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A Technological Analysis of Modified Bone from the Widows Creek Site (1JA305), Alabama

Sean Patrick Coughlin
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Sean Patrick Coughlin entitled "A Technological Analysis of Modified Bone from the Widows Creek Site (1JA305), Alabama." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Walter E. Klippel, Major Professor

We have read this thesis and recommend its acceptance:

Paul W. Parmalee, Charles Faulkner

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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A TECHNOLOGICAL ANALYSIS OF MODIFIED BONE FROM THE WIDOWS CREEK SITE (1JA305), ALABAMA

A Thesis
Presented for the
Master of Arts
Degree
The University of Tennessee

Sean Patrick Coughlin
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ABSTRACT

This study examines chronological and spatial changes in the distribution of modified bone attributes. Five hundred sixty-two modified bone specimens were examined from Late Archaic, Early Woodland, and Middle/Late Woodland contexts of the Widows Creek site. Each specimen was examined for raw material, manufacturing traces, manufacturing stage, and morphology. The Widows Creek material was then compared to material from Russell Cave (1JA181) and Westmoreland-Barber (40MI11) using published data.

The study found that, at a general level, raw material choice varied little through time. However, distinct differences in the distribution of materials in manufacturing stages and morphological categories are present. Manufacturing stage data shows an increase in the manufacture of certain items including fishhooks and bipointed objects in the Middle Late Woodland period. Differences in settlement pattern and site function are observed when the three sites are compared.

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CHAPTER I

INTRODUCTION

Prehistoric humans modified materials such as bone, antler, teeth, and horn into tools and ornaments for much of their evolutionary past. Objects of this nature, often generically labeled as bone tools, are common on many archaeological sites around the world. Although bone tools are numerous, few researchers analyzing bone tools use a technological or behavioral framework. Therefore, the purpose of this thesis is to infer prehistoric cultural behavior from modified bone and antler artifacts. This is accomplished by examining the distribution of technological variables that have behavioral correlations. Both diachronic and synchronic change are examined among Late Archaic, Early Woodland, and Middle/Late Woodland cultures in the Guntersville Basin of the Tennessee River. The three cultural units are compared using a sample of modified bone and antler from the Widows Creek site (1JA305) and data from the Westmoreland-Barber (40MI11) and Russell Cave (1JA181) reports (Figure I-1).

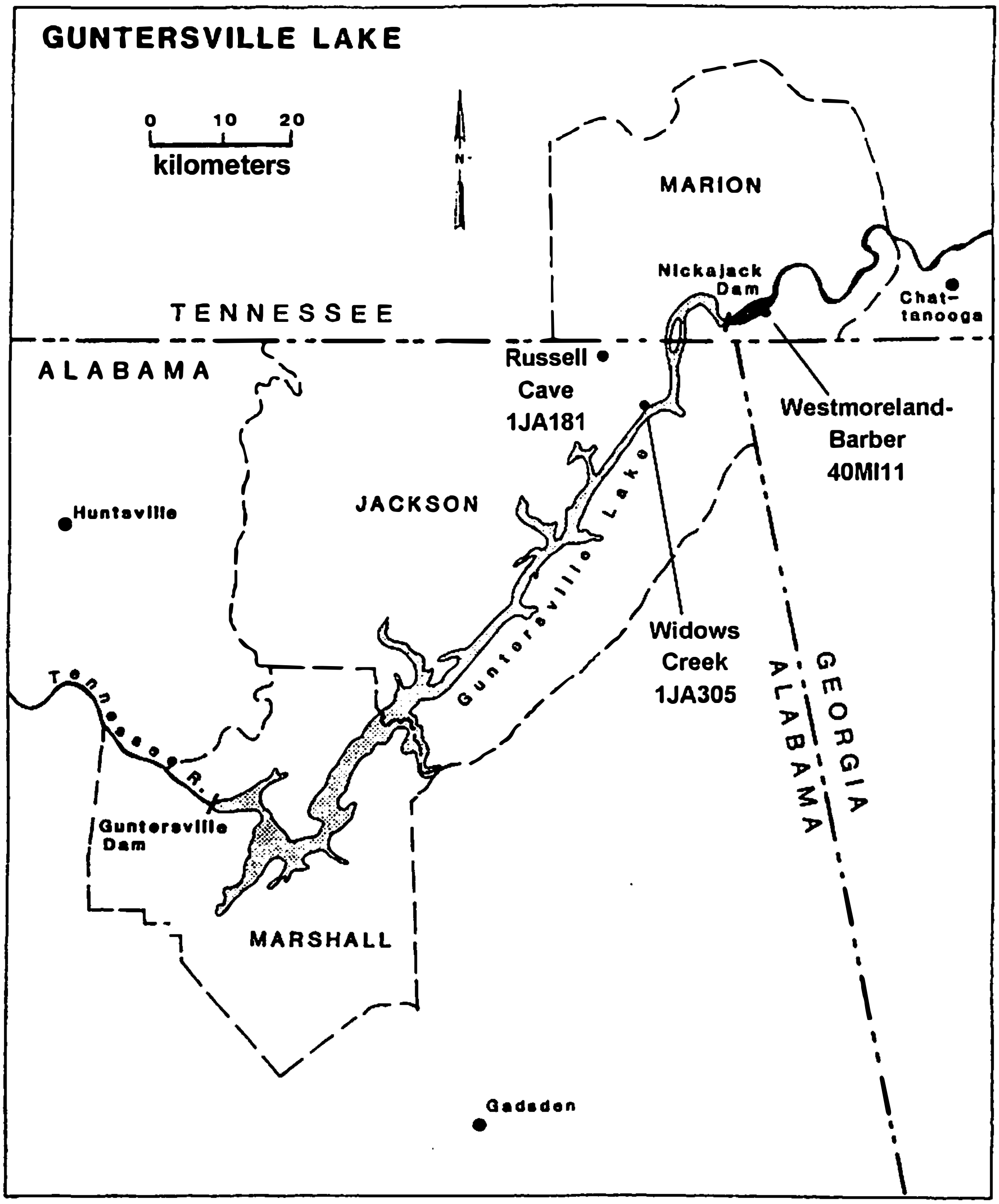

Figure I - 1. The Guntersville Basin and the sites included in this study.
(adopted from Solis and Futato 1987.)

Widows Creek is a shell midden site located on the right bank of the Tennessee River in Jackson County, Alabama, approximately 656.5 km above the mouth of the Tennessee River. Deposits date from the Middle Archaic to the Late Woodland periods. The site, excavated in the 1970s with support from The Tennessee Valley Authority, has only been partially reported (Morey 1995; Warren 1975, 1991). Excavations produced a large and previously undocumented assemblage of modified bone including tools and manufacturing debris. Because the modified bone is undocumented, and I studied the materials firsthand, this assemblage was the primary focus of the study.

Westmoreland-Barber is a shell midden site located on the left bank of the Tennessee River in Marion County, Tennessee, approximately 715 km above the mouth of the Tennessee River. Deposits containing Early Archaic through Protohistoric materials were recovered from the site. J.B. Graham directed excavations at the site in the 1960s, and it was reported by Faulkner and Graham (1965,1966). The modified bone data used in this study was extracted from the published report.

Russell Cave is a cave located in Doran Cove approximately 10 km northwest of the Widows Creek Site, in Jackson County, Alabama. Stratified deposits containing Early Archaic through Mississippian materials were excavated in the cave. John Griffin directed excavations and reported on the site (1974). The modified bone data used in this study was extracted from the published data.

Chapter II presents a literature review to place the study in both a methodological and a cultural context. The first section of Chapter II reviews two frameworks used to approach prehistoric technologies. This review is important for understanding how archaeologists approach the study of prehistoric technology. Although these frameworks have been developed for the study of stone and ceramic technologies, they can be related or applied to the study of modified bone and antler.

The two frameworks, *chaine operatioire* (Inizan et al. 1992; Simek 1994) and organization of technology (Carr 1994; Nelson 1991; Torrence 1989), emphasize slightly different approaches to prehistoric technologies. The schools nonetheless focus on many of the same materials and technological variables.

The second set of reviews examines other modified bone studies. Modified bone is defined here as bone or antler intentionally worked by humans and recognizable by patterned and regular manufacturing traces. This includes both bone and antler tools, ornaments, and manufacturing debris. Conversely, in much of the archaeological literature, modified bone refers to studies that discern naturally altered bone from bone altered by humans (e.g., Bonnichsen and Sorg 1989). Although this literature is important, it is beyond the scope of the current study and will not be discussed.

The literature discussed in the second section deals with intentionally modified bone as archaeologists have described and studied it. This section helps to identify technological variables and stages of modified bone that researchers use in the study of prehistoric technologies. The analysis of modified bone from Widows Creek incorporates a number of these variables.

