University Press of Florida, Gainesville.

Anderson, David G.

1995 Paleoindian Interaction Networks in the Eastern Woodlands. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 3-26. University of Tennessee Press, Knoxville.

1996 Models of Paleoindian and Early Archaic Settlement in the Lower Southeast. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 29-57. University of Alabama Press, Tuscaloosa.

2003 The Evolution of Tribal Social Organization in the Southeastern United States. In *The Archaeology of Tribal Societies*, edited by William A. Parkinson, pp. 246-277. International Monographs in Prehistory Archaeological Series, Ann Arbor, Michigan.

2004 Archaic Mounds and the Archaeology of Southeastern Tribal Societies. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 270-299. University of Alabama Press, Tuscaloosa.

Anderson, David G. and Glen T. Hanson
1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2):262-286.
Anderson, David G. and Kenneth E. Sassaman

1996 Modeling Paleoindian and Early Archaic Settlement in the Southeast: A Historical Perspective. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 16-28. University of Alabama Press, Tuscaloosa.

Andrefsky, William, Jr.
1994 Raw-Material Availability and the Organization of Technology. *American Antiquity* 59(1):21-34.

1998 *Lithics: Macroscopic Approaches to Analysis*. Cambridge University Press, Cambridge, UK.

Arndt, Sandra and Mark Newcomer
1986 Breakage Patterns on Prehistoric Bone Points: An Experimental Study. In *Studies in the Upper Palaeolithic of Britain and Northwest Europe*, edited by D. A. Roe, pp. 165-173. BAR International Series 296.

Arnold, Bettina
2006 Gender and Archaeological Mortuary Analysis. In *Handbook of Gender in Archaeology*, edited by Sarah Milledge Nelson, pp. 137-170. Altamira Press, Lanham, Maryland.

Arnold, Jeanne E.
1987 Technology and Economy: Microblade Core Production from the Channel Islands. In *The Organization of Core Technology*, edited by Jay K. Johnson and Carol A. Morrow, pp. 207-237. Westview Press, Boulder.

1995 Transportation Innovation and Social Complexity among Maritime Hunter-Gatherer Societies. *American Anthropologist* 97(4):733-747.

1996a Organizational Transformations: Power and Labor among Complex Hunter-Gatherers and Other Intermediate Societies. In *Emergent Complexity: The Evolution of Intermediate Societies*, edited by Jeanne E. Arnold, pp. 59-73. International Monographs in Prehistory Archaeological Series 9, Ann Arbor, Michigan.

1996b Understanding the Evolution of Intermediate Societies. In *Emergent Complexity: The Evolution of Intermediate Societies*, edited by Jeanne E. Arnold, pp. 1-12. International Monographs in Prehistory Archaeological Series 9, Ann Arbor, Michigan.

2000 Revisiting Power, Labor Rights, and Kinship: Archaeology and Social Theory. In *Social Theory in Archaeology*, edited by Michael Brian Schiffer, pp. 14-30. University of Utah Press, Salt Lake City.

Arnold, Jeanne E. and Ann Munns

1994 Independent or Attached Specialization: The Organization of Shell Bead Production in California. *Journal of Field Archaeology* 21(4):473-489.

Asch, Nancy B., Richard I. Ford, and David L. Asch

1972 *Paleoethnobotany of the Koster Site: The Archaic Horizons*. Illinois Valley Archaeological Program Research Papers Vol. 6, Illinois State Museum Reports of Investigations No. 24, Springfield, Illinois.

Baby, Raymond S.

1961 A Glacial Kame Wolf Mask-Headdress. *American Antiquity* 26(4):552-553.

1962 A Hopewell Human Bone Whistle. *Ohio Archaeologist* 12(1-2):46-47.

Bader, Anne Tobbe

1992 *An Analysis of Bone and Antler Tool Use Patterns from the Kentucky Air National Guard Site*. Unpublished M.A. thesis, Department of Anthropology, University of Kentucky, Lexington.

Bader, Anne T. and Joseph E. Granger

1989 *Recent Archaeological Investigations on the Kentucky Air National Guard Site (15JF267) Jefferson County, Kentucky*. Granger Consultants. Submitted to Kentucky Air National Guard.

Baer, John Leonard

1921 A Preliminary Report on the So-Called ‘Bannerstones.’ *American Anthropologist* 23(4):445-459.

Barnard, Alan
1992 Social and Spatial Boundary Maintenance among Southern African Hunter-Gatherers. In *Mobility and Territoriality: Social and Spatial Boundaries among Foragers, Fishers, Pastoralists and Peripatetics*, edited by Michael J. Casimir and Aparna Rao, pp. 137-151. Berg, New York.

Barnard, Alan and James Woodburn
1988 Property, Power and Ideology in Hunter-Gathering Societies: An Introduction. In *Hunters and Gatherers Volume 2: Property, Power and Ideology*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 4-31. Berg, Oxford.

Barth, Fredrik
1967 On the Study of Social Change. *American Anthropologist* 69(6):661-669.

Barton, C. Michael and G. A. Clark
1997 Evolutionary Theory in Archaeological Explanation. In *Rediscovering Darwin: Evolutionary Theory and Archeological Explanation*, edited by C. Michael Barton and Geoffrey A. Clark, pp. 3-15. Archaeological Papers of the American Anthropological Association No. 7, Arlington, Virginia.

Barton, C. Michael, G. A. Clark, and Allison E. Cohen
1994 Art as Information: Explaining Upper Palaeolithic Art in Western Europe. *World Archaeology* 26(2):185-207.

Begler, Elsie B.
1978 Sex, Status, and Authority in Egalitarian Society. *American Anthropologist* 80(3):571-588.

Bender, Barbara
1978 Gatherer-Hunter to Farmer: A Social Perspective. *World Archaeology* 10(2):204-222.

1985a Emergent Tribal Formations in the American Midcontinent. *American Antiquity*. 50(1): 52-62.

1985b Prehistoric Developments in the American Midcontinent and in Brittany, Northwest France. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 21-57. Academic Press, Orlando.

Bender, Barbara
1989 The Roots of Inequality. In *Domination and Resistance*, edited by Daniel Miller, Michael Rowlands, and Christopher Tilley, pp. 83-95.

Bentz, Charles Jr.

1986 *The Chapman Site: A Terminal Archaic Settlement in the Middle Cumberland River Drainage of Tennessee*. Tennessee Anthropological Association Miscellaneous Paper No. 11, University of Tennessee, Knoxville, Tennessee.

Bettinger, Robert L.

1991 *Hunter-Gatherers: Archaeological and Evolutionary Theory*. Plenum Press, New York.

Bettis, E. Arthur III

1992 Soil Morphologic Properties and Weathering Zone Characteristics as Age Indicators in Holocene Alluvium in the Upper Midwest. In *Soils in Archaeology: Landscape Evolution and Human Occupation*, edited by Vance T. Holliday, pp. 119-144. Smithsonian Institution Press.

Binford, Lewis R.

1971 Mortuary Practices: Their Study and Their Potential. In *Approaches to the Social Dimensions of Mortuary Practices*, edited by James A. Brown, pp. 6-29. Memoirs of the Society for American Archaeology 25, Washington, D.C.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35(3):255-273.

1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

1981 *Bones: Ancient Men and Modern Myths*. Academic Press, New York.

Bird-David, Nurit

1990 The Giving Environment: Another Perspective on the Economic Systems of Hunter-Gatherers. *Current Anthropology* 31(2):189-196.

1991 Hunter-gatherers and Other People: A Re-examination. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 17-30. Berg, Oxford.

Bloch, Maurice

1983 *Marxism and Anthropology: The History of a Relationship*. Clarendon Press, Oxford.

Boisvert, Richard

1978 Mortuary Practices, Modes of Exchange and Culture Change: Archaeological Evidence from the Lower Ohio Valley. *Bulletin of the Kentucky Archaeological Association, Inc.* 12:1-16.

1979a Aspects of Lithic Technology in Early Archaic, Late Archaic-Early Woodland. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 950-978. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

1979b Excavations at the Spadie Site (15JF14). In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 804-882. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Boserup, Ester
1965 *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. Aldine Publishing Company, Chicago.

Braun, David P. and Stephen Plog
1982 Evolution of 'Tribal' Social Networks: Theory and Prehistoric North American Evidence. *American Antiquity* 47(3):504-525.

Braun, E. Lucy
1950 *Deciduous Forests of Eastern North America*. Blakiston, Philadelphia.

Breitburg, Emanuel
1982 Analysis of Area A Fauna. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 861-957. Center for Archaeological Investigations Research Paper No. 33, Southern Illinois University at Carbondale, Carbondale, Illinois.

Breternitz, David A., Alan C. Swedlund, and Duane C. Anderson
1971 An Early Burial from Gordon Creek, Colorado. *American Antiquity* 36(2):170-182.

Brookes, Samuel O.
1999 Prehistoric Exchange in Mississippi, 10,000 B.C. – A.D. 1600. In *Raw Materials and Exchange in the Mid-South: Proceedings of the 16th Annual Mid-South Archaeological Conference, Jackson, Mississippi—June 3 and 4, 1995*, edited by Evan Peacock and Samuel O. Brookes, pp. 86-94. Mississippi Department of Archives and History Archaeological Report No. 29, Jackson, Mississippi.

Brose, David S.
1979 A Speculative Model of the Role of Exchange in the Prehistory of the Eastern Woodlands. In *Hopewell Archaeology: The Chillicothe Conference*, edited by David S. Brose and N'omi Greber, pp. 3-8. Kent State University Press, Kent, Ohio.

Brown, James A.

1983 Summary. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 5-10. Academic Press, New York.

1985 Long-Term Trends to Sedentism and the Emergence of Complexity in the American Midwest. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 201-231. Academic Press, Orlando.

1986 Food for Thought: Where Has Subsistence Analysis Gotten Us? In *Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in the Eastern Woodlands*, edited by Sarah W. Neusius, pp. 315-330. Center for Archaeological Investigations Occasional Paper No. 6, Southern Illinois University, Carbondale.

Brown, James A. and Robert K. Vierra

1983 What Happened in the Middle Archaic? Introduction to an Ecological Approach to Koster Site Archaeology. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 165-195. Academic Press, New York.

Brown, James A. and T. Douglas Price

1985 Complex Hunter-Gatherers: Retrospect and Prospect. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 435-442. Academic Press, Orlando, Florida.

Brumfiel, Elizabeth M. and Timothy K. Earle

1987 Specialization, Exchange, and Complex Societies: An Introduction. In *Specialization, Exchange, and Complex Societies*, edited by Elizabeth M. Brumfiel and Timothy K. Earle, pp. 1-9. Cambridge University Press, Cambridge.

Buikstra, Jane E.

1981 Mortuary Practices, Palaeodemography and Palaeopathology: A Case Study from the Koster Site (Illinois). In *The Archaeology of Death*, edited by Robert Chapman, Ian Kinnes, and Klavs Randsborg, pp. 123-132. Cambridge University Press, Cambridge.

Buikstra, Jane E. and Douglas K. Charles

1999 Centering the Ancestors: Cemeteries, Mounds, and Sacred Landscapes of the Ancient North American Midcontinent. In *Archaeologies of Landscape: Contemporary Perspectives*, edited by Wendy Ashmore and A. Bernard Knapp, pp. 201-228. Blackwell, Malden, MA.

Builth, Heather
2006 Gunditjmara Environmental Management: The Development of a Fisher-Gatherer-Hunter Society in Temperate Australia. In *Beyond Affluent Foragers: Rethinking Hunter-Gatherer Complexity*, edited by Colin Grier, Jangsuk Kim, and Junzo Uchiyama, pp. 4-23. Proceedings of the 9th Conference of the International Council of Archaeozoology, Oxbow Books, Park End Place, Oxford.

Burch, Ernest S. Jr.
1970 The Eskimo Trading Partnership in North Alaska: A Study in 'Balanced Reciprocity.' *Anthropological Papers of the University of Alaska* 15(1):49-80.

Burdin, Sheldon Richard
2004 *Interaction, Exchange, and Social Organization among Hunter-Gatherers in the Midcontinent—Evidence form the Lower Ohio River Valley: Bannerstone Use from 6500 to 3000 B.P.* Unpublished M.A. thesis, Department of Anthropology, University of Kentucky, Lexington.

Burke, Ariane M.
2004 Alternative Models of Spatial Organization for Pleistocene Hunter-Gatherers. In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 192-210. Center for Archaeological Investigations Occasional Paper No. 31, Southern Illinois University, Carbondale.

Burnett, Richard
1963 Lone Hill. *Central States Archaeological Journal*. 10(3): 84-90.

Bushèe, Eric
1998 Degenerative Joint Disease of the Chiggerville Site (15Oh1) as an Indicator of Biomechanical Stress. In *Current Archaeological Research in Kentucky*, volume 5, edited by Charles D. Hockensmith, Kenneth C. Carstens, Charles Stout, and Sara J. Rivers, pp. 59-70. Kentucky Heritage Council, Frankfort, Kentucky.

Butler, Brian M.
2009 Land between the Rivers: The Archaic Period of Southernmost Illinois. In *Archaic Societies: Diversity and Complexity across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 607-634. State University of New York Press, Albany.

Caldwell, Joseph R.
1958 *Trend and Tradition in the Prehistory of the Eastern United States*. American Anthropological Association Memoir 88, Illinois State Museum Scientific Papers 10, Springfield, Illinois.

Campana, Douglas V.
1989 *Natufian and Protoneolithic Bone Tools: The Manufacture and Use of Bone Implements in the Zagros and the Levant*. BAR International Series 494, Osney Mead, Oxford, Great Britain.

Cantin, Mark
1989 Diachronic Model of Hafted Biface Chert Usage in Southwestern Indiana. *Journal of the Steward Anthropological Society* 18(1-2):37-71.

2000 *Comparative Analysis of Thebes and Kirk Lithic Technology and Home Range Implications in Southwestern Indiana*. Unpublished M.A. thesis; Department of Geography, Geology, and Anthropology; Indiana State University, Terre Haute.

Carlson, David L.
1979 *Hunter-Gatherer Mobility Strategies: An Example from the Koster Site in the Lower Illinois Valley*. Unpublished Ph.D. dissertation, Department of Anthropology, Northwestern University, Evanston, Illinois. University Microfilms, Ann Arbor.

Carneiro, Robert L.
1973 The Four Faces of Evolution. In *Handbook of Social and Cultural Anthropology*, edited by John J. Honigmann, pp. 89-110. Rand McNally, Chicago.

Carr, Christopher
1995 Mortuary Practices: Their Social, Philosophical-Religious, Circumstantial, and Physical Determinants. *Journal of Archaeological Method and Theory* 2(2):105-200.

2005 Rethinking Interregional Hopewellian 'Interaction'. In *Gathering Hopewell: Society, Ritual, and Ritual Interaction,* edited by Christopher Carr and D. Troy Case, pp. 575-623. Kluwer Academic and Plenum Publishers, New York.

Carr, Christopher, Beau J. Goldstein, and Jaimin D. Weets
2006 Estimating the Sizes and Social Compositions of Mortuary-Related Gatherings at Scioto Hopewell Earthwork-Mound Sites. In *Gathering Hopewell: Society, Ritual, and Ritual Interaction*, edited by Christopher Carr and D. Troy Case, pp. 480-532. Springer, New York.

Carr, Philip J. and Lee H. Stewart
2004 Poverty Point Chipped-Stone Tool Raw Materials. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 129-145. University of Alabama Press, Tuscaloosa.

Cashdan, Elizabeth A.

1980 Egalitarianism among Hunters and Gatherers. *American Anthropologist* 82(1):116-120.

1983 Territoriality among Human Foragers: Ecological Models and an Application to Four Bushman Groups. *Current Anthropology* 24(1):47-66.

Casimir, Michael J.