Chapter II also contains a review of Guntersville Basin prehistory to explain the cultural context of the modified bone and antler. This review emphasizes that modified bone and antler is part of a much larger complex of material culture used by groups of people in specific environmental and cultural contexts. The process and purpose for which bone is modified into tools and ornaments are affected by these environmental and cultural contexts. For example, knowing which materials are available to use in modifying bone can affect modification patterns and processes. Only by reviewing the environmental and cultural background can appropriate and relevant behavioral inferences be made.

Chapter III presents the materials and methods used in this study. The first section describes the three sites and how the proveniences of the material studied were chosen. It is important to understand what characteristics the site has and how these characteristics might relate to Guntersville Basin prehistory and cultural lifeways. Provenience information is presented to indicate why the samples from each site were chosen and how their cultural affiliations were determined.

The second section discusses the modified bone attributes used in this analysis. These attributes or variables are chosen based on the information they convey about prehistoric behavior and because they are easily studied. The attributes chosen for the analysis are raw material, manufacturing techniques, condition, and morphology. Only the morphological data were used to compare the three sites because only these data were obtainable from the published site reports.

Chapter IV presents the results of the analysis of the modified bone from the three sites. The data are presented graphically both by site and by culture period.

Chapter V presents the comparisons of the data. The first set of comparisons is a diachronic comparison of the Widows Creek site data using all the variables. The second set of comparisons is between sites and cultural periods with the morphological data. These comparisons show differences among the three sites for the Late Archaic, Early Woodland, and Middle/Late Woodland periods. These differences demonstrate changing patterns of manufacture and transport among the different periods at the different sites. These patterns stress the distribution of the manufacturing sequence as well as the distribution of tool form among the analytical units.

Chapter VI contains a summary of this study emphasizing the inferences derived from the data about prehistoric lifeways in the Guntersville Basin. The data presented in the study is drawn together and similarities and differences that have cultural and behavioral implications are presented. The chapter ends with a discussion of the behavioral inferences and the utility of the method.

CHAPTER II

METHODOLOGICAL BACKGROUND

INTRODUCTION

This chapter has three sections that build a methodological and cultural context for this analysis: prehistoric technology studies, previous studies of modified bone, and the prehistory of the Guntersville Basin.

PREHISTORIC TECHNOLOGY STUDIES

Archaeologists have studied prehistoric technologies (e.g., Baden-Powell 1949; Bordes 1950; Holmes 1890,1892; Semenov 1964; Shepard 1956) but the approaches have often been case specific and not placed within a broader analytical framework. Technological studies have centered on developing ways to learn about prehistoric groups through the artifactual remains. Out of the various approaches used, two major frameworks have been developed to study prehistoric technology: *chaine operatoire*

(Inizan et al. 1992; Sellet 1993; Simek 1994), and organization of technology (Carr 1994; Nelson 1991; Torrence 1989). These two approaches study technology by placing smaller case studies in a broader framework or studying the industry as a whole within the framework. These schools take different approaches but have many similarities.

Chaine Operatoire

In the European approach, *chaine operatoire*, researchers study the chain of events behind an item's production, use and discard. Leroi-Gourhan (1964) originally conceptualized the term *chaine operatoire* to study lithic technology of Paleolithic Europe. Inizan et al. (1992:12) define *chaine operatoire* as "all the processes, from the procurement of raw material until it is discarded, passing through all stages of manufacture and use." Researchers utilize this concept and framework to study the choices individuals make as part of a larger cultural unit in technological areas. The major areas researchers concentrate in are raw materials, physical actions, skills, and tools. These choices have identifiable elements that can be studied through the archaeological remains.

In studies of **raw materials** researchers examine the choices made in raw material choice and utilization. Studies include determining the materials utilized, the source of the materials, the variability of the materials, and material alteration (Inizan et al. 1992). Some of these choices are heavily linked to environmental circumstances. An example is the scheduling of subsistence activities in a region around trips to lithic raw material sources.

Physical actions in this framework are the study of psychomotor actions of a tool manufacturer. Psychomotor actions are a combination of the physical action and the cognitive reasoning of why one action and not another. These actions are studied through the reconstruction of the manufacture of items using experimental flint knapping and refitting methods. Archaeologists use flint knapping experiments to judge lithic raw material suitability, to investigate the physical process of knapping, and to gain an understanding of choices that can be made during the knapping process. Refitting uses the artifactual remains by conjoining the remains to rebuild the actual sequence of manufacture. Experimental knapping helps identify the steps, while the refitting helps to define the process (Inizan et al. 1992).

In this framework the concept of **skills** is a series of psychomotor actions that a manufacturer carries out to complete specific tasks (Inizan et al. 1992:12). Skills represent the combination of the cognitive recognition of a task and the physical ability to follow the task through. An individual may have the ability to perform some or all of the psychomotor actions but not necessarily the skill to link those actions together to complete a task. By studying the whole manufacturing process the skills involved can be delineated.

The **tools** are studied to determine their function and define their style. Understanding the use or function of the tools is important for determining activities performed by prehistoric groups or culture. This is often done through microscopic analysis of a tool, referred to as the use-wear method (e.g., Keeley 1980; Odell 1977). Researchers infer the use of tools in prehistoric activities through the comparison of archaeological specimens to modern replicas used in known activities. Stylistic aspects of the tools are based on concepts of group identity. People within some groups may maintain specific guidelines for shapes and styles of tools. These guidelines help identify members of specific groups to others through tool style.

Utilizing these methods in a *chaine operatoire* framework, some European archaeologists are trying to get into the mind of the tool manufacturer (Inizan et al. 1992:25-26; Sellet 1993:110; Simek 1994:120). Recognizing specific patterns of manufacture, a cognitive or ideational pattern is associated and given a *chaine* identification, thus moving from technology into cognitive recognition. Although a direct correlation of manufacturing actions to cognitive pattern may be overstepping the bounds of inference, the *chaine operatoire* approach does demonstrate how the actions of lithic production are linked to the larger culture as a whole.

In summary, archaeologists employing a *chaine operatoire* approach investigate the material correlates of raw material, physical action, skills, and tools to rebuild the chain of events and behaviors that produced specific technologies. As Simek (1994:120) states "the ultimate goal of this analysis is to characterize, indeed classify, an assemblage based on how the makers and users of the assemblage integrated their particular stone tool technology into their wider social and economic worlds."

Organization of Technology

North American archaeologists developed a framework for studying prehistoric technologies termed organization of technology (OT) (e.g., Binford 1979; Carr 1994;

Kelly 1988; Koldehoff 1987; Nelson 1991). In a recent review, Nelson (1991:57) defines OT as

> the study of the selection and integration of strategies for making, using, transporting, and discarding tools and the materials needed for their manufacture and maintenance. Studies of the organization of technology consider economic and social variables that influence those strategies.

As the definition points out, the emphasis in this framework is the technological strategy a culture develops within its social, economic, and ultimately environmental setting. Through these studies, archaeologists hope to determine how technological changes reveal changes in other behavioral aspects of a society or culture (Carr 1994; Kelly 1983).

Nelson (1991) recognizes several levels of behavior that can be analyzed. Figure II - 1 shows these different levels as organized hierarchically based on the level's distance from material implications. The hierarchy represents not only levels of analysis but also how archaeologists that utilize OT approach the interconnectedness of behavior, technology, and the archaeological record. OT researchers view artifacts as the remains of adaptive activities conducted by human groups to survive in their local environment (Carr 1995; Nelson 1991). Social and economic strategies of the group influence the adaptive technological decisions made. The archaeologist then finds specifically designed and distributed tools and manufacturing debris that are indicative of the technological strategy.

OT research is conducted on many of these levels. **Environmental conditions** are often studied in terms of raw material availability, distribution, and quality (Amick 1994; Carr 1991). **Social strategies** have been examined through OT studies (Arnold 1987; Clark 1987; McAnany 1989). An example is Morrow's (1987) study of Middle Woodland

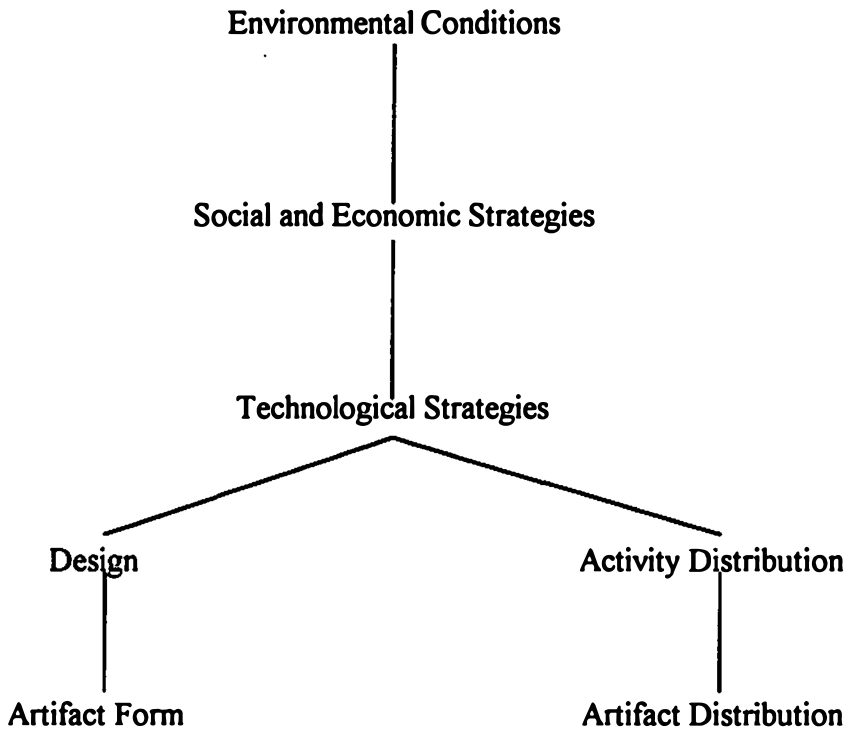

Figure II - 1. Levels of research in organization of technology studies (after Nelson 1991).

blades in the Illinois River valley. In this study Morrow (1987:119) argues that the specialized high quality blades were used as regional markers and not strictly a technological strategy. Archaeologists studying **economic strategies** examine the OT in terms of risk, optimality, and costs and benefits (Binford 1979; Bleed 1986). Technological choices affect the time available to do subsistence activities.

Technological strategies have been more highly developed than other areas. Two strategies are generally identified: curated and expedient. Nelson (1991:62) also recognizes a third called opportunistic behavior. The strategy a culture uses has implications for the nature and kind of materials found.

Under technological strategies are the areas of tool design and activity distribution. **Tool design** is the set of variables that affect tool utility (Nelson 1991:66). Nelson (1991:66) recognizes five variables of design: reliability, maintainability, transportability, flexibility, and versatility. These design variables can be correlated to certain technological strategies and have implications for tool form. All the variables have pros and cons and are suitable under differing conditions (Bleed 1986; Nelson 1991). Design is studied archaeologically through artifact form.

Activity distribution refers to models of tool manufacture, use, and discard in terms of their spatial location. These variables have implications for site function and site activities. Analyses of this nature examine activities within a site, between sites, and in some cases on a regional level. Depending on the technological strategy used, certain expectations can be made of where tool manufacture, use, and discard occur (Carr 1991;

Nelson:1991). Activity distribution is studied archaeologically through the spatial analysis of tools and debitage at sites and between sites.

Although discussed here separately, no level is usually studied exclusively. The analysis and interpretation of archaeological materials in an OT framework often moves up and down the levels, such as the study of mobility (e.g., Kelley 1992). Many OT researchers discuss group mobility through economic and technological strategies, making inferences based on the design of chipped stone tools and debris as well as raw material source (e.g., Amick 1994; Carr 1991; Kelly 1988; Odell 1994).

Because of the broad nature of OT, a number of different methods and different materials have been studied using this framework. Methods used to analyze artifacts include: different kinds of flake analysis, use wear, stone tool form, and experimental replication. Most of the materials studied in the OT framework are stone tools and debitage. However, Nelson and Lippmier (1993) recently examined groundstone tools in an OT framework. Schiffer and Skibo's (1987) study of pottery tempers and their affects on performance characteristics is subsumed under OT by Nelson (1991:74).

In summary, OT is a framework that places the study of prehistoric technology within the environmental conditions and the economic and social strategies of a cultural group. This framework begins with the premise that artifact patterns are products of technological systems embedded in a culture's social and economic strategies to mitigate environmental conditions.

BONE TOOL STUDIES

Bone tool studies can be roughly divided into classification studies, manufacturing studies, and functional studies. In a number of cases, as outlined below, these three distinct areas are often used to make inferences about prehistoric behavior.

Bone Tool Classification

Classification or typing of bone tools is often undertaken using morphology, presumed function, and ethnographic analogy (e.g., Fowke 1902; Lewis and Kneberg 1946). In early excavations by Moorehead (1892), Mills (1916), and Squier and Davis (1848) bone tools were recognized and described based on their presence with burials. In this early phase of archaeology, the concern with burial goods insured the retention of these artifacts unlike faunal debris. The labeling of these tools with functional titles was based on ethnographic analogy. For example, Fowkes' (1902:678-679) early synthesis of Ohio prehistory draws analogies between artifacts found in Ohio mounds and tools used by the Omaha and Shoshone tribes.

This practice of bone tool collection and classification continued throughout the mid 1900s. Burials were a basic interpretational unit. Burial artifacts in context provided archaeologists with cultural items specific to a certain time and place. These burial artifacts, including bone tools, were counted, classified, and incorporated into the "trait" list. Trait lists, created at the site level and the culture level (Adams and Adams

1991:267-269), were lists of artifacts and their frequencies that characterized or defined a culture group.

Within this framework different sites could be compared and contrasted chronologically and geographically. Levels of relatedness were developed based on the number of artifacts and the frequencies that were common between two sites. Groups of sites could then be defined as a culture because they had many of the same artifacts in common. Bone tools in this system were typed and the frequencies compared between differing units (e.g., Webb and Wilder 1951). Typing of bone artifacts was implicitly based on combinations of certain attributes including identifiable animal taxon, shape, and in some cases a presumed function.

A series of standardized bone tools was first systematically laid out by Kidder (1932) in The Artifacts of the Pecos. Bone tools from the Pecos site were separated into approximately 30 classes based on morphological similarity and observed manufacturing patterns. Awls, for example, were classified as "head of bone left intact," or "head of bone worked," etc. (Kidder 1932:202). Functional categories, such as awls or beamers, were based on previous historical categories and ethnographic analogy.

Many of the categories created by Kidder and other archaeologists of the first half of the 1900s, are still used today to categorize or type bone tools (e.g., Bogan et al. 1986; Breitburg 1986; Faulkner and Graham 1966; Lafferty 1981; Olsen 1979,1980; Polhemus 1987; and see Knecht 1991 or Campana 1980 for European examples). Recently, studies of modified bone have moved beyond classification to examine aspects of manufacture and function.

Bone Tool Manufacture

Researchers who examine manufacture techniques concentrate on distinguishing different surface traces left by the tools, generally stone, used to manufacture bone implements. Newcomer's 1974 study focuses on bone tool replication experiments and examination of surface traces. He concludes that groundstone tools and flaked stone tool traces can be distinguished, and that the majority of tools from the site have manufacturing marks similar to those left by both groundstone and flaked stone tools.

Other researchers have examined bone tool manufacturing methods, usually to help categorize or classify different tool types. A study by Kidder and Barondess (1981) classifies or types bone points based on their reduction sequence. However, the bone points they examined were three historical or traditional types for the region, not just pointed objects (Kidder and Barondess 1981:89-90). Kidder and Barondess (1981) used the manufacturing strategies to look at differences within and among the three regional types, as well as how these differences are correlated through space. Examining the distribution of the three point types and their reduction strategies, ecological and adaptational inferences were made about the occupations at a series of sites. Experimental reproduction of tools was required for establishing and confirming certain portions of the sequences, but some ambiguity remained in the actual sequence of manufacture (Kidder and Barondess 1981:93).

Other studies that examine manufacturing include Weston (1986,1993) and Moore (1985) who studied material dating to the contact period from a series of Plains Indian village sites. Although many attributes were examined, the primary focus of their works involved changing use of stone to metal tools in the manufacture of bone implements. In these studies, changes in manufacturing technology and techniques were used to examine changing acculturation through time. Although a very useful study, its applicability to earlier time periods is limited.

Thus, studies of manufacture are often incorporated in or become parts of studies that are used to define bone tool function or examine functional differences.

Bone Tool Function

Determining the function or use of bone tools has been of interest to archaeologists because of the economic and behavioral information imbedded in knowledge of use. How function is inferred from bone tools varies from assumptions of function based on form, ethnographic analogy, artifact context, and use-wear analysis. Many of these techniques were used in concert with but not always consistently across classes.

Early in archaeology, function was closely tied to classification and typing of bone tools. Many classifications of bone tools were considered to represent functional categories of tools based on form, ethnographic analogy, context, and in some cases, presumed function. Lewis and Kneberg (1946) classified and interpreted bone artifacts in the Hiwassee Island report. They discussed the function of bone tubes, which highlights the use of ethnographic analogy:

> Larger bone tubes...may have served for a different purpose, possibly as handles, or pipe stems. Another possible use is suggested by Heizer [1944], namely, the tubular portion of an enema syringe, the bag being made of an animals' bladder. He cites numerous Indian tribes of North America who were known to have used a bulbed syringe. Some of the bone tubes from Hiwassee showed smoke blackening [Lewis and Kneberg 1946:125-126].