1992 The Dimensions of Territoriality: An Introduction. In *Mobility and Territoriality: Social and Spatial Boundaries among Foragers, Fishers, Pastoralists and Peripatetics*, edited by Michael J. Casimir and Aparna Rao, pp. 1-26. Berg, New York.

Champion, Don

1965 Crib Mound, Spencer County, Indiana. *Central States Archaeological Journal* 12(2):51-61.

Chapman, Carl H.

1975 *The Archaeology of Missouri, I*. University of Missouri Press, Columbia, Missouri.

Chapman, Jefferson

1977 *Archaic Period Research in the Lower Little Tennessee River Valley*. University of Tennessee Department of Anthropology Report of Investigations No. 18, Knoxville.

1978 *The Bacon Farm Site and a Buried Site Reconnaissance*. Tennessee Valley Authority Publications No. 21. University of Tennessee, Department of Anthropology, Report of Investigations No. 23, Knoxville.

1985 Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In *Structure and Process in Southeastern Archaeology*, edited by Roy S. Dickens, Jr. and H. Trawick Ward, pp. 137-153. University of Alabama Press, University.

1990 *The Kimberly-Clark Site (40LD208) and Site 40LD207*. Tennessee Anthropological Association Miscellaneous Paper No. 14. Department of Anthropology Report of Investigations No. 51, University of Tennessee, Knoxville.

Charles, Douglas K.

2005 The Archaeology of Death as Anthropology. In *Interacting with the Dead: Perspectives on Mortuary Archaeology for the New Millennium*, edited by Gordon F. M. Rakita, Jane E. Buikstra, Lane A. Beck, and Sloan R. Williams, pp. 15-24. University Press of Florida, Gainesville.

Charles, Douglas K. and Jane E. Buikstra

1983 Archaic Mortuary Sites in the Central Mississippi Drainage: Distribution, Structure, and Behavioral Implications. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 117-145. Academic Press, New York.

2002 Siting, Sighting, and Citing the Dead. In *The Space and Place of Death*, edited by Helaine Silverman and David Small, pp. 13-25. Archaeological Papers of the American Anthropological Association No. 11, Arlington, Virginia.

Charles, Douglas K., Jane E. Buikstra, and Lyle W. Konigsberg

1986 Behavioral Implications of Terminal Archaic and Early Woodland Mortuary Practices in the Lower Illinois Valley. In *Early Woodland Archeology*, edited by Kenneth B. Farnsworth and Thomas E. Emerson, pp. 458-474. Kampsville Seminars in Archeology, Volume 2, Center for American Archeology Press, Kampsville, Illinois.

Charles, Douglas K., Steven R. Leigh, and Donald G. Albertson

1988 Appendix 2: Burial Descriptions. In *The Archaic and Woodland Cemeteries at the Elizabeth Site in the Lower Illinois Valley*, edited by Douglas K. Charles, Steven R. Leigh, and Jane E. Buikstra, pp. 247-274. Kampsville Archeological Center Research Series 7, Center for American Archeology, Kampsville Archeological Center, Kampsville, Illinois.

Childe, V. Gordon

1963 *Social Evolution*. Meridian Books, Cleveland, OH.

Christenson, Andrew L.

1977 Some Trends in Biface Technology in Central Illinois. *Plains Anthropologist* 22-78(part 1):283-290.

Claassen, Cheryl P.

1991 Gender, Shellfishing, and the Shell Mound Archaic. In *Engendering Archaeology: Women and Prehistory*, edited by Joan M. Gero and Margaret W. Conkey, pp. 276-300. Blackwell Publishers, Oxford, United Kingdom.

1992 Shell Mounds as Burial Mounds: A Revision of the Shell Mound Archaic. In *Current Archaeological Research in Kentucky: Volume Two*, edited by David Pollack and A. Gwynn Henderson, pp. 1-11. Kentucky Heritage Council, Frankfurt.

1996 A Consideration of the Social Organization of the Shell Mound Archaic. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 235-258. University Press of Florida, Gainesville.

2010 *Feasting with Shellfish in the Southern Ohio Valley: Archaic Sacred Sites and Rituals*. University of Tennessee Press, Knoxville.

Claassen, Cheryl and Samuella Sigmann

1993 Sourcing *Busycon* Artifacts of the Eastern United States. *American Antiquity* 58(2):333-347.

Claessen, H. J. M.

1981 Reaching for the Moon? Some Problems and Prospects of Cultural Evolutionism. In *Archaeological Approaches to the Study of Complexity*, edited by S. E. van der Leeuw, pp. 15-37. Universiteit van Amsterdam, Amsterdam, The Netherlands.

Clark, Cherie

1980 Bone Tool Manufacture and Use by Prepottery Occupants of the McCutchan-McLaughlin Site. *Bulletin of the Oklahoma Anthropological Society* 29:19-48.

Clark, J. G. D. and M. W. Thompson

1953 The Groove and Splinter Technique of Working Antler in Upper Palaeolithic and Mesolithic Europe with Special Reference to the Material from Star Carr. *Proceedings of the Prehistoric Society* 19:148-160.

Clark, J. Desmond

1977 Bone Tools of the Early Pleistocene. *Eretz-Israel Archaeological, Historical and Geographic Studies* 13:23-37. Israel Exploration Society, Jerusalem.

Clark, John E.

2004 Surrounding the Sacred: Geometry and Design of Early Mound Groups as Meaning and Function. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 162-213. University of Alabama Press, Tuscaloosa.

Clark, John E. and Michael Blake

1996 The Power of Prestige: Competitive Generosity and the Emergence of Rank Societies in Lowland Mesoamerica. In *Contemporary Archaeology in Theory: A Reader*, edited by Robert W. Preucel and Ian Hodder, pp. 258-281. Blackwell, Oxford, United Kingdom.

Clark, John E. and William J. Parry

1990 Craft Specialization and Cultural Complexity. *Research in Economic Anthropology* 12:289-346.

Cleland, Charles E.
1976 The Focal-Diffuse Model: An Evolutionary Perspective on the Prehistoric Cultural Adaptations of the Eastern United States. *Midcontinental Journal of Archaeology* 1(1):59-76.

Cochran, Donald R., Paige Waldron, Ron Richards, Beth McCord, and Debbie Rotman
1998 *McCullough's Run: A Bifurcate Tradition Cemetery in Central Indiana*. Archaeological Resources Management Service Report of Investigations 44, Ball State University, Muncie, Indiana.

Cohen, Mark Nathan
1985 Prehistoric Hunter-Gatherers: The Meaning of Social Complexity. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 99-119. Academic Press, Orlando.

Cole, Fay-Cooper and Thorne Deuel
1937 *Rediscovering Illinois: Archaeological Explorations in and around Fulton County*. University of Chicago Press, Chicago.

Cole, George S.
1972 The Bannerstone as a Spear Weight. *Michigan Archaeologist* 18(1):1-7.

Collins, Michael B.
1975 Lithic Technology as a Means of Processual Inference. In *Making and Using Stone Tools*, edited E. Swanson, pp. 15-35. Mouton, Paris.

1979 The Longworth-Gick Site (15JF243). In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 471-589. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Collins, Michael B. and Boyce N. Driskell
1979 Summary and Conclusions. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky, Volume II*, edited by Michael B. Collins, pp. 1023-1042. Department of Anthropology Occasional Papers in Anthropology No. 1, University of Kentucky, Lexington.

Condon, Keith W. and Jerome C. Rose
1997 Bioarchaeology of the Sloan Site. In *Sloan: A Paleoindian Dalton Cemetery in Arkansas*, edited by Dan F. Morse, pp. 8-13. Smithsonian Institution Press, Washington, D.C.

Conkey, Margaret W.
1985 Ritual Communication, Social Elaboration, and the Variable Trajectories of Paleolithic Material Culture. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 299-323. Academic Press, Orlando.

Connaway, John
1981 The Keenan Bead Cache: Lawrence County, Mississippi. *Louisiana Archaeology* 8:57-71.

Cook, Thomas Genn
1976 *Koster: An Artifact Analysis of Two Archaic Phases in Westcentral Illinois*. Northwestern University Archeological Program Prehistoric Records No. 1, Koster Research Reports No. 3, Evanston, Illinois.

Costin, Cathy Lynne
1991 Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory* 3:1-56.

1998 Introduction: Craft and Social Identity. In *Craft and Social Identity*, edited by Cathy Lynne Costin and Rita P. Wright, pp. 3-16. Archaeological Papers of the American Anthropological Association No. 8.

Coupland, Gary
1996 This Old House: Cultural Complexity and Household Stability on the Northern Northwest Coast of North America. In *Emergent Complexity: The Evolution of Intermediate Societies*, edited by Jeanne E. Arnold, pp. 74-90. International Monographs in Prehistory Archaeological Series 9, Ann Arbor, Michigan.

Crawford, Gary W.
2005 Plant Remains from Carlston Annis (1972, 1974), Bowles, and Peter Cave. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 181-212. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Cross, John R.
1990 *Specialized Production in Non-Stratified Society: An Example from the Late Archaic in the Northeast*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Massachusetts, Amherst.

1993 Craft Specialization in Nonstratified Societies. *Research in Economic Anthropology* 14:61-84.

Crothers, George Martin

1999 *Prehistoric Hunters and Gatherers, and the Archaic Period Green River Shell Middens of Western Kentucky*. Unpublished Ph.D. dissertation, Department of Anthropology, Washington University, St. Louis, Missouri.

2004 The Green River in Comparison to the Lower Mississippi Valley during the Archaic. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 86-96. University of Alabama Press, Tuscaloosa.

2005 Vertebrate Fauna from the Carlston Annis Site. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 295-314. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

2008 From Foraging to Farming: The Emergence of Exclusive Property Rights in Kentucky Prehistory. In *Economies and the Transformation of Landscape*, edited L. Cliggett and C. Pool, pp. 127-147. Altamira Press.

Crothers, George M. and Reinhard Bernbeck

2004 The Foraging Mode of Production: The Case of the Green River Archaic Shell Middens. In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 401-422. Center for Archaeological Investigations Occasional Paper No. 31, Southern Illinois University, Carbondale.

Crumley, Carole L.

1995 Heterarchy and the Analysis of Complex Societies. In *Heterarchy and the Analysis of Complex Societies*, edited by Robert M. Ehrenreich, Carole L. Crumley, and Janet E. Levy, pp. 1-5. Archaeological Papers of the American Anthropological Association No. 6, Arlington, Virginia.

Cunningham, Wilbur M.

1948 *A Study of the Glacial Kame Culture in Michigan, Ohio, and Indiana*. Occasional Contributions from the Museum of Anthropology of the University of Michigan No. 12, University of Michigan Press, Ann Arbor.

Dale, Darla, Fiona Marshall, and Tom Pilgram

2004 Delayed-Return Hunter-Gatherers in Africa? Historic Perspectives from the Okiek and Archaeological Perspectives from the Kansyore. In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 340-375. Center for Archaeological Investigations Occasional Paper No. 31, Southern Illinois University, Carbondale.

Daniel, I. Randolph, Jr.
2001 Stone Raw Material Availability and Early Archaic Settlement in the Southeastern United States. *American Antiquity* 66(2):237-265.

David, Eva
2003 The Contribution of the Technological Study of Bone and Antler Industry for the Definition of the Early Maglemose Culture. In *Mesolithic on the Move: Papers presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*, edited by Lars Larsson, Hans Kindgren, Kjel Knutsson, David Loeffler, and Agneta Åkerlund, pp. 649-657. Oxbow Books, Oxford.

Davis, Dave D., Tristram R. Kidder, and David A. Barondess
1983 Reduction Analysis of Simple Bone Industries: An Example from the Louisiana Coastal Zone. *Archaeology of Eastern North America* 11:98-108.

DeBoer, Warren R.
1988 Subterranean Storage and the Organization of Surplus: The View from Eastern North America. *Southeastern Archaeology* 7(1):1-20.

Delcourt, Paul A. and Hazel R. Delcourt
1979 Late Pleistocene and Holocene Distributional History of the Deciduous Forest in the Southeastern United States. *Veroffentlichungen des Geobotanischen Instituts der ETH* 68:79-107.

1981 Vegetation Maps for Eastern North America. In *Geobotany II*, edited by R. Romans, pp. 123-165. Plenum Press, New York.

D'Errico, Francesco and Lucinda Backwell
2009 Assessing the Function of Early Hominin Bone Tools. *Journal of Archaeological Science* 36:1764-1773.

DiBlasi, Philip James
1981 *A New Assessment of the Archaeological Significance of the Ashworth Site (15Bu236): A Study of the Dynamics of Archaeological Investigation in Cultural Resource Management*. Unpublished M.S. Thesis, Interdisciplinary Studies, University of Louisville, Louisville, Kentucky.

Dietler, Michael
2001 Theorizing the Feast: Rituals of Consumption, Commensal Politics, and Power in African Contexts. In *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics, and Power*, edited by Michael Dietler and Brian Hayden, pp. 65-114. Smithsonian Institution Press, Washington, D.C.

Dobres, Marcia-Anne
1999 Of Paradigms and Ways of Seeing: Artifact Variability as if People Mattered. In *Material Meanings: Critical Approaches to the Interpretation of Material Culture*, edited by Elizabeth S. Chilton, pp. 7-23. University of Utah Press, Salt Lake City.

2000 *Technology and Social Agency: Outlining a Practice Framework for Archaeology*. Blackwell, Malden, Massachusetts.

Doershuk, John Frederick
1989 *Hunter-Gatherer Site Structure and Sedentism: The Koster Site Middle Archaic*. Unpublished Ph.D. dissertation, Department of Anthropology, Northwestern University, Evanston, Illinois.

Dole, Gertrude E.
1968 Tribe as the Autonomous Unit. In *Essays on the Problem of Tribe*, edited by June Helm, pp. 83-100. Proceedings of the 1967 Annual Spring Meeting of the American Ethnological Society, University of Washington Press, Seattle.

Doran, Glen H.
2002 Introduction to Wet Sites and Windover (8BR246) Investigations. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*, edited by Glen H. Doran, pp. 1-38. University Press of Florida, Gainesville.

Doucette, Dianna L.
2001 Decoding the Gender Bias: Inferences of Atlatls in Female Mortuary Contexts. In *Gender and the Archaeology of Death*, edited by Bettina Arnold and Nancy L. Wicker, pp. 159-177. Altamira Press, Walnut Creek, California.

Dowd, John T.
1989 *The Anderson Site: Middle Archaic Adaptation in Tennessee's Central Basin*. Tennessee Anthropological Association Miscellaneous Paper No. 13, University of Tennessee, Knoxville.

Dragoo, Don W.
1976 Some Aspects of Eastern North American Prehistory: A Review 1975. *American Antiquity* 41(1):3-27.

Driskell, Boyce N.
1979 The Rosenberger Site. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 697-803. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Duffield, Lathel F.

1966 *The Robert Dudgeon Site: A Stratified Archaic Site in the Green River Reservoir, South Central Kentucky*. University of Kentucky. Submitted to the National Park Service, Contract No. 14-10-0131-1659. Copies available at the Office of State Archaeology, University of Kentucky, Lexington.

1979 Faunal Studies. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 1006-1019. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Dunnell, Robert C.

1980 Evolutionary Theory and Archaeology. *Advances in Archaeological Method and Theory* 3:35-99.

Dye, David H.

1996 Riverine Adaptations in the Midsouth. In *Of Caves and Shell Mounds*, edited by Kenneth C. Carstens and Patty Jo Watson, pp. 140-158. University of Alabama Press, Tuscaloosa.

Dyson-Hudson, Rada and Eric Alden Smith

1978 Human Territoriality: An Ecological Reassessment. *American Anthropologist* 80(1):21-41.

Earle, Timothy

1997 *How Chiefs Come to Power: The Political Economy in Prehistory*. Stanford University Press, Stanford.

Ellen, Roy

1994 Modes of Subsistence: Hunting and Gathering to Agriculture and Pastoralism. In *Companion Encyclopedia of Anthropology*, edited by Tim Ingold, pp. 197-225. Routledge, London.

Emerson, Thomas E. and Dale L. McElrath

1983 A Settlement-Subsistence Model of the Terminal Late Archaic Adaptation in the American Bottom, Illinois. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A Brown, pp. 219-242. Academic Press, New York.

2001 Interpreting Discontinuity and Historical Process in Midcontinental Late Archaic and Early Woodland Societies. In *The Archaeology of Traditions: Agency and History Before and After Columbus*, edited by Timothy R. Pauketat, pp. 195-217. University Press of Florida, Gainesville.

Farnsworth, Kenneth B.
1987 Part Two: Preliminary Evaluation of Bannerstones and Other Ground-Stone Artifacts from the Bullseye Site, 11-Ge-127. In *The Bullseye Site: A Floodplain Archaic Mortuary Site in the Lower Illinois River Valley*, edited by Harold Hassen and Kenneth B. Farnsworth, pp. 13-54. Illinois State Museum Reports of Investigations No. 42, Springfield, Illinois.

Feinman, Gary M.
1995 The Emergence of Inequality: A Focus on Strategies and Processes. In *Foundations of Social Inequality*, edited by T. Douglas Price and Gary M. Feinman, pp. 255-279. Plenum Press, New York.

Fiedel, Stuart J.
1989 Social Implications of Ornaments in Hunter-Gatherer Burials. In *Proceedings of the 1986 Shell Bead Conference*, edited by Charles F. Hayes III, Lynn Ceci, and Connie Cox Bodner, pp. 189-197. Rochester Museum and Science Center Research Record No. 20, Rochester, New York.

Field, Stephanie, Anne J. Goldberg, and Tina Lee
2006 Gender, Status, and Ethnicity in the Scioto, Miami, and Northeastern Ohio Hopewellian Regions, as Evidenced by Mortuary Practices. In *Gathering Hopewell: Society, Ritual, and Ritual Interaction*, edited by Christopher Carr and D. Troy Case, pp. 386-404. Springer, New York.

Flannery, Kent V.
1972 Summary Comments: Evolutionary Trends in Social Exchange and Interaction. In *Social Exchange and Interaction*, edited by Edwin N. Wilmsen, pp. 129-135. Museum of Anthropology Anthropological Papers No. 46, University of Michigan, Ann Arbor.

Flenniken, J. Jeffrey
1981 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site*. *Laboratory of Anthropology Reports of Investigations 59*, Washington State University, Pullman.

Ford, James A. and Gordon R. Willey
1941 An Interpretation of the Prehistory of the Eastern United States. *American Anthropologist* 43(3):325-363.

Fowler, Melvin L.
1957 *Ferry Site, Hardin County, Illinois*. Illinois State Museum Scientific Papers 8(1), Springfield, Illinois.

1959a Modoc Rock Shelter: An Early Archaic Site in Southern Illinois. *American Antiquity* 24(3):257-270.

1959b *Modoc Rock Shelter: A Summary and Analysis of Four Seasons of Excavations*. Illinois State Museum Report of Investigations No. 8, Springfield, Illinois.

Fried, Morton H.

1966 On the Concepts of 'Tribe' and 'Tribal Society'. *Transactions of the New York Academy of Sciences*, Series II, 28(4):527-540.

1967 *The Evolution of Political Society: An Essay in Political Anthropology*. Random House, New York.

Frison, George C. and Carolyn Craig

1982 Bone, Antler, and Ivory Artifacts and Manufacture Technology. In *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*, edited by George C. Frison and Dennis J. Stanford, pp. 157-173. Academic Press, New York.

Frison, George C. and George M. Zeimens

1980 Bone Projectile Points: An Addition to the Folsom Cultural Complex. *American Antiquity* 45(2):231-237.

Fritz, Gayle J.

1997 A Three-Thousand-Year-Old Cache of Crop Seeds from Marble Bluff, Arkansas. In *People, Plants, and Landscapes: Studies in Paleoethnobotany*, edited by Kristen J. Gremillion, pp. 42-62. University of Alabama Press, Tuscaloosa.

Funkhouser, W. D. and W. S. Webb

1928 *Ancient Life in Kentucky: A Brief Presentation of the Paleontological Succession in Kentucky Coupled with a Systematic Outline of the Archaeology of the Commonwealth*. Kentucky Geological Survey, Frankfort, Kentucky.

Gamble, Clive

1986 *The Palaeolithic Settlement of Europe*. Cambridge University Press, Cambridge.

Gardner, Paul S.

1987 New Evidence Concerning the Chronology and Paleoethnobotany of Salts Cave, Kentucky. *American Antiquity* 52(2):358-367.

1994 Late Archaic Period Carbonized Plant Remains from the Wan's Floodplain (15Bt45) and the York-Render (15Bt92) Sites. In *The Archaic Settlement System of the Middle Green River Valley, Kentucky*, Christine Kay Hensley, pp. 304-325. Unpublished Ph.D. dissertation, Washington University, St. Louis.

1997 The Ecological Structure and Behavioral Implications of Mast Exploitation Strategies. In *People, Plants, and Landscapes Studies in Paleoethnobotany*, edited by Kristen J. Gremillion, pp. 161-178. University of Alabama Press, Tuscaloosa.

Gatus, Thomas W.

2005 A Preliminary Reconnaissance of Some West Central Kentucky Chert Resources. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 431-451. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Geller, Pamela L.

2005 Skeletal Analysis and Theoretical Complications. *World Archaeology* 37(4):597-609.

Gibson, Jon L.

1987 The Poverty Point Earthworks Reconsidered. *Mississippi Archaeology* 22(2):14-31.

1990 Lower Mississippi Valley Exchange at 1100 B.C. *Louisiana Archaeology* 17:1-12.

1994a Empirical Characterization of Exchange Systems in Lower Mississippi Valley Prehistory. In *Prehistoric Exchange Systems in North America*, edited by Timothy G. Baugh and Jonathon E. Ericson, pp. 127-175. Plenum Press, New York.

1994b Over the Mountain and Across the Sea: Regional Poverty Point Exchange. *Louisiana Archaeology* 17:251-299.

1996 Religion of the Rings, Poverty Point Iconology and Ceremonialism. In *Mounds, Embankments, and Ceremonialism in the Midsouth*, edited by R. C. Mainfort, Jr., and R. Walling, pp. 1-6. Research Series No. 46, Arkansas Archaeological Survey, Fayetteville.

1999 Swamp Exchange and the Walled Mart: Poverty Point's Rock Business. In *Raw Materials and Exchange in the Mid-South: Proceedings of the 16th Annual Mid-South Archaeological Conference, Jackson, Mississippi—June 3 and 4, 1995*, edited by Evan Peacock and Samuel O. Brookes, pp. 57-63. Mississippi Department of Archives and History Archaeological Report No. 29, Jackson, Mississippi.

2001 *The Ancient Mounds of Poverty Point: Place of Rings*. University Press of Florida, Gainesville.

2004 The Power of Beneficent Obligation in First Mound-Building Societies. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 254-269. University of Alabama Press, Tuscaloosa.

Gibson, Jon L. and David l. Griffing
1990 Only a Stone's Throw Away: Exchange in the Poverty Point Hinterland. *Louisiana Archaeology* 17:207-250.

Gibson, Jon L. and Philip J. Carr
2004 Big Mounds, Big Rings, Big Power. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 1-9. University of Alabama Press, Tuscaloosa.

Gilliland, Marion S.
1975 *The Material Culture of Key Marco, Florida*. University Presses of Florida, Gainesville.

Glore, Michael T.
2005 Vertebrate Faunal Remains from the Carlston Annis Site (15Bt5): An Evaluation of Cultural Stratigraphy. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 315-337. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Goad, Sharon I.
1980 Patterns of Late Archaic Exchange. *Tennessee Anthropologist* 5(1):1-16.

Goldman-Finn, Nurit S.
1994 Dust Cave in Regional Context. *Journal of Alabama Archaeology* 40(1-2):212-231.

Goldman-Finn, Nurit S. and Renee B. Walker
1994 The Dust Cave Bone Tool Assemblage. *Journal of Alabama Archaeology* 40(1-2):107-115.

Gorski, Linda
2005 Microstratigraphic Analysis at the Carlston Annis Site, Butler County, Kentucky. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 153-166. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Gray, Henry H.
1984 Archaeological Sedimentology of Overbank Silt Deposits on the Floodplain of the Ohio River near Louisville, Kentucky. *Journal of Archaeological Science* 11:421-432.

Green, Thomas J., Bruce Cochran, Todd W. Fenton, James C. Woods, Gene L. Titmus, Larry Tieszen, Mary Anne Davis, and Susanne J. Miller
1998 The Buhl Burial: A Paleoindian Woman from Southern Idaho. *American Antiquity* 63(3):437-456.

Gremillion, Kristen J.
1995 Botanical Contents of Paleofeces from Two Eastern Kentucky Rockshelters. In *Current Archaeological Research in Kentucky: Volume Three*, edited by John F. Doershuk, Christopher A. Bergman, and David Pollack, pp. 52-69. Kentucky Heritage Council, Frankfort.

1996 Early Agricultural Diet in Eastern North America: Evidence from Two Kentucky Rockshelters. *American Antiquity* 61(3):520-536.

1997 New Perspectives on the Paleoethnobotany of the Newt Kash Shelter. In *People, Plants, and Landscapes Studies in Paleoethnobotany*, edited by Kristen J. Gremillion, pp. 23-41. University of Alabama Press, Tuscaloosa.

2004 Seed Processing and the Origins of Food Production in Eastern North America. *American Antiquity* 69(2):215-233.

Gremillion, Kristen J. and Kristin D. Sobolik
1996 Dietary Variability among Prehistoric Forager-Farmers of Eastern North America. *Current Anthropology* 37(3):529-539.

Grier, Colin
2006 Affluence on the Prehistoric Northwest Coast of North America. In *Beyond Affluent Foragers: Rethinking Hunter-Gatherer Complexity*, edited by Colin Grier, Jangsuk Kim, and Junzo Uchiyama, pp. 126-135. Proceedings of the 9th Conference of the International Council of Archaeozoology, Oxbow Books, Park End Place, Oxford.

Griffin, John W.
1974 *Investigations in Russell Cave, Russell Cave National Monument, Alabama*. National Park Service Publications in Archeology 13, U.S. Department of the Interior, Washington, D.C.

Griffitts, Janet and Clive Bonsall
2001 Experimental Determination of the Function of Antler and Bone 'Bevel-Ended Tools' from Prehistoric Shell Middens in Western Scotland. In *Crafting Bone: Skeletal Technologies Through Time and Space*. Proceedings of the 2nd meeting of the (ICAZ) Worked Bone Research Group, Budapest, edited by Alice M. Choyke and Laszlo Bartosiewicz, pp. 207-220. BAR International Series 937, Archaeopress, Oxford.

Guernsey, E. Y.
1939 Relationships among Various Clark County Sites. *Proceedings of the Indiana Academy of Science* 48:27-32.

1942 The Culture Sequence of the Ohio Falls Sites. *Proceedings of the Indiana Academy of Science* 51:60-67.

Guthrie, R. Dale
1983 Osseous Projectile Points: Biological Considerations Affecting Raw Material Selection and Design among Paleolithic and Paleoindian Peoples. In *Animals and Archaeology 1: Hunters and Their Prey*, edited by J. Clutton-Brock and C. Grigson, pp. 273-294. BAR 163, Oxford.

Hadlock, Wendell S.
1943 Bone Implements from Shell Heaps around Frenchman's Bay, Maine. *American Antiquity* 8(4):341-353.

Hall, Martin
1988 At the Frontier: Some Arguments against Hunter-Gathering and Farming Modes of Production in Southern Africa. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 137-147. Berg, Oxford.

Halsey, John R.
2008 'Ancient Diggings': A Review of Nineteenth-Century Observations in the Prehistoric Copper Mining Pits of the Lake Superior Basin. Paper presented at the 54th Annual Midwest Archaeological Conference, Milwaukee, Wisconsin.

Halstead, Paul and John O'Shea
1989 Introduction: Cultural Responses to Risk and Uncertainty. In *Bad Year Economics: Cultural Responses to Risk and Uncertainty*, edited by Paul Halstead and John O'Shea, pp. 1-7. Cambridge University Press, Cambridge.

Hamilton, Annette
1982 Descended from Father, Belonging to Country: Rights to Land in the Australian Western Desert. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 85-108. Cambridge University Press, Cambridge.

Hammett, Julia E. and Beverly A. Sizemore

1989 Shell Beads and Ornaments: Socioeconomic Indicators of the Past. In *Proceedings of the 1986 Shell Bead Conference*, edited by Charles F. Hayes III, Lynn Ceci, and Connie Cox Bodner, pp. 125-137. Rochester Museum and Science Center Research Record No. 20, Rochester, New York.

Haskins, Valerie A. and Nicholas P. Herrmann

1996 Shell Mound Bioarchaeology. In *Of Caves & Shell Mounds*, edited by Kenneth C. Carstens and Patty Jo Watson, pp. 107-118. University of Alabama Press, Tuscaloosa, Alabama.

Hassen, Harold

1987 Part One: Preliminary Summary and Interpretation of the 1984 Investigation at the Bullseye Site, 11-Ge-127. In *The Bullseye Site: A Floodplain Archaic Mortuary Site in the Lower Illinois River Valley*, edited by Harold Hassen and Kenneth B. Farnsworth, pp. 1-12. Illinois State Museum Reports of Investigations No. 42, Springfield, Illinois.

Hayden, Brian

1981 Research and Development in the Stone Age: Technological Transitions among Hunter-Gatherers. *Current Anthropology* 22(5):519-548.

1994 Competition, Labor, and Complex Hunter-Gatherers. In *Key Issues in Hunter-Gatherer Research*, edited by E.S. Burch and L.J. Ellanna, pp. 223-242. Berg, Oxford, United Kingdom.

1995 The Emergence of Prestige Technologies and Pottery. In *The Emergence of Pottery: Technology and Innovation in Ancient Societies*, edited by William K. Barnett and John W. Hoopes, pp. 257-265. Smithsonian Institution Press, Washington.

1996 Thresholds of Power in Emergent Complex Societies. In *Emergent Complexity: The Evolution of Intermediate Societies*, edited by Jeanne E. Arnold, pp. 50-58. International Monographs in Prehistory Archaeological Series 9. Ann Arbor, Michigan.

Hegmon, Michelle

2003 Setting Theoretical Egos Aside: Issues and Theory in North American Archaeology. *American Antiquity* 68(2): 213-243.

Hegmon, Michelle and Lynn E. Fisher

1991 Information Strategies in Hunter-Gatherer Societies. In *Foragers in Context: Long-Term, Regional, and Historical Perspectives in Hunter-Gatherer Studies,* edited by Preston T. Miracle, pp. 127-145. Michigan Discussions in Anthropology, Hunter-Gatherer Studies, volume 10, University of Michigan, Ann Arbor.

Helms, Mary W.
1998 *Access to Origins: Affines, Ancestors, and Aristocrats*. University of Texas Press, Austin.

Hensley, Christine K.
1991a The Green River Archaeological Study. In *Studies in Kentucky Archaeology*, edited by Charles D. Hockensmith, pp. 11-26. Kentucky Heritage Council, Frankfort, Kentucky.

1991b The Middle Green River Shell Mounds: Challenging Traditional Interpretations Using Internal Site Structure Analysis. In *The Human Landscape in Kentucky's Past: Site Structure and Settlement Patterns*, edited by Charles Stout and Christine K. Hensley, pp. 78-97. Kentucky Heritage Council, Frankfurt.

1994 *The Archaic Settlement System of the Middle Green River Valley, Kentucky*. Unpublished Ph.D. dissertation, Washington University, St. Louis.

Hensley-Martin, Christine
1986 *A Reanalysis of the Lithic Industry from the Read Site, Butler County, Kentucky (15Bt10).* Unpublished M.A. thesis, Department of Anthropology, Washington University, St. Louis, Missouri.