This discussion demonstrates the ambiguity involved in using a direct analogy between the ethnographic and archaeological record. Different cultures could use morphologically similar items for different functions, thus making ethnographic analogy a weak framework by itself. This was further demonstrated by Kroeber's (1909, 1925) observations of California Indians use of awls. Two different Native American groups used morphologically similar awls for three different functions: sewing, basketry, and preparing eels. One group that used these awls for preparing eels did not use or make baskets. Thus, an assumption that awls were basketry tools on these sites would be erroneous.

Another example from Lewis and Kneberg's (1946) study highlights how burial context was incorporated and combined with ethnographic analogy to provide functional interpretations for modified turtle shell:

> From the Moravian brethren who visited the Cherokee town of Oostanaula in 1803 we have a vivid description: "The female leader of this dance wore leather shoes with turtle backs fastened thereto with which she mightily rattled." Strangely enough, the Dallas burials accompanied by such rattles never had them at the legs, and one was with an adult male [Lewis and Kneberg 1946:127].

Combining archaeological context with ethnographic analogy offered a better interpretational base for determining tool use. However, there are distinct shortcomings to determining function with these methods. One is that tool function is more assumed than proven. Also, these methods did not often consider the possibility of multiple use tools. Use-wear studies of bone tools were developed to address these issues.

The first landmark use-wear study was Semenov's Prehistoric Technology (1964). Semenov was one of the first to examine use-wear and manufacture traces in an attempt to understand stone and bone tool function and manufacture. Using a binocular microscope, a reflecting light source, and various surface enhancers, Semenov examined stone and bone tools from various Paleolithic sites. Semenov identified flaking, notching, chiseling, and grinding as methods used to form bone tools. To examine use, bone tools were replicated and utilized and their surfaces examined. These experimental traces were then compared to archaeological specimens. This work developed criteria that allowed better qualification of a tools' function.

Following Semenov's methodology, Campana (1980) undertook use-wear studies of traditionally classified Natufian and Protoneolithic bone tools. He experimented with bone tool manufacture and use so that manufacturing traces could be distinguished from use-wear. Campana concluded in his study that manufacturing traces could be discerned from use-wear traces. Use-wear traces were helpful for discerning motion of the action. However, use-wear was unable to reliably determine what the tools were being used on for the archaeological samples. Pointed objects or awls were very problematic in determining use, but other tool types were more readily categorized to use or function (Campana 1980:354-356).

Other studies that included use-wear trace analysis are Olsen (1984), Knecht (1991,1993), and LeMoine (1991,1994). Of these three studies Olsen (1984) and Knecht

(1991,1993) combined a number of methods to determine tool function. Olsen (1984) studied three assemblages of bone artifacts, one from the American Southwest, one from northern Syria, and one from Indonesia. Olsen used a multiple method approach including studies of artifact form, artifact context, experimental replication and use, and ethnographic analogy. Olsen made several conclusions concerning these methods. First, that manufacturing and taphonomic traces were easier to distinguish than use-wear, especially in situations of poor preservation. Second, reliance on ethnographic analogy to determine use, used alone, was a weak analytic tool. Third, archaeological context is useful for interpretive purposes but can be confounded by disposal patterns that remove tools from the use location. Fourth, experimental replication is a useful heuristic device but more studies replicating use are necessary. Fifth, artifact form is useful when combined with these other techniques. Lastly, Olsen (1984:468-473) concludes that these methods must be used in concert to get the best results.

Knecht (1991,1993) conducted a comprehensive study of a specific group of Paleolithic bone points from Europe, explicitly following a *chaine operatoire* approach to technology. Knecht used morphological characteristics, surface trace studies, and experimental studies to look at five traditional types of Upper Paleolithic organic projectile points. Using these methods and materials Knecht examined technological change in the manufacture, hafting techniques, and performance of these projectiles across different areas of Europe.

LeMoine's (1991,1994) analysis of MacKenzie Inuit bone implements is one of the most comprehensive use-wear studies. LeMoine applied tribological concepts relating to polish, abrasion, and wear formation to a replicated and used assemblage of bone tools. Tribology is the study of the interaction of surfaces (LeMoine 1994:317). These experimental traces were then applied to archaeological materials. It should be noted here that many of the archaeological tools examined in this study were observed ethnographically. Also, of the collections examined by LeMoine the best use-wear results were obtained from a site recently excavated from permafrost where preservation was excellent. LeMoine (1991:226-230,1994:329) did have less success in identifying use-wear on specimens in stored collections or collections where preservation was not as good.

The last two functional studies do not consider surface traces to define use, but examine use-wear patterning among and between tool types. Chomko (1975) recognized the inconsistency inherent in assuming similar functions for tools within a morphological class. Using a sample of awls and modified antler tines from Arnold Research Cave (23CY64), Chomko examined use wear within and between different morphological classes. Chomko worked under the assumption that if tools in the same morphological class were used for a similar function they should have similar use wear patterns. Chomko used Semenov's (1964) analysis of manufacturing traces to identify manufacturing marks. The traces or marks not identified as manufacture patterns were attributed to use. Chomko found eleven different wear patterns on seven different morphological classes of awls and four different wear patterns for a single class of antler tine tools.

Another similar study is Bader's (1992) analysis of pointed implements from a Middle Archaic site in southwest Jefferson County, Kentucky. Bader examined two aspects of pointed bone implements. First, classification the bone tools using morphological characteristics, then the surface traces within and among these types were examined and correlated with the morphological types. Like Chomko (1975), no interpretation of tool function is discussed, just an examination of the use-wear patterns within and among the different morphological types.

From this survey of functional studies it is clear that a variety of techniques are utilized to determine function including ethnographic analogy, experimental replication, examination of archaeological context, and use-wear studies. Of these methods use-wear is applicable to a wide range of tools and gets at the actual tool function more closely than some of the other methods. However, as LeMoine (1991,1994) discussed, preservation of the specimens is of paramount importance due to greater plasticity of bone when compared to stone.

Summary of Bone Tool Studies

Several trends can be identified from this survey of bone tool classification, manufacturing studies, and functional studies. Trends in bone implement classification or typology include: use of traditional typologies (e.g., Bogan et al. 1986; Lafferty 1981; Polhemus 1987), morphological classifications (e.g., Bader 1992), manufacturing sequences (e.g., Kidder and Barondess 1981), and functional assessments (e.g., Chomko 1975). Areas being investigated in manufacturing studies include discerning manufacturing traces from use-wear traces (e.g., Campana 1980; LeMoine 1991,1994; Olsen 1984; Semenov 1964), demonstrating how manufacturing traces relate to changes in the tools used to manufacture the bone implement (e.g., Moore 1985; Newcomer 1974; Weston 1986,1993), and how manufacturing trajectories can be used to classify objects (e.g., Kidder and Barondess 1981). Trends in functional analyses include ethnographic analogy, experimental replication, examination of archaeological context, and use-wear studies (e.g., Campana 1980; Knecht 1991,1993; LeMoine 1991,1994; Olsen 1984).

Many studies examine classification, manufacture and function together and from these studies two trends are apparent. Many bone tool studies examining manufacture or function rely on traditionally typed tools (e.g., Campana 1980; Knecht 1991,1993; LeMoine 1991,1994; Olsen 1984), despite the problems that can be associated with them. As seen from the discussion of classification above, many of the traditional typologies relied on inconsistent assumptions of function or uncritical ethnographic analogy. Ultimately these early typologies were developed to describe the tool industry and infer the behaviors associated with them through some assumptions or estimates of function. Another difficulty of many of these typologies is that they are not comparable within regions or between regions. In addition, many studies concentrate on specific assemblages of tools within the overall bone industry (e.g., Bader 1992; Chomko 1975; Kidder and Barondess 1981; Knecht 1991,1993).

These trends show that there are several ways in which modified bone has been studied. However, many studies examine specific categories of traditionally typed bone tools. Overall, very little has been done to approach the entire modified bone assemblage from a non-traditional standpoint.

PREHISTORY OF THE GUNTERSVILLE BASIN

The last subject reviewed in this chapter is the prehistory of the Guntersville Basin. This review places the sites and materials in a cultural and environmental context.

The modified bone from Widows Creek is associated with three cultural periods: the Late Archaic (4000 - 1000 B.C.), the Early Woodland (1000 B.C. - A.D. 100), Middle Woodland (A.D. 100 - 500), and Late Woodland (A.D. 500 - 1000) periods.