Herrmann, Nicholas Paul
1990 *The Paleodemography of the Read Shell Midden, 15BT10*. Unpublished M.A. thesis, Department of Anthropology, Washington University, St. Louis.

2002 *Biological Affinities of Archaic Period Populations from West-Central Kentucky and Tennessee*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Tennessee, Knoxville.

2006 Human Remains. In *The Highland Creek Site: Middle to Late Archaic Wetland Utilization in Western Kentucky*, written by Greg Maggard and David Pollack, pp. 88-97. Kentucky Archaeological Survey Research Report No. 5, Lexington, Kentucky.

2007 New Radiocarbon Dates from Three Archaic Shell Middens in Western Kentucky: Indian Knoll (15OH2), Ward (15McL11) and Barrett (15McL4). In *Current Archaeological Research in Kentucky: Volume Eight*, edited by Sarah E. Miller, David Pollack, Kenneth Carstens, and Christopher R. Moore, pp. 77-89. Kentucky Heritage Council, Frankfort.

Hiatt, L. R.
1968 Ownership and Use of Land among the Australian Aborigines. In *Man the Hunter*, edited by Richard B. Lee and Irven DeVore, pp. 99-102. Aldine Publishing Company, Chicago.

Hindess, Barry and Paul Q. Hirst
1975 *Pre-Capitalist Modes of Production*. Routledge, London.

Hitchcock, Robert K.
1982 Patterns of Sedentism among the Basarwa of Eastern Botswana. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 223-267. Cambridge University Press, Cambridge.

Hitchcock, Robert K. and Laurence E. Bartram, Jr.
1998 Social Boundaries, Technical Systems, and the Use of Space and Technology in the Kalahari. In *The Archaeology of Social Boundaries*, edited by Miriam T. Stark, pp. 12-49. Smithsonian Institution Press, Washington, D.C.

Hockensmith, Charles D.
1983 Chiggerville Site, 15Oh1, Ohio County, Kentucky. *Kentucky Archaeological Site Survey Form*. On file at the Office of State Archaeology, University of Kentucky, Lexington.

Hodder, Ian
1979 Economic and Social Stress and Material Culture Patterning. *American Antiquity* 44(3):446-454.

Hoffman, Brian W.
2002 Broken Eyes and Simple Grooves: Understanding Eastern Aleut Needle Technology through Experimental Manufacture and Use of Bone Needles. In *Many Faces of Gender: Roles and Relationships through Time in Indigenous Northern Communities*, edited by Lisa Frink, Rita S. Shepard, and Gregory A. Reinhardt, pp. 151-164. University Press of Colorado, Boulder.

Hofman, Jack L.
1986 *Hunter-Gatherer Mortuary Variability: Toward an Explanatory Model*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Tennessee, Knoxville.

Hollenbach, Kandace R.
2009 *Foraging in the Tennessee River Valley, 12,500 to 8,000 Years Ago*. University of Alabama Press, Tuscaloosa.

Howard, Calvin D.
1974 The Atlatl: Function and Performance. *American Antiquity* 39(1):102-104.

Hrdlička, Aleś
1927 *Catalogue of Human Crania in the United States National Museum Collections*. Proceedings of the United States National Museum 69(5). Smithsonian Institution Press, Washington, D.C.

Hunt, Robert C.

2000 Forager Food Sharing Economy: Transfers and Exchanges. In *The Social Economy of Sharing: Resource Allocation and Modern Hunter-Gatherers*, edited by George W. Wenzel, Grete Hovelsrud-Broda, Nobuhiro Kishigami, pp. 7-26. National Museum of Ethnology Senri Ethnological Studies No. 53, Osaka.

Ingold, Tim

1988 Notes on the Foraging Mode of Production. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 269-285. Berg, Oxford.

1999 On the Social Relations of the Hunter-Gatherer Band. In *The Cambridge Encyclopedia of Hunters and Gatherers*, edited by Richard B. Lee and Richard Daly, pp. 399-410. Cambridge University Press, Cambridge, UK.

Jackson, H. Edwin

1991 The Trade Fair in Hunter-Gatherer Interaction: The Role of Intersocietal Trade in the Evolution of Poverty Point Culture. In *Between Bands and States*, edited by Susan A. Gregg, pp. 265-286. Center for Archaeological Investigations Occasional Paper No. 9, Southern Illinois University at Carbondale, Carbondale, Illinois.

Janzen, Donald E.

1971 Excavations at the Falls of the Ohio River Region. *The Filson Club History Quarterly* 45(4):373-380.

1972 Archaeological Investigations in Louisville and Vicinity: A Historical Sketch. *The Filson Club History Quarterly* 46(4):305-321.

1977 An Examination of Late Archaic Development in the Falls of the Ohio River Area. In *For the Director: Research Essays in Honor of James B. Griffin*, edited by Charles E. Cleland, pp. 123-143. Museum of Anthropology Anthropological Papers No. 61, University of Michigan, Ann Arbor.

Jefferies, Richard W.

1982 Archaeological Overview of the Carrier Mills District. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 1459-1509. Southern Illinois University at Carbondale Center for Archaeological Investigations Research Paper No. 33, Carbondale, Illinois.

1988 The Archaic Period in Kentucky: New Deal Archaeological Investigations. In *New Deal Era Archaeology and Current Research in Kentucky*, edited by David Pollack and Mary Lucas Powell, pp. 14-25. Kentucky Heritage Council, Frankfurt.

1990 A Technological and Functional Analysis of Middle Archaic Hafted Endscrapers from the Black Earth Site, Saline County, Illinois. *Midcontinental Journal of Archaeology* 15(1):3-36.

1995 Late Middle Archaic Exchange and Interaction in the North American Midcontinent. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 73-99. University of Tennessee Press, Knoxville.

1996a Hunters and Gatherers after the Ice Age. In *Kentucky Archaeology*, edited by R. Barry Lewis, pp. 39-77. University Press of Kentucky, Lexington.

1996b The Emergence of Long-Distance Exchange Networks in the Southeastern United States. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 222-234. University Press of Florida, Gainesville.

1997 Middle Archaic Bone Pins: Evidence of Mid-Holocene Regional-Scale Social Groups in the Southern Midwest. *American Antiquity* 62(3):464-487.

2004 Regional-Scale Interaction Networks and the Emergence of Cultural Complexity along the Northern Margins of the Southeast. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 71-85. University of Alabama Press, Tuscaloosa.

2006 Immediate and Long-Term Impacts of Hunter-Gatherer Activity on the Lower Ohio Valley Landscape. Paper presented at the 63rd Annual Meeting of the Southeastern Archaeological Conference, Little Rock, Arkansas.

2008 *Holocene Hunter-Gatherers of the Lower Ohio River Valley*. University of Alabama Press, Tuscaloosa.

2009 Archaic Cultures of Western Kentucky. In *Archaic Societies: Diversity and Complexity across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 635-666. State University of New York Press, Albany.

Jefferies, Richard W. and B. Mark Lynch

1983 Dimensions of Middle Archaic Cultural Adaptation at the Black Earth Site, Saline County, Illinois. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 299-322. Academic Press, New York.

Jefferies, Richard W., Victor D. Thompson, and George R. Milner

2005 Archaic Hunter-Gatherer Landscape Use in West-Central Kentucky. *Journal of Field Archaeology*. 30(1): 3-23.

Jefferies, Richard W., Victor D. Thompson, George R. Milner, Renee M. Bonzani, and Tanya M. Peres

2007 Cypress Creek Revisited: Settlement and Subsistence in West-Central Kentucky. In *Current Archaeological Research in Kentucky: Volume Eight*, edited by Sarah E. Miller, David Pollack, Kenneth Carstens, and Christopher R. Moore, pp. 37-75. Kentucky Heritage Council, Frankfort.

Jochim, Michael

2006 The Implications of Inter-Group Food Exchange for Hunter-Gatherer Affluence and Complexity. In *Beyond Affluent Foragers: Rethinking Hunter-Gatherer Complexity*, edited by Colin Grier, Jangsuk Kim, and Junzo Uchiyama, pp. 80-89. Proceedings of the 9th Conference of the International Council of Archaeozoology, Oxbow Books, Park End Place, Oxford.

Johnson, Jay K.

1979 Archaic Biface Manufacture: Production Failures, A Chronicle of the Misbegotten. *Lithic Technology* 8(2):25-35.

1981a Further Additional Biface Production Failures. *Lithic Technology* 10(2-3):26-28.

1981b *Lithic Procurement and Utilization Trajectories: Analysis, Yellow Creek Nuclear Power Plant Site, Tishomingo County, Mississippi, Vol. II*. Tennessee Valley Authority Publications in Anthropology No. 28. Archaeological Papers of the Center for Archaeological Research No. 1, University of Mississippi, University, Mississippi.

Johnson, Jay K. and Samuel O. Brookes

1989 Benton Points, Turkey Tails, and Cache Blades: Middle Archaic Exchange in the Midsouth. *Southeastern Archaeology* 8(2):134-145.

Johnson, Neil F.

2007 *Two's Company, Three is Complexity: A Simple Guide to the Science of all Sciences*. Oneworld, Oxford.

Johnston, Francis E. and Charles E. Snow

1961 The Reassessment of the Age and Sex of the Indian Knoll Skeletal Population: Demographic and Methodological Aspects. *American Journal of Physical Anthropology*, n.s., 19(3):237-244.

Justice, Noel D.

1995 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington.

2006 *Looking at Prehistory: Indiana's Hoosier National Forest Region, 12,000 B.C. to 1650*. United States Department of Agriculture, Government Printing Office.

Keeley, Lawrence H.
1988 Hunter-Gatherer Economic Complexity and "Population Pressure": A Cross-Cultural Analysis. *Journal of Anthropological Archaeology*. 7: 373-411.

1995 Protoagricultural Practices among Hunter-Gatherers. In *Last Hunters-First Farmers: New Perspectives on the Prehistoric Transition to Agriculture*, edited by T. Douglas Price and Anne Birgitte Gebauer, pp. 243-272. School of American Research Press, Santa Fe, New Mexico.

Kelly, Robert L.
1988 The Three Sides of a Biface. *American Antiquity* 53(4):717-734.

1991 Sedentism, Sociopolitical Inequality, and Resource Fluctuations. In *Between Bands and States*, edited by Susan A. Gregg, pp. 135-158. Center for Archaeological Investigations Occasional Paper No. 9, Southern Illinois University at Carbondale, Carbondale, Illinois.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Smithsonian Institution Press, Washington.

1998 Foraging and Sedentism. In *Seasonality and Sedentism: Archaeological Perspectives from Old and New World Sites*, edited by Thomas R. Rocek and Ofer Bar-Yosef, pp. 9-23. Peabody Museum of Archaeology and Ethnology Bulletin 6, Harvard University, Cambridge.

Kidder, Alfred V.
1932 *The Artifacts of Pecos*. Yale University Press, New Haven, Connecticut.

Kidder, Tristram R.
2002 Mapping Poverty Point. *American Antiquity* 67(1):89-101.

Kidder, Tristram R. and David A. Barondess
1981 A Proposed Bone Tool Classification: A Case Study from Southeast Louisiana. *Louisiana Archaeology* 8:87-108.

Kim, Jangsuk and Colin Grier
2006 Beyond Affluent Foragers. In *Beyond Affluent Foragers: Rethinking Hunter-Gatherer Complexity*, edited by Colin Grier, Jangsuk Kim, and Junzo Uchiyama, pp. 192-200. Proceedings of the 9th Conference of the International Council of Archaeozoology, Oxbow Books, Park End Place, Oxford.

Kimball, Larry R.

1996 Early Archaic Settlement and Technology: Lessons from Tellico. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 149-186. University of Alabama Press, Tuscaloosa.

King, Thomas F.

1978 Don't That Beat the Band?: Nonegalitarian Political Organization in Prehistoric Central California. In *Social Archeology: Beyond Subsistence and Dating*, edited by Charles L. Redman et al., pp. 225-248. Academic Press, New York.

Klippel, Walter E.

1969 *The Booth Site: A Late Archaic Campsite*. Missouri Archaeological Society Research Series No. 6, Columbia, Missouri.

Knecht, Heidi

1991 *Technological Innovation and Design during the Early Upper Paleolithic: A Study of Organic Projectile Technologies*. Unpublished Ph.D. dissertation, Department of Anthropology, New York University.

1993 Early Upper Paleolithic Approaches to Bone and Antler Projectile Technology. In *Hunting and Animal Exploitation in the Later Palaeolithic and Mesolithic of Eurasia*, edited by Gail Larsen Peterkin, Harvey M. Bricker, and Paul Mellars, pp. 33-47. Archeological Papers of the American Anthropological Association Number 4, U.S.A.

Kowalewski, Stephen A.

1995 Large-Scale Ecology in Aboriginal Eastern North America. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 147-173. University of Tennessee Press, Knoxville.

Kroeber, A. L.

1927 Disposal of the Dead. *American Anthropologist* 29(3):308-315.

Kuhn, Thomas S.

1996 *The Structure of Scientific Revolutions*. Third Edition. University of Chicago Press, Chicago.

Kwas, Mary L.

1982 Bannerstones: A Historical Overview. *Journal of Alabama Archaeology* 28(2):155-178.

Lannie, Donna Dean

1979 Ethnobotanical Analysis. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 978-1006. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Layton, Robert

1986 Political and Territorial Structures among Hunter-Gatherers. *Man* 21(1):18-33.

Leacock, Eleanor and Richard Lee

1982 Introduction. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 1-20. Cambridge University Press, Cambridge.

Lee, Richard B.

1968 What Hunters Do for a Living, or, How to Make Out on Scarce Resources. In *Man the Hunter*, edited by Richard B. Lee and Irven DeVore, pp. 30-48. Aldine Publishing Company, Chicago.

1972a Population Growth and the Beginnings of Sedentary Life among the !Kung Bushmen. In *Population Growth: Anthropological Perspectives*, edited by Brian Spooner, pp. 329-342. MIT Press, Cambridge, Massachusetts.

1972b The Intensification of Social Life among the !Kung Bushmen. In *Population Growth: Anthropological Perspectives*, edited by Brian Spooner, pp. 343-350. MIT Press, Cambridge, Massachusetts.

1982 Politics, Sexual and Non-Sexual, in an Egalitarian Society. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 37-59. Cambridge University Press, Cambridge.

1988 Reflections on Primitive Communism. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 252-268. Berg, Oxford.

1990 Primitive Communism and the Origin of Social Inequality. In *The Evolution of Political Systems: Sociopolitics in Small-Scale Sedentary Societies*, edited by Steadman Upham, pp. 225-246. Cambridge University Press, Cambridge, UK.

Lee, Richard B. and Irven DeVore

1968 Problems in the Study of Hunters and Gatherers. In *Man the Hunter*, edited by Richard B. Lee and Irven DeVore, pp. 3-12. Aldine Publishing Company, Chicago.

Lehmann, Geoffrey R.

1981 The Slate Site, A Poverty Point Lapidary Industry in the Southern Yazoo Basin, Mississippi. *Louisiana Archaeology* 8:37-56.

Lemoine, Genevieve

1989 Use Wear Analysis of Bone Tools. *ArchaeoZoologia* 3(1/2):211-223.

1994 Use Wear on Bone and Antler Tools from the Mackenzie Delta, Northwest Territories. *American Antiquity* 59(2):316-334.

Lesick, Kurtis S.

1997 Re-engendering Gender: Some Theoretical and Methodological Concerns on a Burgeoning Archaeological Pursuit. In *Invisible People and Processes: Writing Gender and Childhood into European Archaeology*, edited by Jenny Moore and Eleanor Scott, pp. 31-41. Leicester University Press, Leicester.

Lewis, R. Barry

1983 Archaic Adaptations to the Illinois Prairie: The Salt Creek Region. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 99-116. Academic Press, New York.