Late Archaic (4000 - 1000 B.C.)

Late Archaic cultural remains are present in the Guntersville Basin but are found in low quantities compared to the Pickwick Basin and later Woodland period occupations. Walthall (1980) describes the Late Archaic of northern Alabama by focusing on the Lauderdale culture of the Pickwick Basin (see also Bense 1994:91-94 for a discussion of the Lauderdale culture). Solis and Futato (1987:4) state that although the Pickwick Basin is adjacent to the Guntersville Basin, many of the diagnostic characteristics of the Lauderdale culture are not present in the Guntersville Basin. Guntersville Basin Late Archaic components are documented in shell midden and rockshelter sites (Faulkner and Graham 1966; Futato 1977; Griffin 1974; Webb and Wilder 1951).

Futato (1977) discusses some of the materials associated with Late Archaic components in his report on the Bellefonte site (1JA300) located in the Guntersville Basin. Flaked stone artifacts that are associated with these components include projectile points that resemble Pickwick, and Wade or Ledbetter cluster points. Futato (1977) also found steatite vessel fragments associated with Late Archaic materials at Bellefonte. Other sites in the Nickajack Reservoir include shell midden accumulations and features related to Late Archaic occupations (Faulkner and Graham 1965,1966; Futato 1977:236).

Early Woodland (1000 B.C. - A.D. 100)

Early Woodland occupations in the Guntersville Basin are well documented and are referred to by Walthall (1980:112) as Colbert culture components. This culture is described by Walthall as beginning 300 B.C. and ending approximately A.D. 100. The presence of a fabric impressed limestone tempered pottery is a hallmark of this period.

Diagnostic artifacts present in Colbert occupations include ceramic and lithic artifacts. Pottery of this period consists of two types, Long Branch Fabric Impressed and Mulberry Creek Plain. Wide-mouthed globular jars with conoidal bases are the only vessel type associated with this period (Walthall 1980:112-114). Flaked stone artifacts associated with Colbert occupations may include Upper Valley Side-Notched, Knight Island, and Sublett Ferry projectile points (Futato 1977:240).

Based on excavations in the Guntersville Basin, Walthall identifies two basic site types of the Colbert settlement system, a semi-sedentary to sedentary village, and a temporary camp or site in the uplands. Semi-sedentary to sedentary village sites were located in the bottomlands of the basin and were probably related to warm weather occupations and often included shell midden deposits. The temporary camps or sites in the uplands were fall-winter camps for hunting and collecting. Several villages and rockshelters have been excavated (Walthall 1980:114-115; Webb and Wilder 1951).

Middle Woodland (A.D. 100 - 500)

The Middle Woodland period of the Guntersville Basin is dominated by a burial complex termed Copena (Walthall 1980:116-117). Diagnostic artifacts of this culture include pottery, lithics, and exotic materials. Most of the pottery in Copena occupations continued to be Long Branch Fabric Marked and Mulberry Creek Plain, but Wright Check Stamped, Bluff Creek Simple Stamped, and Pickwick Complicated Stamped were also associated. Flaked stone artifacts diagnostic of this period include Copena, Bradley Spike and New Market points (Futato 1977:242-243). Exotic objects of this culture include copper items, such as reel-shaped gorgets, beads, and earspools. Other non-copper items include galena nodules, marine shell cups and beads, and pearl beads (Walthall 1980:118).

The largest number of Copena artifacts has been recovered from burial mounds and burial caves. The dead were buried with spectacular items including copper reel shaped gorgets, copper earspools, copper bracelets, copper and greenstone celts, marine shell beads, and large steatite pipes. These funerary practices are characteristic of Hopewellian influenced cultures during the Middle Woodland (Walthall 1980:119-125).

The settlement system for the Copena culture is, essentially the same as the earlier Colbert culture. In addition to Colbert culture pattern, burial mounds and burial caves are added to the settlement pattern. A noticeable difference between Colbert and Copena occupations is the absence of shell on Copena sites. This absence of shell middens is made even more significant because of the increased consumption of shellfish during the Late Woodland period.

Late Woodland (A.D. 500 - 1000)

The Late Woodland period of the Guntersville Basin is represented by the Flint River culture. The Flint River culture has been described as having a large stable population well adapted to the Guntersville Basin (Walthall 1980:136). Diagnostic artifacts of Flint River sites include Flint River Brushed and scraped Mulberry Creek Plain ceramics with projectile point types limited to Hamilton style points (Futato 1977:244-245). Large bone tool assemblages are also noted for the first time (Walthall 1980:135).

Flint River peoples practiced floodplain horticulture and had a seasonally based settlement system. The Flint River settlement system includes three site types: large summer - fall floodplain settlements, small dispersed winter base camps, and temporary upland hunting camps. The floodplain settlements are characterized by large, well-developed shell middens.

Summary of Guntersville Prehistory

Guntersville Basin prehistory, as reflected on the Widows Creek site, is represented by Late Archaic, Early Woodland, Middle Woodland, and Late Woodland cultures. All of these cultures have diagnostic artifacts and fairly well documented settlement patterns. The flamboyant burial complex of the Middle Woodland Copena culture is one of the most conspicuous aspects of the areas' prehistory. A point of interest in comparing the three Woodland periods is the absence of shell middens during the Middle Woodland period, that are present in the preceding Early Woodland and following Late Woodland periods. Although, diagnostic artifacts from the periods are known, only a few sites have been recently excavated and have produced sizable modified bone assemblages. Thus, Widows Creek should add more to our knowledge of the modified bone industry of the Guntersville Basin.

CHAPTER III

MATERIALS AND METHODS

INTRODUCTION

This chapter presents the data and units considered in the analysis of modified bone from the Widows Creek, Westmoreland-Barber, and Russell Cave sites. Information on the excavations, recovery methods, and materials recovered, and the proveniences selected for analysis are discussed. Also, a discussion of the attributes that will be examined for description of the modified bone assemblage is presented.

WIDOWS CREEK (1JA305)

The Widows Creek site, a multicomponent shell midden site on the left bank of the Tennessee River in the Guntersville Reservoir, provided modified bone that is the main material of this study. The site is approximately 183 m (600 ft.) long by 43 m (140 ft.) wide with the long axis running parallel to the river. Excavations began in May of 1973 under the direction of F. A. Calabrese, Project Director, and J. B. Graham of the University of Alabama, Field Supervisor, under Tennessee Valley Authority contract TV-37899A (Calabrese 1974). A baseline was placed perpendicular to the shore. Stakes were placed at 3.05 m (10 ft) intervals designated as 30B/L, 40B/L, 50B/L, etc. Stakes placed right of this baseline were designated successively R10, R20, etc. Each 3.05-x-3.05-m (10-x-10-ft.) unit was designated by its northeastern stake with labels 40R10, 40R20, etc. Units were excavated in 15 cm (.5 ft.) arbitrary levels, referred to as general cuts. Control columns, consisting of 61-x-61-cm (2-x-2-ft.) squares, were established in the northeast corner of each 3.05 meter square unit. These columns were waterscreened through .635 cm (.25 in.) and .025 cm (.0625 in.) hardware cloth (Calabrese 1974; Warren 1975).

The total excavated area covered approximately 178 m^2 (1,918 $ft.^2$). The three block trenches were excavated parallel to the baseline, one to a maximum depth of 3.4 m below ground surface (Figure III-1). The largest block was located along the baseline. A total of 21 control columns and 181 features was excavated.

Table III - 1 shows the quantity of the different feature types excavated. The features were distributed across 12 stratigraphic zones, with the greatest concentration in the upper zones although all zones contained archaeological material (Warren 1975). All materials recovered from features were waterscreened through .635 cm (.25 in.) and .025 cm (.0625 in.) hardware cloth (Calabrese 1974; Warren 1975,1991).

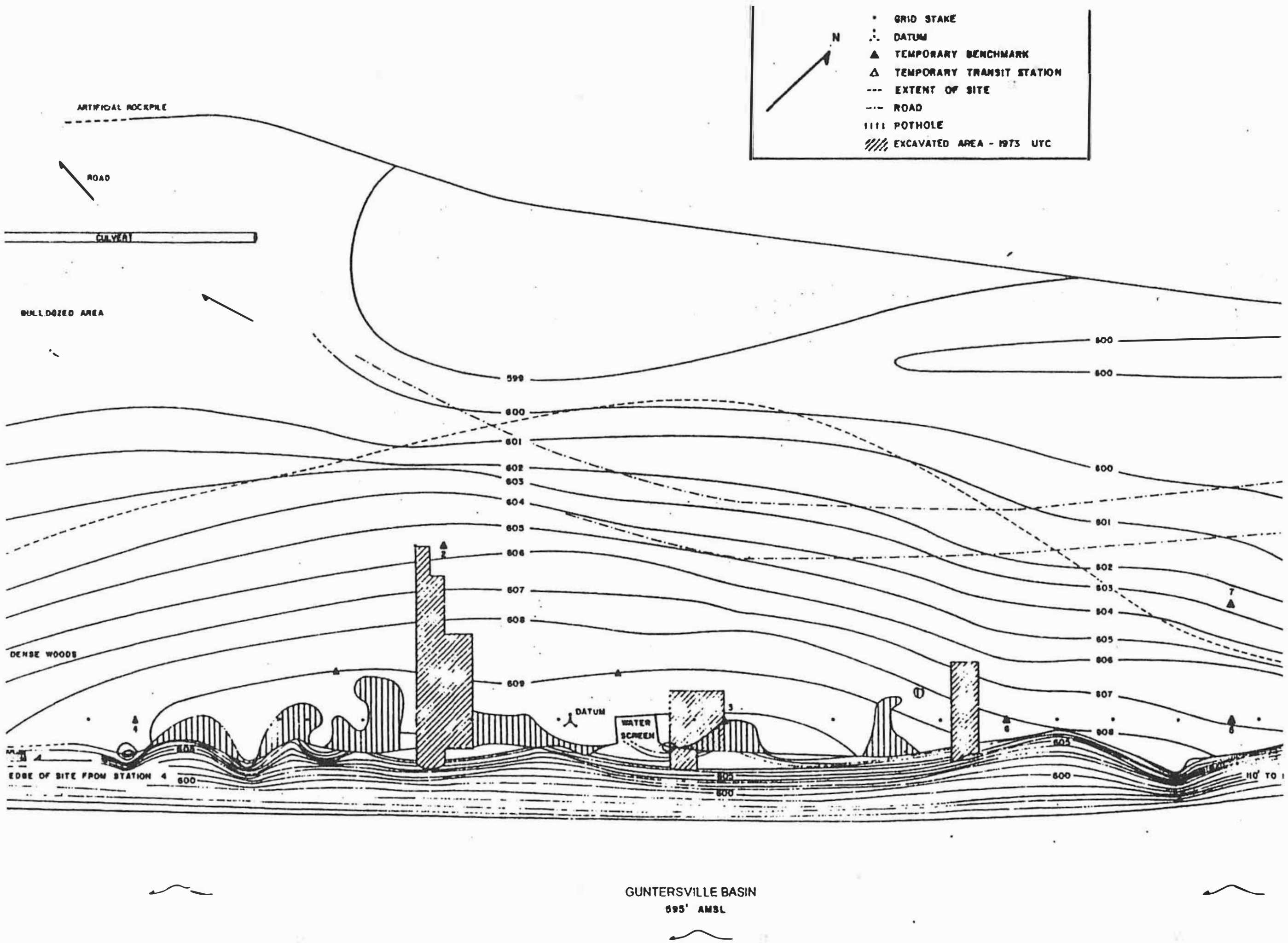

Figure III - 1. Map of the Widows Creek site.

Table III - 1. Feature type and quantity for the Widows Creek site.

FEATURE TYPE	QUANTITY
Basin Shaped Pits	42
Beaker Shaped Pits	5
Fire Pits/Hearths	31
Burials	24
Shallow Fired Areas	25
Bell-Shaped Pits	16
Charcoal Concentrations	14
Mollusk Shell Pits	11

Site chronology is based on a series of 10 radiocarbon assays (Table III - 2) that can be correlated to four cultural components, as described by Walthall (1980). These components are a Late Archaic component (strata I and J), an Early Woodland component (strata E, F and G), and a Middle/Late Woodland component (strata A, B, C, and D). The Middle and Late Woodland components are combined because the standard deviations of the assays overlap significantly, enough so that they are not significantly different (Figure III - 2). Serriational methods also can not separate these components because only a fraction of the other diagnostic material has been analyzed.

Walthall's description of the Woodland period in northeastern Alabama indicates that this site probably represents a typical shell midden site of the Guntersville Basin. Widows Creek is probably very similar in occupational sequence to the Flint River site (1MA48) (Webb and Dejarnette 1948) as well as the Westmoreland-Barber site(40MI11) (Walthall 1980:135 and see Faulkner and Graham 1966). The heaviest artifact concentration is in the Middle/Late Woodland occupation.

Widows Creek Proveniences

Based on the current state of the collection and no written reports on stratigraphy across the site, the proveniences chosen for analysis were limited. The proveniences include the radiocarbon dated features; general level, control column, and feature material from the Baseline R10 units; and a few features associated with the Early Woodland period.

Table III - 2. Uncorrected C^{14} dates with their feature and stratigraphic correlations from the Widows Creek site. MLW = Middle/Late Woodland; EW = Early Woodland; LA = Late Archaic.

Feature Number	Strata	Cultural Component	Uncorrected C^{14} Date
106	C	MLW	1230±60 B.P. (720 A.D.)
100	C	MLW	1310±100 B.P. (640 A.D.)
19	C	MLW	1365±65 B.P. (585 A.D.)
115B	D	MLW	1415±65 B.P. (535 A.D.)
56	D	MLW	1460±65 B.P. (490 A.D.)
54	E	EW	2555±65 B.P. (605 B.C.)
147	E-F	EW	2725±130 B.P. (775 B.C.)
160	G	EW	2495±70 B.P. (545 B.C.)
112	I	LA	3655±75 B.P. (1705 B.C.)
168	J	LA	4280±155 B.P. (2330 B.C.)

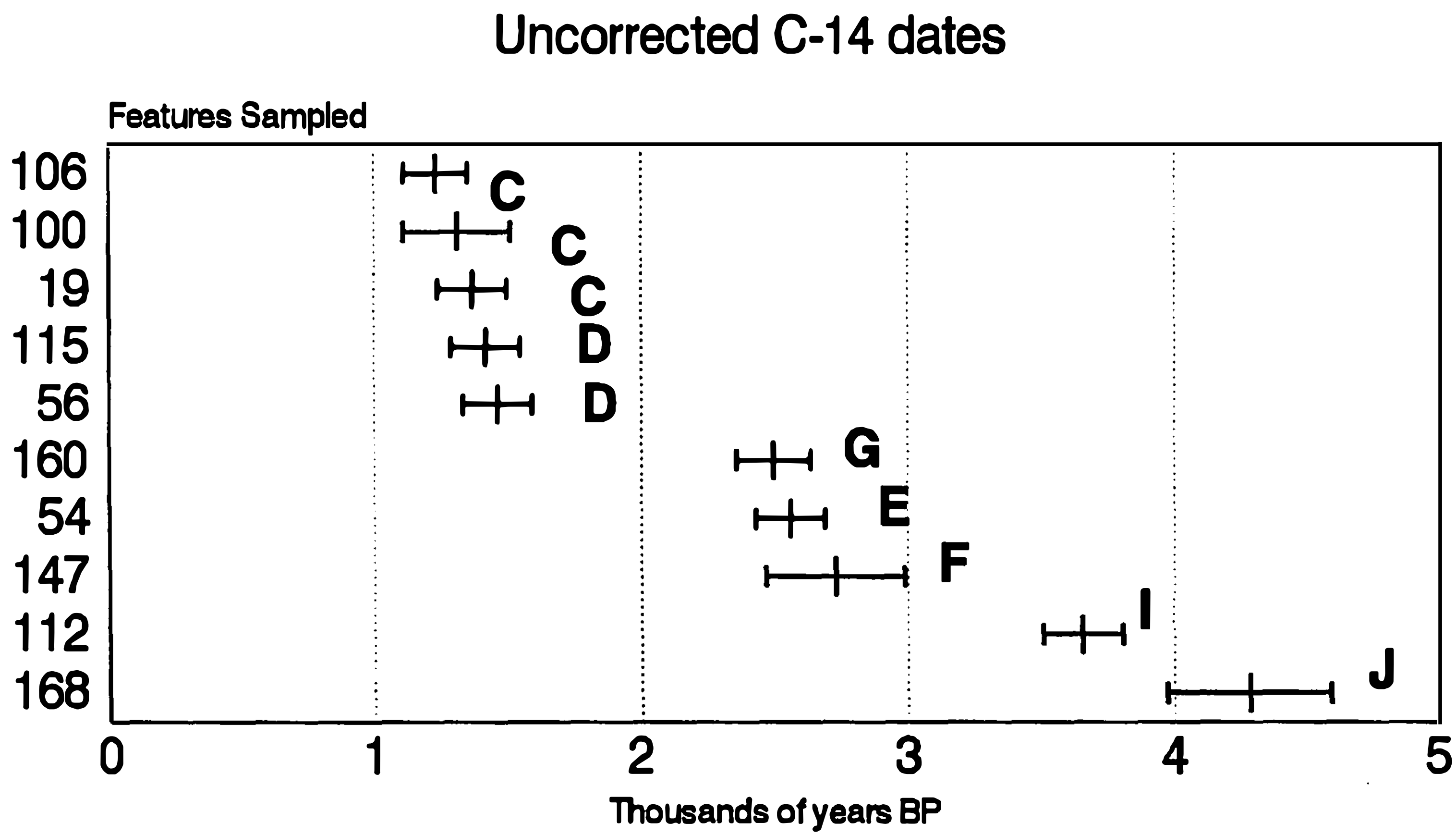

Figure III - 2. Radiocarbon ages from 10 features at the Widows Creek site. The vertical line represents the centroid and the horizontal line represents plus and minus two standard deviations. The letters designate the stratigraphic correlations.