Lewis, Thomas M. N. and Madeline Kneberg Lewis

1961 *Eva: An Archaic Site*. University of Tennessee Press, Knoxville.

1995 Bone Industry. In *The Prehistory of the Chickamauga Basin in Tennessee*, written by Thomas M. N. Lewis and Madeline D. Kneberg Lewis, pp. 151-159. University Tennessee Press, Knoxville.

Littleton, Judith and Harry Allen

2007 Hunter-Gatherer Burials and the Creation of Persistent Places in Southern Australia. *Journal of Anthropological Archaeology* 26:283-298.

Lopinot, Neal H.

1982 Plant Macroremains and Paleoethnobotanical Implications. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 671-860. Southern Illinois University at Carbondale Center for Archaeological Investigations Research Paper No. 33, Carbondale, Illinois.

Lourandos, Harry

1985 Intensification and Australian Prehistory. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 385-423. Academic Press, Orlando.

Lucy, S. J.
1997 Housewives, Warriors and Slaves? Sex and Gender in Anglo-Saxon Burials. In *Invisible People and Processes: Writing Gender and Childhood into European Archaeology*, edited by Jenny Moore and Eleanor Scott, pp. 150-168. Leicester University Press, Leicester.

Lutz, David L.
2000 *The Archaic Bannerstone: Its Chronological History and Purpose from 6000 B.C. to 1000 B.C.* Hynek Printing, Richland Center, Wisconsin.

Lynch, B. Mark
1982 Mortuary Behavior in the Carrier Mills Archaeological District. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 1115-1231. Southern Illinois University at Carbondale Center for Archaeological Investigations Research Paper No. 33, Carbondale, Illinois.

MacDonald, Douglas H.
2001 Grief and Burial in the American Southwest: The Role of Evolutionary Theory in the Interpretation of Mortuary Remains. *American Antiquity* 66(4):704-714.

MacDonald, Douglas H., Jonathan C. Lothrop, David L. Cremeens, and Barbara A. Munford
2006 Holocene Land-Use, Settlement Patterns, and Lithic Raw Material Use in Central West Virginia. *Archaeology of Eastern North America* 34:121-140.

MacNeish, Richard S.
1948 The Pre-Pottery Faulkner Site of Southern Illinois. *American Antiquity* 13(3):232-243.

Magennis, Ann L.
1977 *Middle and Late Archaic Mortuary Patterning: An Example from the Western Tennessee Valley*. Unpublished M.A. Thesis, Department of Anthropology, University of Tennessee, Knoxville.

Maggard, Greg and David Pollack
2006 *The Highland Creek Site: Middle to Late Archaic Wetland Utilization in Western Kentucky*. Kentucky Archaeological Survey Research Report No. 5, Lexington, Kentucky.

Mandel, Rolfe D. and E. Arthur Bettis III
2001 Use and Analysis of Soil by Archaeologists and Geoscientists: A North American Perspective. In *Earth Sciences and Archaeology*, edited by Paul Goldberg, Vance T. Holliday, and C. Reid Ferring, pp. 173-204. Kluwer Academic/Plenum Publishers, New York.

Marquardt, William H.

1985 Complexity and Scale in the Study of Fisher-Gatherer-Hunters: An Example from the Eastern United States. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 59-98. Academic Press, Orlando.

1988 Politics and Production among the Calusa of South Florida. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 161-188. Berg, Oxford.

2005 Lithic Artifacts in the Middle Green River Region. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 351-429. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Marquardt, William H. and Patty Jo Watson

1983 The Shell Mound Archaic of Western Kentucky. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 323-339. Academic Press, New York.

2005a Regional Survey and Testing. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 41-70. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

2005b SMAP Investigations at the Carlston Annis Site, 15Bt5. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 87-120. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

2005c The Green River Shell Mound Archaic: Conclusions. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 629-647. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Marshall, Lorna

1976 Sharing, Talking, and Giving: Relief of Social Tensions among the !Kung. In *Kalahari Hunter-Gatherers: Studies of the !Kung San and Their Neighbors*, edited by Richard B. Lee and Irven DeVore, pp. 349-372. Harvard University Press, Cambridge, Massachusetts.

Mason, Ronald J. and Carol Irwin
1960 An Eden-Scottsbluff Burial in Northeastern Wisconsin. *American Antiquity* 26(1):43-57.

Mauss, Marcel
1990 *The Gift: The Form and Reason for Exchange in Archaic Societies*. Translated by W. D. Halls. W. W. Norton, New York.

May, Ernest E.
1982 Analysis of Carrier Mills Projectile Points. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 1347-1379. Southern Illinois University at Carbondale Center for Archaeological Investigations Research Paper No. 33, Carbondale, Illinois.

McAlpine, Tommy
2005 *A Study of the Beamer: A Prehistoric Hide Processing Tool*. Unpublished M.A. thesis, Department of Anthropology, Ball State University, Muncie, Indiana.

McBride, John David Edward
2000 *The Baker Site and the Late Middle Archaic Period in the Green River Region of West Central Kentucky*. Unpublished M.A. thesis, Department of Anthropology, University of Kentucky, Lexington.

McCoid, Catherine Hodge and LeRoy D. McDermott
1996 Toward Decolonizing Gender: Female Vision in the Upper Paleolithic. *American Anthropologist* 98(2):319-326.

McElrath, Dale L.
1993 Mule Road: A Newly Defined Late Archaic Phase in the American Bottom. *Illinois Archaeology* 5(1-2):148-157.

McElrath, Dale L. and Andrew C. Fortier
1983 *The Missouri Pacific #2 Site*. American Bottom Archaeology FAI-270 Site Reports, Vol. 3. University of Illinois Press, Urbana.

McGuire, Randall H.
1983 Breaking Down Cultural Complexity: Inequality and Heterogeneity. *Advances in Archaeological Method and Theory* 6:91-142.

McMillan, R. Bruce
1976 The Dynamics of Cultural and Environmental Change at Rodgers Shelter, Missouri. In *Prehistoric Man and His Environments: A Case Study in the Ozark Highland*, edited by W. Raymond Wood and R. Bruce McMillan, pp. 211-232. Academic Press, New York.

Meeks, Scott C.

1999 The 'Function' of Stone Tools in Prehistoric Exchange Systems: A Look at Benton Interaction in the Mid-South. In *Raw Materials and Exchange in the Mid-South: Proceedings of the 16th Annual Mid-South Archaeological Conference*, edited by Evan Peacock and Samuel O Brookes, pp. 29-43. Mississippi Department of Archives and History Archaeological Report No. 29, Jackson, Mississippi.

Mellars, Paul A.

1985 The Ecological Basis of Social Complexity in the Upper Paleolithic of Southwestern France. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 271-297. Academic Press, Orlando.

Meltzer, David J. and Bruce D. Smith

1986 Paleoindian and Early Archaic Subsistence Strategies in Eastern North America. In *Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in the Eastern Woodlands*, edited by Sarah W. Neusius, pp. 3-31. Center for Archaeological Investigations Occasional Paper No. 6, Southern Illinois University, Carbondale.

Mensforth, Robert P.

1986 *Paleodemography of the Carlston Annis (Bt-5) Skeletal Population*. Unpublished Ph.D. dissertation, Department of Anthropology, Kent State University, Kent, Ohio.

2001 Warfare and Trophy Taking in the Archaic Period. In *Archaic Transitions in Ohio & Kentucky Prehistory*, edited by Olaf H. Prufer, Sara E. Pedde, and Richard S. Meindl, pp. 110-138. Kent State University Press, Kent, Ohio.

2005 Paleodemography of the Skeletal Population from Carlston Annis (15Bt5). In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 453-487. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Metcalf, Peter and Richard Huntington

1991 *Celebrations of Death: The Anthropology of Mortuary Ritual*. Second Edition. Cambridge University Press, Cambridge.

Milanich, Jerald T. and Charles H. Fairbanks

1980 *Florida Archaeology*. Academic Press, New York.

Miller, M. G.

2002 Human Vertebra Transfixed by a Spearpoint of Antler. In *Some Aboriginal Sites on Green River, Kentucky. Certain Aboriginal Sites on Lower Ohio River*, written by Clarence B. Moore, pp. 477-480. Reprinted. University of Alabama Press, Tuscaloosa. Originally published 1916, Journal of the Academy of Natural Sciences of Philadelphia, 2nd series 16(3):431-491.

Miller, Rex K.

1941 *McCain Site, Dubois County, Indiana*. Prehistory Research Series 2(1), Indiana Historical Society, Indianapolis.

Mills, Barbara J.

2004 The Establishment and Defeat of Hierarchy: Inalienable Possessions and the History of Collective Prestige Structures in the Pueblo Southwest. *American Anthropologist* 106(2):238-251.

Milner, George R.

1999 Warfare in Prehistoric and Early Historic Eastern North America. *Journal of Archaeological Research* 7(2):105-151.

2004 Old Mounds, Ancient Hunter-Gatherers, and Modern Archaeologists. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 300-315. University of Alabama Press, Tuscaloosa.

Milner, George R. and Richard W. Jefferies

1998 The Read Archaic Shell Midden in Kentucky. *Southeastern Archaeology*. 17(2): 119-132.

Milner, George R. and Virginia G. Smith

1988 Kentucky's New Deal Archaeological Excavations, Museum Collections, and Research. In *New Deal Era Archaeology and Current Research in Kentucky*, edited by David Pollack and Mary Lucas Powell, pp. 1-13. Kentucky Heritage Council, Frankfurt.

Moore, Christopher R.

2007 Preliminary Analysis of Bone Tools from Site 12D563, Dearborn Co., Indiana. Paper presented at the 123rd Annual Meeting of the Indiana Academy of Science, University of Indianapolis, Indianapolis, Indiana.

2008a A Macroscopic Investigation of Technological Style and the Production of Middle to Late Archaic Fishhooks at the Chiggerville, Read, and Baker Sites. Paper presented at the 65th Annual Meeting of the Southeastern Archaeological Conference, Charlotte, North Carolina.

2008b Raw Material Utilization in Carroll County, Indiana: A Small-Scale Analysis of Diachronic Patterns in the Usage of Attica, Kenneth, and Wyandotte Cherts. *Midcontinental Journal of Archaeology* 33(1): 73-106.

2009a Hooked on Fishing: A Preliminary Survey of Fishhook Manufacturing Techniques and Fishhook Styles in Eastern North America. Paper presented at the 26th Annual Kentucky Heritage Council Archaeological Conference, Murray, Kentucky.

2009b Paleoamerican Utilization of the Green River Shell Middens: The Chiggerville Site (15Oh1), Kentucky. *Current Research in the Pleistocene* 26:91-92.

2010 A Macroscopic Investigation of Technological Style and the Production of Middle to Late Archaic Fishhooks at the Chiggerville, Read, and Baker Sites, Western Kentucky. *Southeastern Archaeology* 29(1):197-221.

Moore, Christopher R. and Christopher W. Schmidt

2009 Paleoindian and Early Archaic Organic Technologies: A Review and Analysis. *North American Archaeologist* 30(1):57-86.

Moore, Christopher R. and George M. Crothers

2010 SMAP 2.0! Recent Excavations at the Baker (15Mu12) and Chiggerville (15Oh1) Shell Middens in Western Kentucky. Paper presented at the 27th Annual Kentucky Heritage Council Archaeological Conference, Corbin, Kentucky.

Moore, Christopher R. and Jessica K. Leger

2009 Analysis of the Works Progress Administration Excavations at the Middle Archaic Jackson Bluff Site (15Oh12), Ohio County, Kentucky. Paper presented at the 125th Annual Meeting of the Indiana Academy of Science, Indiana-University, Kokomo.

Moore, Clarence B.

2002 *Some Aboriginal Sites on Green River, Kentucky. Certain Aboriginal Sites on Lower Ohio River*. Reprinted. University of Alabama Press, Tuscaloosa. Originally published 1916, Journal of the Academy of Natural Sciences of Philadelphia, 2nd series 16(3):431-491.

Morey, Darcy F. and George M. Crothers

1998 Clearing up Clouded Waters: Palaeoenvironmental Analysis of Freshwater Mussel Assemblages from the Green River Shell Middens, Western Kentucky. *Journal of Archaeological Science* 25:907-926.

Morey, Darcy F., George M. Crothers, Julie K. Stein, James P. Fenton, and Nicholas P. Herrmann
2002 The Fluvial and Geomorphic Context of Indian Knoll, an Archaic Shell Midden in West-Central Kentucky. *Geoarchaeology* 17(6):521-553.

Morgan, Lewis H.
1877 *Ancient Society or Researches in the Lines of Human Progress from Savagery, through Barbarism to Civilization*. Henry Holt and Company, New York.

Morgan, William N.
1999 *Precolumbian Architecture in Eastern North America*. University Press of Florida, Gainesville.

Morrison, David
1986 Inuit and Kutchin Bone and Antler Industries in Northwestern Canada. *Canadian Journal of Archaeology* 10:107-125.

Morrow, Carol A.
1982 Analysis of Area A Middle Archaic Flaked Stone Technology. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 1289-1346. Southern Illinois University at Carbondale Center for Archaeological Investigations Research Paper No. 33, Carbondale, Illinois.

Morrow, Carol A. and Richard W. Jefferies
1989 Trade or Embedded Procurement?: A Test Case from Southern Illinois. In *Time, Energy and Stone Tools*, edited by Robin Torrence, pp. 27-33. Cambridge University Press, Cambridge, UK.

Morse, Dan F.
1971 The Hawkins Cache: A Significant Find in Northeast Arkansas. *Bulletin of the Arkansas Archeological Society* 12(1):9-20.

1977 A Human Femur Tube from Arkansas. *Bulletin of the Arkansas Archeological Society* 16-18:42-44.

1982 A Paleo-Indian/Early Archaic Cemetery Possibility in Arkansas. In *Peopling of the New World*, edited by Jonathon E. Ericson, R. E. Taylor, and Rainer Berger, pp. 147-162. Ballena Press Anthropological Papers No. 23, Los Altos California.

1997a An Overview of the Dalton Period in Northeastern Arkansas and in the Southeastern United States. In *Sloan: A Paleoindian Dalton Cemetery in Arkansas*, edited by Dan F. Morse, pp. 123-139. Smithsonian Institution Press, Washington, D.C.

1997b Description of the Artifacts. In *Sloan: A Paleoindian Dalton Cemetery in Arkansas*, edited by Dan F. Morse, pp. 14-52. Smithsonian Institution Press, Washington, D.C.

Muller, Jon
1997 *Mississippian Political Economy*. Plenum Press, New York.

Munson, Patrick J.
1986a Hickory Silviculture: A Subsistence Revolution in the Prehistory of Eastern North America. Paper presented at the Emergent Horticultural Economies of the Eastern Woodlands Conference, Southern Illinois University, Carbondale, Illinois.

1986b What Happened in the Archaic in the Midwestern United States? *Reviews in Anthropology* 13:276-282.

Murray, Peter F.
1972a Bone, Antler and Shell Artifacts. In *The Schultz Site at Green Point: A Stratified Occupation Area in the Saginaw Valley of Michigan*, edited by James E. Fitting, pp. 225-243. Memoirs of the Museum of Anthropology No. 4, University of Michigan, Ann Arbor.

1972b Use and Techniques of Manufacture of Antler Implements from the Schultz Site. In *The Schultz Site at Green Point: A Stratified Occupation Area in the Saginaw Valley of Michigan*, edited by James E. Fitting, pp. 305-308. Memoirs of the Museum of Anthropology No. 4, University of Michigan, Ann Arbor.

Myster, Susan M.
1990 Appendix 1: Human Skeletal Remains. In *The Kimberly-Clark Site (40LD208) and Site 40LD207*, by Jefferson Chapman, pp. 32-59. Tennessee Anthropological Association Miscellaneous Paper No. 14. Department of Anthropology Report of Investigations No. 51, University of Tennessee, Knoxville.