The radiocarbon dated features were a sample of dated and thus culturally correlated provenience units. These features were also the mechanism for correlating differing strata to a cultural component. Table III - 2 shows the radiocarbon dated features with their stratigraphic correlates. The correlation of features to strata allowed the assignment of cultural affiliation to the stratigraphic units presented in the R10 Baseline profile.

The general cut, control column, and non-dated feature materials of the R10 Baseline units were chosen to increase the sample size for analysis. However, some assumptions of the stratigraphic formation were made. A large profile of the baseline wall (Figure III - 3), or East wall, was available to correlate stratigraphic zones with 15 cm (. 5 ft.) general cuts. General cuts that, based on the profile, would have encompassed single strata were assigned to the associated component. Any general cut that contained portions of two or more strata correlated to different components was left unassigned. Non-dated features were similarly classified based on their respective points of origin within general cuts. This correlation assumes that the stratigraphic lenses do not change in elevation across the 3.05 m unit. Despite this assumption, it is argued that the increased sample size develops better comparative samples.

A few additional features were added to the Early Woodland sample based on their artifact associations. To assist in the selection of features for radiocarbon dating, some preliminary sorting of the ceramic assemblage was done. Based on this data, several features outside the R10 block that had only quantities of Long Branch Fabric Marked

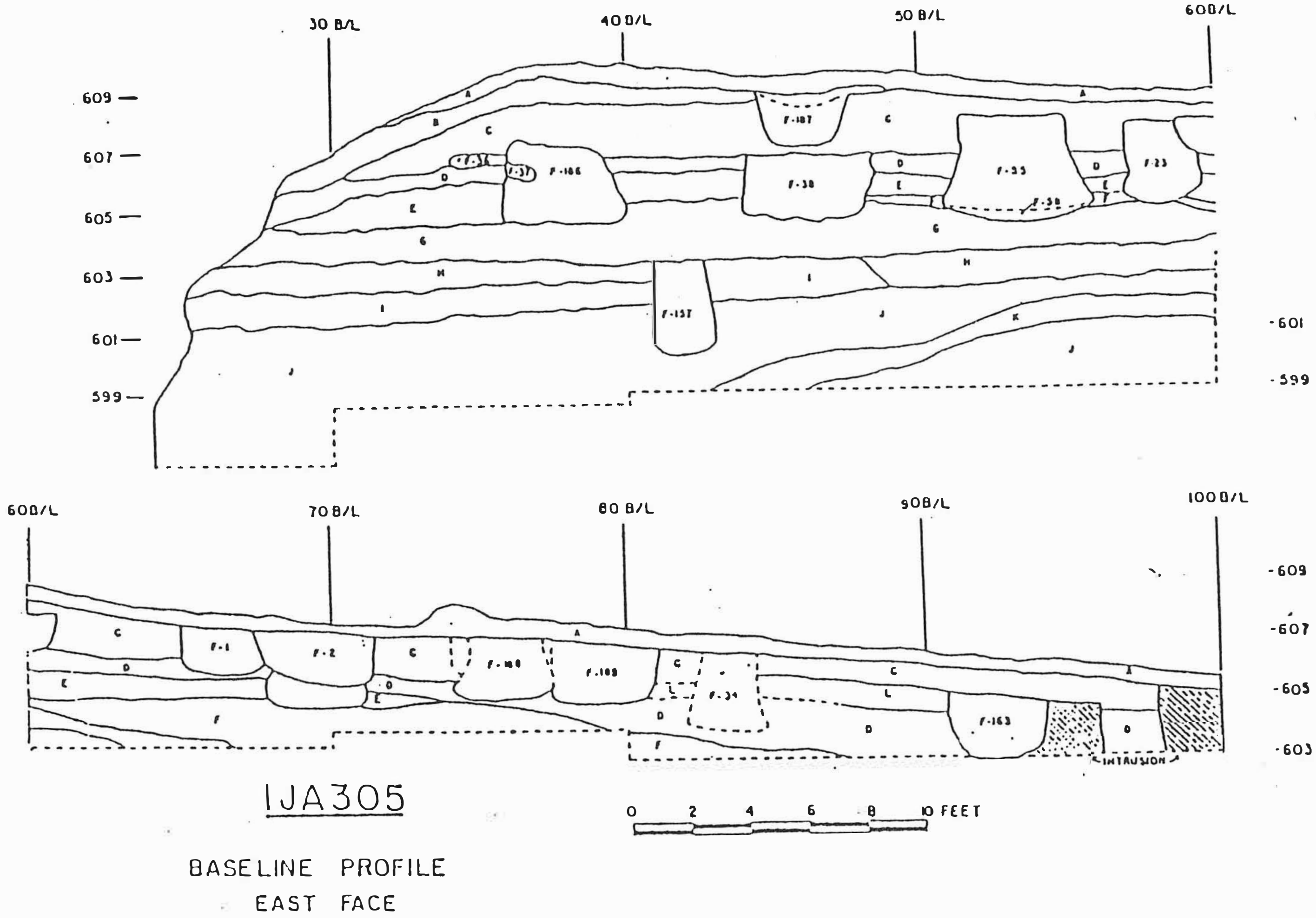

Figure III - 3. Baseline profile map of the Widows Creek site.

ceramics, were assigned to the Early Woodland period. The modified bone from 49 features and 43 general cuts, including control column material, was analyzed.

RUSSELL CAVE (1JA181)

Russell Cave is a rockshelter site located approximately seven miles northwest of the Tennessee River in the Widows Creek watershed. Griffin's Investigations in Russell Cave (1974), describes excavations at Russell Cave that uncovered a series of stratified deposits containing materials associated with Early Archaic, Middle Archaic, Late Archaic, Early Woodland, Woodland, Late Woodland and the Mississippian periods. Unlike Widows Creek, all the materials from the excavations have been analyzed. The modified bone assemblage from Russell Cave consists of 266 specimens, of which this thesis considers only the portions from the layers pertaining to the Late Archaic through the Middle/Late Woodland. Because of the small 10 km distance between Russell Cave and Widows Creek and its placement in the same drainage, it is likely that the archaeological deposits at the Widows Creek and Russell Cave sites were produced by the same population. A comparison of the modified bone material from these two sites' may illuminate differences in the respective sites functions.

Russell Cave Proveniences

The modified bone data were sorted by layer, and each layer was given a cultural designation (Ingmanson and Griffin 1974:Table 14). Thus, modified bone from each time period was easily determined. However, Griffin's report (1974) does not describe the exact proveniences from which the artifacts for study were drawn. Griffin states that due to mixing of the cave deposits, selected levels from particular units were utilized, but details were not given (Griffin 1974:5-15).

WESTMORELAND-BARBER (40MI11)

Excavations at Westmoreland-Barber revealed a series of stratified deposits containing materials associated with Early Archaic to Protohistoric culture periods. Excavations and recovered materials were discussed in Excavations in the Nickajack Reservoir: Season I and Westmoreland-Barber Site (40Mi-11), Nickajack Reservoir, Season II by Faulkner and Graham (1965 and 1966, respectively). The Westmoreland-Barber site is a shell midden site located at approximately mile 429 on the east bank of the Tennessee River. As stated previously, Westmoreland-Barber is the most recently excavated site that is similar in assemblage composition and site structure to the Widows Creek site. A majority of the material like Widows Creek is associated with Late Archaic through Late Woodland periods. Walthall (1980:135) described Westmoreland-Barber as a fall-summer occupation site in the Late Woodland Flint River culture settlement model. Comparison of the modified bone assemblages from Widows Creek and Westmoreland-Barber sites may elicit information on the role of Widows Creek in the settlement model.