Nance, Jack D.
1986 The Morrisroe Site: Projectile Point Types and Radiocarbon Dates from the Lower Tennessee Valley. *Midcontinental Journal of Archaeology*. 11(1): 11-50.

1987 The Archaic Sequence in the Lower Tennessee-Cumberland-Ohio Region. *Southeastern Archaeology* 6(2):129-140.

Nassaney, Michael S. and Kenneth E. Sassaman
1995 Introduction: Understanding Native American Interactions. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. xix-xxxviii. University of Tennessee Press, Knoxville.

Nelson, Margaret C.
1991 The Study of Technological Organization. *Archaeological Method and Theory* 3:57-100.

Nelson, Nels C.
1917 *Contributions to the Archaeology of Mammoth Cave and Vicinity, Kentucky*. American Museum of Natural History Anthropological Papers 22(1), New York.

Newcomer, Mark H.
1974 Study and Replication of Bone Tools from Ksar Akil (Lebanon). *World Archaeology* 6(2):138-153.

Odell, George H.
1988 Preliminary Analysis of Lithic and Other Nonceramic Assemblages. In *The Archaic and Woodland Cemeteries at the Elizabeth Site in the Lower Illinois Valley*, edited by Douglas K. Charles, Steven R. Leigh, and Jane E. Buikstra, pp. 155-190. Kampsville Archeological Center Research Series 7, Center for American Archeology, Kampsville Archeological Center, Kampsville, Illinois.

1996 *Stone Tools and Mobility in the Illinois Valley: From Hunter-Gatherer Camps to Agricultural Villages*. International Monographs in Prehistory Archaeological Series 10, Ann Arbor, Michigan.

1998 Investigating Correlates of Sedentism and Domestication in Prehistoric North America. *American Antiquity* 63(4):553-571.

2003 *Lithic Analysis*. Springer, New York.

Olsen, Sandra L.
1979 A Study of Bone Artifacts from Grasshopper Pueblo, AZ P:14:1. *The Kiva* 44(4):341-373.

1980 Bone Artifacts from Kinishba Ruin: Their Manufacture and Use. *The Kiva* 46(1-2):39-67.

1984 *Analytical Approaches to the Manufacture and Use of Bone Artifacts in Prehistory*. Unpublished Ph.D. dissertation, Institute of Archaeology, University of London.

1989 On Distinguishing Natural from Cultural Damage on Archaeological Antler. *Journal of Archaeological Science* 16:125-135.

O'Shea, J. M.
1989 The Role of Wild Resources in Small-Scale Agricultural Systems: Tales from the Lakes and the Plains. In *Bad Year Economics: Cultural Responses to Risk and Uncertainty*, edited by Paul Halstead and John O'Shea, pp. 57-67. Cambridge University Press, Cambridge.

O'Shea, John M. and Alex W. Barker
1996 Measuring Social Complexity and Variation: A Categorical Imperative? In *Emergent Complexity: The Evolution of Intermediate Societies*, edited by Jeanne E. Arnold, pp. 13-24. International Monographs in Prehistory Archaeological Series 9, Ann Arbor, Michigan.

Owens, D'Ann and Brian Hayden
1997 Prehistoric Rites of Passage: A Comparative Study of Transegalitarian Hunter-Gatherers. *Journal of Anthropological Archaeology* 16:121-161.

Pálsson, Gísli
1988 Hunters and Gatherers of the Sea. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 189-204. Berg, Oxford.

Palter, John L.
1976 A New Approach to the Significance of the 'Weighted' Spear Thrower. *American Antiquity* 41(4):500-510.

Panter-Brick, Catherine, Robert H. Layton, and Peter Rowley-Conwy
2001 Lines of Enquiry. In *Hunter-Gatherers: An Interdisciplinary Perspective*, edited by Catherine Panter-Brick, Robert H. Layton, and Peter Rowley-Conwy, pp. 1-11. Cambridge University Press, Cambridge.

Parker Pearson, Mike
1999 *The Archaeology of Death and Burial*. Texas A & M Press, College Station, Texas.

Parmalee, Paul W.
1969 Appendix I: Animal Remains from the Archaic Riverton, Swan Island and Robeson Hills Sites, Illinois. In *The Riverton Culture: A Second Millennium Occupation in the Central Wabash Valley*, written by Howard D. Winters, pp. 139-144. Illinois State Museum Reports of Investigations No. 13, Illinois Archaeological Survey Monograph No. 1, Springfield, Illinois.

Parry, William J. and Robert L. Kelly

1987 Expedient Core Technology and Sedentism. In *The Organization of Core Technology*, edited by Jay Johnson and Carol Morrow, pp. 285-304. Westview Press.

Paton, Robert

1994 Speaking Through Stones: A Study from Northern Australia. *World Archaeology* 26(2):172-184.

Pauketat, Timothy R.

2007 *Chiefdoms and Other Archaeological Delusions*. Altamira Press, Lanham, Maryland.

Paynter, Robert

1989 The Archaeology of Equality and Inequality. *Annual Review of Anthropology* 18:369-399.

Peets, Orville H.

1960 Experiments in the Use of Atlatl Weights. *American Antiquity* 26(1):108-110.

Penders, Thomas Edward

1997 *A Study of the Form and Function of the Bone and Antler Artifacts from the Windover Archaeological Site (8BR246), Brevard County, Florida*. Unpublished M.S. Thesis, Department of Anthropology, Florida State University.

2002 Bone, Antler, Dentary, and Lithic Artifacts. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*, edited by Glen H. Doran, pp. 97-120. University Press of Florida, Gainesville.

Peregrine, Peter

1992 *Mississippian Evolution: A World-System Perspective*. Monographs in World Archaeology No. 9, Prehistory Press, Madison, Wisconsin.

Perino, Gregory

1970 The Stilwell II Site, Pike County, Illinois. *Central States Archaeological Journal* 17(3):118-121.

Peterson, Nicolas

1975 Hunter-Gatherer Territoriality: The Perspective from Australia. *American Anthropologist* 77(1):53-68.

Phillips, James L. and Bruce G. Gladfelter
1983 The Labras Lake Site and the Paleogeographic Setting of the Late Archaic in the American Bottom. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 197-218. Academic Press, New York.

Pollack, David
2008 Introduction. In *The Archaeology of Kentucky: An Update*. State Historic Preservation Comprehensive Plan Report No. 3, edited by David Pollack, pp. 1-26. Kentucky Heritage Council, Frankfort, Kentucky.

Pool, Christopher A.
1992 Integrating Ceramic Production and Distribution. In *Ceramic Production and Distribution: An Integrated Approach*, edited by George J. Bey III and Christopher Pool, pp. 275-313. Westview Press, Boulder, Colorado.

Powell, Mary Lucas
1996 Health and Disease in the Green River Archaic. In *Of Caves and Shell Mounds*, edited by Kenneth C. Carstens and Patty Jo Watson, pp. 119-131. University of Alabama Press, Tuscaloosa.

Precourt, Prudence
1973 The Archaic Banner-Stone: A Social Category Marker. *Lambda Alpha Journal of Man* 5(1):1-26.

Price, T. D.
1981 Complexity in 'Non-Complex' Societies. In *Archaeological Approaches to the Study of Complexity*, edited by S. E. van der Leeuw, pp. 53-97. Institut voor Pre- en Protohistorie, Amsterdam.

Price, T. Douglas and Anne Birgitte Gebauer
1995 New Perspectives on the Transition to Agriculture. In *Last Hunters, First Farmers: New Perspectives on the Prehistoric Transition to Agriculture*, edited by T. Douglas Price and Anne Birgitte Gebauer, pp. 3-19. School of American Research Press, Santa Fe.

Price, T. Douglas and James A. Brown
1985 Aspects of Hunter-Gatherer Complexity. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 3-20. Academic Press, Orlando.

Price, T. Douglas, Robert W. Swick, and Elizabeth P. Chase
1986 Bone Chemistry and Prehistoric Diet: Strontium Studies of Laboratory Rats. *American Journal of Physical Anthropology* 70:365-375.

Purdy, Barbara A.

1973 The Temporal and Spatial Distribution of Bone Points in the State of Florida. *Florida Anthropologist* 26(4):143-152.

Putnam, F. W.

1887 The Way Bone Fish-Hooks Were Made in the Little Miami Valley. *Twentieth Annual Report of the Trustees of the Peabody Museum of American Archaeology and Ethnology* 3(7):581-586.

Redmond, Brian G. and Kenneth B. Tankersley

2005 Evidence of Early Paleoindian Bone Modification and Use at the Sheriden Cave Site (33WY252), Wyandot County, Ohio. *American Antiquity* 70(3):503-526.

Renfrew, Colin

1975 Trade as Action at a Distance: Questions of Integration and Communication. In *Ancient Civilization and Trade*, edited by J. A. Sabloff and C. C. Lamberg-Karlovsky, pp. 3-59. University of New Mexico Press, Albuquerque.

Rey, Pierre-Philippe

1975 The Lineage Mode of Production. *Critique of Anthropology* 3:27-79.

Rindos, David

1989 Undirected Variation and the Darwinian Explanation of Cultural Change. *Archaeological Method and Theory* 1:1-45.

Ritchie, William A.

1932 *The Lamoka Lake Site: The Type Station of the Archaic Algonkin Period in New York*. Researches and Transactions of the New York State Archeological Association 7(4), Rochester Museum of Arts and Sciences, Rochester, New York.

1971 *New York Projectile Points: A Typology and Nomenclature*. New York State Museum Bulletin 384. Revised Edition. University of the State of New York, Albany.

Ritzenthaler, Robert E. and George I. Quimby

1962 The Red Ocher Culture of the Upper Great Lakes and Adjacent Areas. *Fieldiana: Anthropology* 36(11):243-275.

Rogers, Rhea J.

1995 Tribes as Heterarchy: A Case Study from the Prehistoric Southeastern United States. In *Heterarchy and the Analysis of Complex Societies*, edited by Robert M. Ehrenreich, Carole L. Crumley, and Janet E. Levy, pp. 7-16. Archaeological Papers of the American Anthropological Association No. 6, Arlington, Virginia.

Rolingson, Martha Ann

1967 *Temporal Perspectives on the Archaic Cultures of the Middle Green River Region, Kentucky*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Rolingson, Martha Ann and Douglas W. Schwartz

1966 *Late Paleo-Indian and Early Archaic Manifestations in Western Kentucky*. University of Kentucky Press Studies in Anthropology No. 3, Lexington.

Ross-Stallings, Nancy

2009 The Fauna and Human Remains at the Panther Rock Site (15CL58). Paper presented at the 26th Annual Kentucky Heritage Council Archaeological Conference, Murray, Kentucky.

Rothschild, Nan Askin

1975 *Age and Sex, Status and Role, in Prehistoric Societies of Eastern North American*. Unpublished Ph.D. dissertation, Department of Anthropology, New York University, New York.

1979 Mortuary Behavior and Social Organization at Indian Knoll and Dickson Mounds. *American Antiquity* 44(4):658-675.

Rowley-Conwy, Peter

2001 Time, Change and the Archaeology of Hunter-Gatherers: How Original is the 'Original Affluent Society'? In *Hunter-Gatherers: An Interdisciplinary Perspective*, edited by Catherine Panter-Brick, Robert H. Layton, and Peter Rowley-Conwy, pp. 39-72. Cambridge University Press, Cambridge, UK.

Rowley-Conwy, Peter and Marek Zvelebil

1989 Saving It for Later: Storage by Prehistoric Hunter-Gatherers in Europe. In *Bad Year Economics: Cultural Responses to Risk and Uncertainty*, edited by Paul Halstead and John O'Shea, pp. 40-56. Cambridge University Press, Cambridge.

Ruby, Bret J., Christopher Carr, and Douglas K. Charles

2005 Community Organizations in the Scioto, Mann, and Havana Hopewellian Regions: A Comparative Perspective. In *Gathering Hopewell: Society, Ritual, and Ritual Interaction*, edited by Christopher Carr and D. Troy Case, pp. 119-176. Kluwer Academic and Plenum Publishers, New York.

Russo, Michael

1996 Southeastern Archaic Mounds. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 259-287. University of Florida Press, Gainesville.

Safer, Jane Fearer and Frances McLaughlin Gill
1982 *Spirals from the Sea: An Anthropological Look at Shells*. Clarkson N. Potter, Inc. Publishers, New York.

Sahlins, Marshall D.
1961 The Segmentary Lineage: An Organization of Predatory Expansion. *American Anthropologist* 63(2):322-345.

1968 *Tribesmen*. Foundations of Modern Anthropology Series, Prentice Hall, Inc., Englewood Cliffs, New Jersey.

1972 *Stone Age Economics*. Aldine Atherton, Inc., Chicago.

Sampson, C. Garth
1988 *Stylistic Boundaries among Mobile Hunter-Foragers*. Smithsonian Institution Press, Washington.

Sanders, Thomas N.
1979 Kentucky Archaeological Site Survey Form – 15Mu12. Manuscript on file, William S. Webb Museum of Anthropology, University of Kentucky, Lexington.

Sassaman, Kenneth E.
1995 The Cultural Diversity of Interactions among Mid-Holocene Societies of the American Southeast. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 174-204. University of Tennessee Press, Knoxville.

1996 Early Archaic Settlement in the South Carolina Coastal Plain. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 58-83. University of Alabama Press, Tuscaloosa.

2004 Complex Hunter-Gatherers in Evolution and History: A North American Perspective. *Journal of Archaeological Research* 12(3):227-280.

Sassaman, Kenneth E. and Asa R. Randall
2007 The Cultural History of Bannerstones in the Savannah River Valley. *Southeastern Archaeology* 26(2):196-211.

Sassaman, Kenneth E. and Michael J. Heckenberger
2004a Crossing the Symbolic Rubicon in the Southeast. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 214-233. University of Alabama Press, Tuscaloosa.

2004b Roots of the Theocratic Formative of the Archaic Southeast. In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 423-444. Center for Archaeological Investigations Occasional Paper No. 31. Southern Illinois University, Carbondale.

Sassaman, Kenneth E. and R. Jerald Ledbetter
1996 Middle and Late Archaic Architecture. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 76-98. University Press of Florida, Gainesville.

Sassaman, Kenneth E. and Michael S. Nassaney
1995 Epilogue. In *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands*, edited by Michael S. Nassaney and Kenneth E. Sassaman, pp. 341-353. University of Tennessee Press, Knoxville.

Sassaman, Kenneth E., Glen T. Hanson, and Tommy Charles
1988 Raw Material Procurement and the Reduction of Hunter-Gatherer Range in the Savannah River Valley. *Southeastern Archaeology* 7(2):79-94.

Saunders, Jeffrey J., C. Vance Haynes, Jr., Dennis Stanford, and George A. Agogino
1990 A Mammoth-Ivory Semifabricate from Blackwater Locality No. 1, New Mexico. *American Antiquity* 55(1):112-119.

Saunders, Joe
2004 Are We Fixing to Make the Same Mistake Again? In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 146-161.

Saunders, Joe W., Rolfe D. Mandel, C. Garth Sampson, Charles M. Allen, E. Thurman Allen, Daniel A. Bush, James K. Feathers, Kristen J. Gremillion, C. T. Hallmark, H. Edwin Jackson, Jay K. Johnson, Reca Jones, Roger T. Saucier, Gary L. Stringer, and Malcolm F. Vidrine
2005 Watson Brake, A Middle Archaic Mound Complex in Northeast Louisiana. *American Antiquity* 70(4):631-668.

Saxe, Arthur Alan
1970 *Social Dimensions of Mortuary Practices*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Scheidegger, Edward
1962 The Crib Mound. *Central States Archaeological Journal*. 9(1): 4-14.

Schiffer, Michael B.
1975a An Alternative Model to Morse's Dalton Settlement Pattern Hypothesis. *Plains Anthropologist* 20:253-266.

1975b Some Further Comments on the Dalton Settlement Pattern Hypothesis. In *The Cache River Archeological Project: An Experiment in Contract Archeology*, edited by Michael B. Schiffer and John H. House, pp. 103-112. Arkansas Archeological Survey Research Series No. 8, Fayetteville.

Schock, Jack M., William Howell, Mary L. Bowman, Richard Alvey, Dana Beasley, and Joel Stoner
1977 A Report on the Excavations of Two Archaic Sites (CH 302 and CH 307) in Christian County, Kentucky. *Kentucky Archaeological Association Bulletins* 6 and 7.

Schortman, Edward M.
1989 Interregional Interaction in Prehistory: The Need for a New Perspective. *American Antiquity* 54(1):52-65.

Schuldenrein, Joseph
1996 Geoarchaeology and the Mid-Holocene Landscape History of the Greater Southeast. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 3-27. University Press of Florida, Gainesville.

Schulting, R. J.
1996 Antlers, Bone Pins and Flint Blades: the Mesolithic Cemeteries of Téviec and Hoëdic, Brittany. *Antiquity* 70(268): 335-350.

Schwartz, Douglas W.
1967 *Conceptions of Kentucky Prehistory: A Case Study in the History of Archeology*. University of Kentucky Press Studies in Anthropology 6, Lexington.

Seeman, Mark F.
1994 Intercluster Lithic Patterning at Nobles Pond: A Case for 'Disembedded' Procurement among Early Paleoindian Societies. *American Antiquity* 59(2):273-288.

Semenov, S. A.
1964 *Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear*. Translated by M.W. Thompson. Harper and Row Publishers, New York.

Service, Elman R.
1966 *The Hunters*. Prentice-Hall, Englewood Cliffs, New Jersey.

1971 *Primitive Social Organization: An Evolutionary Perspective*. Second Edition. Random House, New York.

1993 Political Power and the Origin of Social Complexity. In *Configurations of Power: Holistic Anthropology in Theory and Practice*, edited by John S. Henderson and Patricia J. Netherly, pp. 112-134. Cornell University Press, Ithaca.

Sheehan, Glenn W.
1985 Whaling as an Organizing Focus in Northwestern Alaskan Eskimo Society. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 123-154. Academic Press, Orlando.

Shnirelman, Victor A.
1992 Complex Hunter-Gatherers: Exception or Common Phenomenon? *Dialectical Anthropology* 17:183-196.

Shott, Michael
1986 Technological Organization and Settlement Mobility: An Ethnographic Examination. *Journal of Anthropological Research* 42(1):15-51.

2004 Hunter-Gatherer Aggregation in Theory and Evidence: The Eastern North American Paleoindian Case. In *Hunters and Gatherers in Theory and Archaeology*, edited by George M. Crothers, pp. 68-102. Center for Archaeological Investigations Occasional Paper No. 31, Southern Illinois University, Carbondale.

Shott, Michael J. and Jesse A. M. Ballenger
2007 Biface Reduction and the Measurement of Dalton Curation: A Southeastern United States Case Study. *American Antiquity* 72(1):153-175.

Silberbauer, George
1982 Political Process in G/wi Bands. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 23-35. Cambridge University Press, Cambridge.

Simon, Mary L. and Kathryn E. Parker
2006 Prehistoric Plant Use in the American Bottom: New Thoughts and Interpretations. *Southeastern Archaeology* 25(2):212-257.

Skarland, Ivar
1939 The Skeletal Material. In *The Chiggerville Site, Site 1, Ohio County Kentucky*, written by William S. Webb and William G. Haag, pp. 28-49. University of Kentucky Reports in Anthropology 4(1), Lexington.

Slaughter, Bob H. and B. Reed Hoover
1965 An Antler Artifact from the Late Pleistocene of Northeastern Texas. *American Antiquity* 30(3):351-352.

Smith, Bruce D.

1977 Archaeological Inference and Inductive Confirmation. *American Anthropologist* 79(3):598-617.

1986 The Archaeology of the Southeastern United States: From Dalton to de Soto, 10,500-500 B.P. In *Advances in World Archaeology*, volume 5, edited by F. Wendorf and A. Close, pp. 1-92. Academic Press, Orlando.

1987 The Independent Domestication of Indigenous Seed-Bearing Plants in Eastern North America. In *Emergent Horticultural Economies of the Eastern Woodlands*, edited by William F. Keegan, pp. 3-47. Center for Archaeological Investigations Occasional Paper No. 7, Southern Illinois University, Carbondale.

1995 Seed Plant Domestication in Eastern North America. In *Last Hunters, First Farmers*, edited by T. Douglas Price and Anne Birgitte Gebauer, pp. 193-213. School of American Research Press, Santa Fe.

2001 Low-Level Food Production. *Journal of Archaeological Research* 9(1):1-43.

Smith, Bruce D. and C. Wesley Cowan

1987 Domesticated Chenopodium in Prehistoric Eastern North America: New Accelerator Dates from Eastern Kentucky. *American Antiquity* 52(2):355-357.

Smith, Bruce D. and Richard A. Yarnell

2009 Initial Formation of an Indigenous Crop Complex in Eastern North America at 3800 B.P. *Proceedings of the National Academy of Science*, early edition. Electronic document, http://www.pnas.org/cgi/doi/10.1073/pnas.0901846106, accessed April 14, 2009.

Smith, Edward E., Jr.

1995 The Swan's Landing Site (12HR304): An Early Archaic (Kirk Horizon) Site in Harrison County, South-Central Indiana. *Midcontinental Journal of Archaeology* 20(2):192-238.

Smith, Eric Alden

1988 Risk and Uncertainty in the 'Original Affluent Society': Evolutionary Ecology of Resource-Sharing and Land Tenure. In *Hunters and Gatherers Volume 1: History, Evolution and Social Change*, edited by Tim Ingold, David Riches, and James Woodburn, pp. 222-251. Berg, Oxford.

Smith, Harlan I.

1910 *The Prehistoric Ethnology of a Kentucky Site*. American Museum of Natural History Anthropological Papers 6(2), New York.

Smith, Maria O.
1996 Biocultural Inquiry into Archaic Period Populations of the Southeast. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 134-154. University Press of Florida, Gainesville.

Sofaer, Joanna
2006 *The Body as Material Culture: A Theoretical Osteoarchaeology*. Cambridge University Press, Cambridge.

Soffer, Olga
1985 Patterns of Intensification as Seen from the Upper Paleolithic of the Central Russian Plain. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 235-271. Academic Press, Orlando.

2004 Recovering Perishable Technologies through Use Wear on Tools: Preliminary Evidence for Upper Paleolithic Weaving and Net Making. *Current Anthropology* 45(3):407-413.

Soil Survey Staff
2007 *Custom Soil Resource Report for McLean and Muhlenberg Counties, Kentucky, and Ohio County, Kentucky*. United States Department of Agriculture Natural Resources Conservation Service. Electronic document generated using the Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, accessed October 19, 2007.

Solway, Jacqueline S. and Richard B. Lee
1990 Foragers, Genuine or Spurious? *Current Anthropology* 31(2):109-146.

Sommer, Jeffrey, D.
2006 Modified Bone Artifacts from 20SA1251, Saginaw County, Michigan. *Saginaw Valley Archaeologist* 2006-1:5-17.

Spears, Carol S.
1975 Hammers, Nuts and Jolts, Cobbles, Cobbles, Cobbles: Experiments in Cobble Technologies in Search of Correlates. In *Arkansas Eastman Archeological Project*, edited by Charles M. Baker, pp. 83-116. Arkansas Archeological Survey Research Report No. 6, Fayetteville, Arkansas.

Spector, Janet D.
1993 *What this Awl Means: Feminist Archaeology at a Wahpeton Dakota Village*. Minnesota Historical Society Press, St. Paul.

Spencer, Herbert
1862 *First Principles*. Williams and Norgate, London.

Spielmann, Katherine A.

1998 Ritual Craft Specialists in Middle Range Societies. In *Craft and Social Identity*, edited by Cathy Lynne Costin and Rita P. Wright, pp. 153-159. Archeological Papers of the American Anthropological Association Number 8.

Squier, E. G. and E. H. Davis

1848 *Ancient Monuments of the Mississippi Valley: Comprising the Results of Extensive Original Surveys and Explorations*. Smithsonian Institution Contributions to Knowledge 1, Washington, D.C.

Staats, Dayton F.

1988 Alternative Uses of the Stone Celt. *Pennsylvania Archaeologist* 58(1):26-29.

Stafford, C. Russell

1994 Structural Changes in Archaic Landscape Use in the Dissected Uplands of Southwestern Indiana. *American Antiquity*. 59(2): 219-237.

Stanish, Charles

2004 The Evolution of Chiefdoms: An Economic Anthropological Model. In *Archaeological Perspectives on Political Economies*, edited by G. Feinman and L. Nicholas, pp. 7-24. The University of Utah Press, Salt Lake City.

Stein, Julie K.

2005 Environment of the Green River Sites. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 19-39. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Stein, Julie Kay, Patty Jo Watson, and William B. White

1981 Geoarchaeology of the Flint Mammoth Cave System and the Green River, Western Kentucky. In *Geomorphology, Geoarchaeology, Engineering Geology*, edited by Thomas G. Roberts, pp. 507-542. Geological Society of America 1981 Fieldtrip Guidebook, Vol. III, Falls Church, VA.

Steinbring, Jack

1966 The Manufacture and Use of Bone Defleshing Tools. *American Antiquity* 31(4):575-581.

Steward, Julian H.

1955 *Theory of Culture Change: The Methodology of Multilinear Evolution*. University of Illinois Press, Urbana, Illinois.

Stewart, T. D.
1962 Comments on the Reassessment of the Indian Knoll Skeletons. *American Journal of Physical Anthropology* 20(2):143-148.

Stone, Linda
2006 *Kinship and Gender: An Introduction*. Third Edition. Westview Press, Boulder, Colorado.

Stothers, David M.
1996 Resource Procurement and Band Territories: A Model for Lower Great Lakes Paleoindian and Early Archaic Settlement Systems. *Archaeology of Eastern North America* 24:173-216.

Stothers, David M., Timothy J. Abel, and Andrew M. Schneider
2001 Archaic Perspectives in the Western Lake Erie Basin. In *Archaic Transitions in Ohio & Kentucky Prehistory*, edited by Olaf H. Prufer, Sara E. Pedde, and Richard S. Meindl, pp. 233-289. Kent State University Press, Kent, Ohio.

Stout, David B.
1938a Field Notes on the Excavation of Mu12. Manuscript on file, William S. Webb Museum of Anthropology, University of Kentucky, Lexington.

1938b Fields Notes on the Excavation of Oh1. Manuscript on file, William S. Webb Museum of Anthropology, University of Kentucky, Lexington.

1938c Site Survey Form – Mu12. Manuscript on file, William S. Webb Museum of Anthropology, University of Kentucky, Lexington.

Styles, Bonnie W. and Walter E. Klippel
1996 Mid-Holocene Faunal Exploitation in the Southeastern United States. In *Archaeology of the Mid-Holocene Southeast*, edited by Kenneth E. Sassaman and David G. Anderson, pp. 115-133. University Press of Florida, Gainesville.

Styles, Bonnie W., Steven R. Ahler, and Melvin L. Fowler
1983 Modoc Rock Shelter Revisited. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 261-297. Academic Press, New York.

Sullivan, Norman C.
1977 *The Physical Anthropology of Chiggerville: Demography and Pathology*. Unpublished M.A. thesis, Western Michigan University, Kalamazoo, Michigan.

Sundick, Robert I.

1972 *Human Skeletal Growth and Dental Development as Observed in the Indian Knoll Population*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Toronto.

Suttles, Wayne

1968 Coping with Abundance: Subsistence on the Northwest Coast. In *Man the Hunter*, edited by Richard B. Lee and Irven DeVore, pp. 56-68. Aldine Publishing Company, Chicago.

Tankersley, Kenneth B.

1994 Clovis Mastic and Its Hafting Implications. *Journal of Archaeological Science* 21:117-124.

1996 Ice Age Hunters and Gatherers. In *Kentucky Archaeology*, edited by R. Barry Lewis, pp. 21-38. University Press of Kentucky, Lexington.

1998 Variation in the Early Paleoindian Economies of Late Pleistocene Eastern North America. *American Antiquity* 63(1):7-20.

Teltser, Patrice A. (editor)

1995 *Evolutionary Archaeology: Methodological Issues*. University of Arizona Press, Tucson.

Terray, Emmanuel

1972 *Marxism and 'Primitive' Societies*. Translated by Mary Klopper. Monthly Review Press, New York.

Testart, Alain

1982 The Significance of Food Storage among Hunter-Gatherers: Residence Patterns, Population Densities, and Social Inequalities. *Current Anthropology* 23(5):523-537.

Thiel, Barbara

1971 The Validity of Archaeological Sampling. Manuscript on file, William S. Webb Museum of Anthropology, University of Kentucky, Lexington.

Thomas, David Hurst

1986 *Refiguring Anthropology: First Principles of Probability and Statistics*. Waveland Press, Prospect Heights, Illinois.

Thomson, Donald F.

1936 Notes on Some Bone and Stone Implements from North Queensland. *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 66:71-74.

Tomak, Curtis H.

1979 Jerger: An Early Archaic Mortuary Site in Southwestern Indiana. *Proceedings of the Indiana Academy of Science for 1979* 88: 62-69. Indianapolis.

1991 The Jerger Phase and Early Archaic Mortuary Ceremonialism in Southwestern Indiana. Paper presented at the Midwest Archaeological Conference.

Torrence, Corbett McPherson

1996 *From Objects to the Cultural System: A Middle Archaic Columella Extraction Site On Useppa Island, Florida*. Unpublished M.A. Thesis, Department of Anthropology, University of Florida, Gainesville.

1999 The Archaic Period on Useppa Island: Excavations on Calusa Ridge. In *The Archaeology of Useppa Island*, edited by William H. Marquardt, pp. 23-76. Institute of Archaeology and Paleoenvironmental Studies, Monograph 3. University of Florida, Gainesville.

Turnbull, Colin M.

1968 The Importance of Flux in Two Hunting Societies. In *Man the Hunter*, edited by Richard B. Lee and Irven DeVore, pp. 132-137. Aldine Publishing Company, Chicago.

Tuross, Noreen, Marilyn L. Fogel, Lee Newsom, and Glen H. Doran

1994 Subsistence in the Florida Archaic: The Stable-Isotope and Archaeobotanical Evidence from the Windover Site. *American Antiquity* 59(2):288-303.

Tyzzer, E. E.

1936 The 'Simple Bone Point' of the Shell-Heaps of the Northeastern Algonkian Area and Its Probable Significance. *American Antiquity* 1(4):261-279.

Ucko, Peter J.

1969 Ethnography and Archaeological Interpretation of Funerary Remains. *World Archaeology* 1(2):262-280.

Vanhaeren, Marian and Francesco d'Errico

2003 Childhood in the Epi-Palaeolithic. What do Personal Ornaments Associated with Burials Tell Us? In *Mesolithic on the Move: Papers presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*, edited by Lars Larsson, Hans Kindgren, Kjel Knutsson, David Loeffler, and Agneta Åkerlund, pp. 494-505. Oxbow Books, Oxford.

Vickery, Kent D.

1970 Preliminary Report on the Excavation of the ‘Great Mound’ at Mounds State Park in Madison County, Indiana. *Proceedings of the Indiana Academy of Science* 79:75-82.

Vierich, Helga I. D.

1982 Adaptive Flexibility in a Multi-Ethnic Setting: The Basarwa of the Southern Kalahari. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 213-222. Cambridge University Press, Cambridge.

Wagner, Gail E.

1996 Botanizing along Green River. In *Of Caves and Shell Mounds*, edited by Kenneth C. Carstens and Patty Jo Watson, pp. 88-93. University of Alabama Press, Tuscaloosa.

2005 Anthropogenic Changes at the Carlston Annis Site. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 213-242. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Waguespack, Nicole M.

2005 The Organization of Male and Female Labor in Foraging Societies: Implications for Early Paleoindian Archaeology. *American Anthropologist* 107(4):666-676.

Waguespack, Nicole M. and Todd A. Surovell

2003 Clovis Hunting Strategies, or How to Make Out on Plentiful Resources. *American Antiquity* 68(2):333-352.

Walthall, John A.

1998a Overwinter Strategy and Early Holocene Hunter-Gatherer Mobility in Temperate Forests. *Midcontinental Journal of Archaeology* 23(1):1-22.

1998b Rockshelters and Hunter-Gatherer Adaptation to the Pleistocene/Holocene Transition. *American Antiquity* 63(2):223-238.

Walthall, John A. and George R. Holley

1997 Mobility and Hunter-Gatherer Toolkit Design: Analysis of a Dalton Lithic Cache. *Southeastern Archaeology* 16(2):152-162.

Watson, Patty Jo

1983 Jarmo Worked Bone. In *Prehistoric Archaeology along the Zagros Flanks*, edited by Braidwood et al., pp. 347-367. O.I.P. vol. 105, Oriental Institute, University of Chicago.

2005 WPA Excavations in the Middle Green River Area: A Comparative Account. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 515-628. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Watson, Patty Jo and Mary C. Kennedy

1991 The Development of Horticulture in the Eastern Woodlands of North America: Women's Role. In *Engendering Archaeology: Women and Prehistory*, edited by Joan M. Gero and Margaret W. Conkey, pp. 255-275. Blackwell Publishers, Oxford, United Kingdom.

Watson, Patty Jo and William H. Marquardt

2005 The History of Butler County, Morgantown, Logansport, and the Big Bend. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 1-11. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

Webb, S. David and C. Andrew Hemmings

2001 Ivory and Bone Tools from Late Pleistocene Deposits in the Aucilla and Wacissa River, North-Central Florida. In *Enduring Records: The Environmental and Cultural Heritage of Wetlands*, edited by Barbara A. Purdy, pp. 1-8. Oxbow Books, Oxford.

Webb, William S.

1950a *The Carlson Annis Mound, Site 5, Butler County, Kentucky*. University of Kentucky Reports in Anthropology 7(4), Lexington, Kentucky.

1950b *The Read Shell Midden, Site 10, Butler County, Kentucky*. University of Kentucky Reports in Anthropology 7(5), Lexington, Kentucky.

1951 *The Parrish Village Site, Site 45, Hopkins County, Kentucky*. University of Kentucky Reports in Anthropology 7(6), Lexington, Kentucky.

1957 *The Development of the Spearthrower*. University of Kentucky Occasional Papers in Anthropology No. 2, Lexington.

1974 *Indian Knoll*. Reprinted. University of Tennessee Press, Knoxville. Originally published 1946, *University of Kentucky Reports in Anthropology and Archaeology*, Volume IV, No. 3, Part 1, Lexington, KY.

Webb, William S. and David L. DeJarnette
1942 *An Archeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi and Tennessee*. Smithsonian Institution Bureau of American Ethnology Bulletin 129, United States Government Printing Office, Washington.

Webb, William S. and William G. Haag
1939 *The Chiggerville Site, Site 1, Ohio County Kentucky*. University of Kentucky Reports in Anthropology 4(1), Lexington.

Webb, William S. and William G. Haag
1940 *Cypress Creek Villages, Sites 11 and 12, McLean County, Kentucky*. University of Kentucky Reports in Anthropology 4(2), Lexington.

1947 *Archaic Sites in McLean County, Kentucky*. University of Kentucky Reports in Anthropology 7(1), Lexington, Kentucky.

Weiner, Annette B.
1992 *Inalienable Possessions: The Paradox of Keeping-While-Giving*. University of California Press, Berkeley.

White, Andrew A.
2006 A Model of Paleoindian Hafted Biface Chronology in Northeastern Indiana. *Archaeology of Eastern North America* 34:29-59.

White, Karli Erica
1990 *An Analysis of Bone Tools from the Carlston Annis Site (15Bt5), Kentucky*. Unpublished M.A. thesis, Department of Anthropology, Washington University, St. Louis, Missouri.

2005 Bone Artifacts from the Carlston Annis Site. In *Archaeology of the Middle Green River Region, Kentucky*, edited by William H. Marquardt and Patty Jo Watson, pp. 339-350. Institute of Archaeology and Paleoenvironmental Studies Monograph 5, Florida Museum of Natural History, University of Florida, Gainesville.

White, Leslie A.
1959 *The Evolution of Culture: The Development of Civilization to the Fall of Rome*. McGraw-Hill, New York.

1966 *The Social Organization of Ethnological Theory*. Rice University Studies Monograph in Cultural Anthropology 52(4), Houston, Texas.

Wiant, Michael D. and Harold Hassen
1984 The Role of Lithic Resource Availability and Accessibility in the Organization of Lithic Technology. In *Lithic Resource Procurement: Proceedings from the Second Conference on Prehistoric Chert Exploitation*, edited by Susan C. Vehik, pp. 101-114. Center for Archaeological Investigations Occasional Paper 4, Southern Illinois University, Carbondale.

Widmer, Randolph J.
2004 Explaining Sociopolitical Complexity in the Foraging Adaptations of the Southeastern United States: The Roles of Demography, Kinship, and Ecology in Sociocultural Evolution. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by Jon L. Gibson and Philip J. Carr, pp. 234-253. University of Alabama Press, Tuscaloosa.

Wiessner, Polly
1982 Risk, Reciprocity, and Social Influences on !Kung San Economics. In *Politics and History in Band Societies*, edited by Eleanor Leacock and Richard Lee, pp. 61-84. Cambridge University Press, Cambridge, UK.

1983a Social and Ceremonial Aspects of Death among the !Kung San. *Botswana Notes and Records* 15:1-5.

1983b Style and Social Information in Kalahari San Projectile Points. *American Antiquity* 48(2):253-276.

1984 Reconsidering the Behavioral Basis for Style: A Case Study among the Kalahari San. *Journal of Anthropological Archaeology* 3:190-234.

Wilkins, Gary R., Paul A. Delcourt, Hazel R. Delcourt, Frederick W. Harrison, and Manson R. Turner
1991 Paleoecology of Central Kentucky since the Last Glacial Maximum. *Quaternary Research* 36:224-239.

Willoughby, Charles C.
1901 Antler-Pointed Arrows of the South-Eastern Indians. *American Anthropologist* 3(3):431-437.

Wilmsen, Edwin N.
1973 Interaction, Spacing Behavior, and the Organization of Hunting Bands. *Journal of Anthropological Research* 29(1):1-31.

Winters, Howard D.
1967 *An Archaeological Survey of the Wabash Valley in Illinois*. Revised Edition. Illinois State Museum Reports of Investigations No. 10, Springfield, Illinois.

1968 Value Systems and Trade Cycles of the Late Archaic in the Midwest. In *New Perspectives in Archeology*, edited by Sally R. Binford and Lewis R. Binford, pp. 175-221. Aldine Publishing Company, Chicago.

1969 *The Riverton Culture: A Second Millennium Occupation in the Central Wabash Valley*. Illinois State Museum Reports of Investigations No. 13, Illinois Archaeological Survey Monograph No. 1, Springfield, Illinois.

1974 Introduction to the New Edition. In *Indian Knoll*, written by William S. Webb, pp. v-xxvii. University of Tennessee Press, Knoxville. Originally published 1946. University of Kentucky Reports in Anthropology and Archaeology 4(3), Part 1, Lexington.

Witthoft, John

1953 Broad Spearpoints and the Transitional Period Cultures. *Pennsylvania Archaeologist* 23(1):4-31.

Wobst, H. Martin

1977 Stylistic Behavior and Information Exchange. In *For the Director: Research Essays in Honor of James B. Griffin*, edited by Charles E. Cleland, pp. 317-342. Anthropological Papers No. 61, Museum of Anthropology, University of Michigan, Ann Arbor.

Wolf, David J. and Robert L. Brooks

1979 The Prehistoric People of the Rosenberger Site. In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky*, edited by Michael B. Collins, pp. 899-945. Occasional Papers in Anthropology 1, Department of Anthropology, University of Kentucky, Lexington.

Woodburn, James

1980 Hunters and Gatherers Today and Reconstruction of the Past. In *Soviet and Western Anthropology*, edited by Ernest Gellner, pp. 95-117. Columbia University Press, New York.

1982 Egalitarian Societies. *Man* 17(3):431-451.

Wright, Henry and Melinda Zeder

1977 The Simulation of a Linear Exchange System Under Equilibrium Conditions. In *Exchange Systems in Prehistory*, edited by Timothy K. Earle and Jonathon E. Ericson, pp. 233-253. Academic Press, New York.

Wright, Katherine I.

1994 Ground-Stone Tools and Hunter-Gatherer Subsistence in Southwest Asia: Implications for the Transition to Farming. *American Antiquity* 59(2):238-263.

Wyckhoff, Larry M.

1977 *The Physical Anthropology of Chiggerville: Biological Relationships and Growth*. Unpublished M.A. thesis, Western Michigan University, Kalamazoo, Michigan.

Yarnell, Richard A.

1974 Plant Food and Cultivation of the Salts Cavers. In *Archeology of the Mammoth Cave Area*, edited by Patty Jo Watson, pp. 113-122. Academic Press, New York.

1976 Early Plant Husbandry in Eastern North America. In *Cultural Change and Continuity: Essays in Honor of James Bennett Griffin*, edited by Charles E. Cleland, pp. 265-273. Academic Press, New York.

1993 The Importance of Native Crops during the Late Archaic and Woodland Periods. In *Foraging and Farming in the Eastern Woodlands*, edited by C. Margaret Scarry, pp. 13-26. University Press of Florida, Gainesville.

2004 Riverton Plant Remains and Terminal Archaic Crops. In *Aboriginal Ritual Economy in the Eastern Woodlands: Essays in Memory of Howard Dalton Winters*, edited by Anne-Marie Cantwell, Lawrence A. Conrad, and Jonathan E. Reyman, pp. 123-130. Illinois State Museum Scientific Papers 30, Kampsville Studies in Archeology and History 5, Springfield, Illinois.

Yellen, John E.

1989 The Present and the Future of Hunter-Gatherer Studies. In *Archaeological Thought in America*, edited by C. C. Lamberg-Karlovsky, pp. 103-116. Cambridge University Press, Cambridge, UK.

Yengoyan, Aram A.

1972 Ritual and Exchange in Aboriginal Australia: An Adaptive Interpretation of Male Initiation Rites. In *Social Exchange and Interaction*, edited by Edwin N. Wilmsen, pp. 5-9. Museum of Anthropology Anthropological Papers No. 46, University of Michigan, Ann Arbor.

Yerkes, Richard W.

2003 Hopewell Tribes: A Study of Middle Woodland Social Organization in the Ohio Valley. In *The Archaeology of Tribal Societies*, edited by William A. Parkinson, pp. 227-245. International Monographs in Prehistory Archaeological Series, Ann Arbor, Michigan.

Yerkes, Richard and Linda M. Gaertner

1997 Microwear Analysis of Dalton Artifacts. In *Sloan: A Paleoindian Dalton Cemetery in Arkansas*, edited by Dan F. Morse, pp. 58-71. Smithsonian Institution Press, Washington, D.C.

Yesner, David R.
1980 Maritime Hunter-Gatherers: Ecology and Prehistory. *Current Anthropology* 21(6):727-750.

Yoffee, Norman
1993 Too Many Chiefs? (or Safe Texts for the '90s). In *Archaeological Theory: Who Sets the Agenda*, edited by N. Yoffee and A. Sherratt, pp. 60-78. Cambridge University Press, Cambridge.

Young, Donald and Douglas B. Bamforth
1990 On the Macroscopic Identification of Used Flakes. *American Antiquity* 55(2):403-409.

Vita

Christopher Ray Moore

Birthplace: Kokomo, Indiana, Date: August 11, 1981

Education

2008	M.A., University of Kentucky, Lexington Field of Study: Anthropology
2004	B.S., University of Indianapolis, Indianapolis Field of Study: Archeology
2004	B.A., University of Indianapolis, Indianapolis Filed of Study: Anthropology

Academic Positions & Affiliations

2009 – present	Visiting Instructor of Geology, Department of Physics & Earth-Space Sciences, University of Indianapolis, Indianapolis
2009	Instructor, Department of Anthropology, University of Kentucky, Lexington
2005-2008	Teaching Assistant, Department of Anthropology, University of Kentucky, Lexington

Scholastic & Professional Honors

2010	Honorable Mention, Margaret Lantis Award for Graduate Student Research, Department of Anthropology, University of Kentucky, Lexington
2009-10	Non-service Dissertation Year Fellowship, The Graduate School, University of Kentucky, Lexington
2008	Second Place, Southeastern Archaeology Conference Student Paper Contest
2007	Susan Abbott-Jamieson Pre-dissertation Research Grant, Department of Anthropology, University of Kentucky, Lexington
2004	Anthropology Excellence Award, Department of Anthropology, University of Indianapolis, Indianapolis
2004	Richard R. Priddy Award for Excellence in Geology, Department of Physics & Earth-Space Sciences, University of Indianapolis, Indianapolis

Professional Publications

Moore, Christopher R. and Victoria G. Dekle. 2010. "Hickory Nuts, Bulk Processing, and the Advent of Early Horticultural Economies in Eastern North America." *World Archaeology* 42(4):595-608.

Moore, Christopher R. 2010. "A Macroscopic Investigation of Technological Style and the Production of Middle to Late Archaic Fishhooks at the Chiggerville, Read, and Baker Sites, Western Kentucky." *Southeastern Archaeology* 29(1):197-221.

Moore, Christopher R. 2004-06. "A Geoarchaeological Investigation of Chert Resources along the Wildcat Creek, Carroll County, Indiana." *Michigan Archaeologist* 50-52(1-4):203-213. Published in 2010.

Moore, Christopher R. 2009. "Paleoamerican Utilization of the Green River Shell Middens: The Chiggerville Site (15Oh1)." *Current Research in the Pleistocene* 26:91-92.

Moore, Christopher R. and Christopher W. Schmidt. 2009. "Paleoindian and Early Archaic Organic Technologies: A Review and Analysis." *North American Archaeologist* 30(1):57-86.

Moore, Christopher R. 2008. "Raw Material Utilization in Carroll County, Indiana: A Small- Scale Analysis of Diachronic Patterns in the Usage of Attica, Kenneth, and Wyandotte Cherts." *Midcontinental Journal of Archaeology* 33(1):73-106.

Jefferies, Richard W. and Christopher R. Moore. n.d. "In Search of Mission San Joseph de Sapala: Mission Period Archaeological Research on Sapelo Island, Georgia." In *Native American Archaeology of the Georgia Coast*, edited by Victor D. Thompson and David Hurst Thomas. American Museum of Natural History Anthropological Papers. New York. In press.

Jefferies, Richard W. and Christopher R. Moore. 2010. "Recent Investigations of Mission Period Activity on Sapelo Island, Georgia." In *Archaeological Encounters with Georgia's Spanish Period, 1526 – 1700: New Findings and Perspectives*, edited by Dennis B. Blanton and Robert A. DeVillar, pp. 67-85. Society for Georgia Archaeology Special Publication No. 2 and the Institute for Global Initiatives Journal of Global Initiatives 5(1), Athens, Georgia.

Schmidt, Christopher W., Christopher R. Moore, and Randall Leifheit. n.d. "A Preliminary Assessment of Using a White Light Confocal Imaging Profiler for Cutmark Analysis." In *Forensic Microscopy for Skeletal Tissues: Methods and Protocols*, edited by Bell Lynne. Springer, New York. In press.

Miller, Sarah E., David Pollack, Kenneth Carstens, and Christopher R. Moore (editors). 2007. Current Archaeological Research in Kentucky: Volume Eight. Kentucky Heritage Council, Frankfort.