Westmoreland-Barber Proveniences

Proveniences from Westmoreland-Barber included features and general levels. The features were assigned to cultural time periods by Faulkner and Graham (1966:16-39), and this report uses these affiliations. Because levels were excavated in six inch arbitrary units no cultural affiliations were assigned. To increase the sample size, the distribution of diagnostic pottery and lithics were examined. Based on these data, the levels were assigned cultural affiliations. Levels that contained homogeneous diagnostics for a time period were designated by that time period. In a number of cases, the levels were designated based on a majority of the material being homogeneous for a cultural group. In some cases, no affiliation was assigned because the materials were too mixed. Mixing was especially prevalent in trenches 3, 4, 5 and test pits 5 and 6. The greater mixing may have been due to the combination of these materials as presented in the report (Faulkner and Graham 1966:Table 18) . Table III - 3 presents the assigned cultural affiliations per level in the Westmoreland-Barber units.

MODIFIED BONE VARIABLES

In this thesis modified bone is defined as bone intentionally worked by humans and recognizable by patterned manufacturing traces. The analysis will include bone and antler tools, ornaments and manufacturing debris. Analysis of the Russell Cave and Westmoreland-Barber materials was restricted to data from published reports. Analysis of this material follows an organization of technology framework because it examines the

Table III - 3. Cultural Affiliations assigned to excavated levels at the Westmoreland-Barber site (40MI11). MLW = Middle/Late Woodland; EW = Early Woodland; LA = Late Archaic.

Levels	Trench 1 and Test Pits 1 and 2	Trench 2 and Test Pits 3 and 4	Test Pit 7	Trenches 3,4,5 and Test Pits 5 and 6
0.0-0.5	MLW	MLW	MLW	MLW
0.5-1.0	MLW	MLW	MLW	MLW
1.0-1.5	MLW	MLW	MLW	NA
1.5-2.0	NA	EW	MLW	NA
2.0-2.5	EW	EW	MLW	NA
2.5-3.0	EW	EW	NA	NA
3.0-3.5	EW	-	EW	EW
3.5-4.0	EW	-	EW	EW
4.0-4.5	LA	-	LA	LA
4.5-5.0	LA	-	LA	LA

cycle or series of behaviors that go into creating bone implements. The specific variables examined in this thesis are raw material, manufacturing techniques, manufacturing stage, and morphological category.

Raw Material

Raw material source and raw material choice are important considerations in lithic and ceramic studies (e.g., Carr 1991; Rice and Cordell 1986). In many modified bone studies, raw material choice is simply a secondary resource of meat procurement (e.g., Bogan et al. 1986). However, raw material selection includes not only the animal selected, but also the element selected from in that animal. These decisions reflect technological choices. Classification at this level simply involves tabulation of the species used for modification and, more specifically, the elements utilized.

A series of broad categories was created to classify the modified bone. These categories consisted of cervid antler, whitetail deer bone, miscellaneous mammal bone, bird bone, turtle shell, and indeterminate. Because prehistoric peoples in the Southeast utilized both antler and deer bone for bone tools, each was quantified separately. The miscellaneous mammal category included identifiable mammals (other than whitetail deer) as well as indeterminate mammal bone specimens. This category also contains fragmented unidentifiable whitetail deer bone. The bird bone category included identifiable birds as well as unidentified bird specimens. The turtle shell category consisted of any recognized modified turtle shell regardless of species. Indeterminate specimens reflected small fragments that could not be identified to the class level. Also, any elements identifiable to a genus or species level were recorded.

Manufacturing Traces

Manufacturing traces are visible traces that reflect the actions of the maker in producing bone implements. As has been shown by Semenov (1964:160) and Newcomer (1974:149), use of flaked stone tools to carve and shape bone is generally distinguishable from groundstone tools through differences in surface traces. The nature of striations and the presence of chattermarks identified flaked stone tools (Newcomer 1974). Chattermarks are described by Newcomer as "closely spaced corrugations at right angles to the striations"(1974:149). These marks differ from the grouped fine or coarse striations from grinding or abrading with groundstone tools (Olsen 1984:196-198; Semenov 1964:160-161). Table III - 4 contains the descriptions and references of the modification traces identified in this study. Modified bone implements were examined for these traces and each recorded; many items had multiple codes for multiple traces present.

Manufacturing Stage

The third variable to be examined is manufacturing stage. This classification sorts specimens based on their inferred placement into differing stages of manufacture. Sorting the modified bone from Widows Creek draws on previously published sources of manufacturing stage information as well as an intuitive placement of some item in one stage or another.

Table III - 4. Description of Modification Traces

Code Value	Description
A	Ground/smoothed: Specimens that are ground or smoothed exhibited shallow grouped striations of fairly similar shape and size as a result of abrading the bone with a large or fine grained stone (see Semenov 1964:160, Figure 81; also see Olsen 1984:196-198).
B	Grooved-Snapped: Specimens are grooved using a lithic fragment to grind or cut through the specimen and then split or snapped at the groove. The remaining pieces have a groove remnant and often splintered portions of an unclean break (see Semenov 1964:151-153)
C	Grooved-Splintered: Specimens, most often antler, are grooved using a stone tool in two parallel lines in a v-shaped fashion to remove longitudinal wedges. This is opposed to grooved-snapped where grooving is for snapping through a piece (Clark and Thompson 1953; Semenov 1964:155-158)
E	Carved/Incised: Specimens with carving or incising exhibit single and multiple striations that are uneven in depth and size generally due to a variably shaped edge of a flake or biface. Often scraped or carved pieces exhibit chattermarks. Chattermarks are described by Newcomer as "closely spaced corrugations at right angles to the striations"(1974:149) (see Olsen 1984:192-196).
F	Chopped: Specimens with chopping exhibit gouged areas in which the bone or antler is crushed in until a specimen can be broken or chopped through. Chopping was probably accomplished using a large stone tool (Olsen 1984:198-202; Semenov 1964:149-151).
G	Drilled: Specimens with drilling exhibit cone shaped holes, widest at the bone or starting surface and narrowest at its deepest point, through one or opposite sides. The cones exhibit circular striations from drilling through the bone with stone tools (Olsen 1984:202-203).
H	Notched: Specimens with notching exhibit marks similar to those resulting from chopping but on a much smaller scale. A flake or biface is generally used to crush a surface, leaving a v-shaped notch (Semenov 1964:147).
I	Grooved: Specimens that exhibit a channel that has striations in it, indicative of groove creation using a stone tool (Semenov 1964:155-158)
K	Percussion Flaked: Specimens with percussion flaking exhibit somewhat cone shaped scars. The cone is narrowest at the surface and widest at the interior of the material. Flakes are driven off as result of striking with a stone (Semenov 1964:147-148, Figure 72).
L	Indeterminate: Specimens that have been modified but the are obliterated or unknown as to method of modification.

Stage 1 consisted of completed items. Stage 1 was broken down into three groups. Stage 1A consisted of complete unbroken items. Stage 1B consisted of items designated as having been completed but were broken recently. Broken recently is defined as those items exhibit fresh breaks probably due to excavation or post-excavation treatment. These breaks are characteristically white in color. Stage 1C consisted of items designated as having been completed but were broken not recently. Items broken not recently exhibit breaks that cannot be relate to excavation or post-excavation treatment. These breaks are characteristically brown in color.

Stage 2 is a manufacturing byproduct/discard group that has distinct and patterned groups of stages. Stage 2 was divided into six groups. Stage 2A consisted of discarded fishhook debris. This debris has a bifurcated proximal end, one prominence pointed and the other knobbed. Webb and Dejarnette (1948:61, Figure 31) describe and illustrate this debris from the Flint River site (1MA48), making it very recognizable. Stage 2B consisted of aborted fishhook manufacture discard, retaining a broken partially manufactured fishhook not removed from the blank (see Webb and Dejarnette 1948:Figure 31). Stage 2C consisted of groove and snap discard. These specimens exhibit a grooved and snapped proximal end and are remnants of bone or antler removal that is snapped perpendicular to the long axis of the specimen. Stage 2D consisted of groove and snap fragments, exhibiting portions of grooved and snapped edges. Stage 2E consisted of grooved specimens, but were aborted before they were snapped or split. Stage 2F consisted of groove and snap discard from turkey (*Meleagris gallopavo*) tarsometatarsus elements with removed spurs, including both removed spurs and shaft portions.

Stage 3 consisted of different stages of whitetail deer metapodial manufacturing stages. Widows Creek possessed a large quantity of this material and each stage was developed based on the patterned artifacts. Stage 3A consisted of metapodials split in half longitudinally. Generally these specimens retained some form of a proximal epiphysis and were greater than half the shaft in length. Stage 3B consisted of split quarter shaft sections. Generally these specimens retained some form of a proximal epiphysis and were greater than half the shaft in length. Stage 3C consisted of half and quarter split shaft fragments that were less than half the shaft in length and retained no epiphysis. Stage 3D consisted of modified whole or fairly whole proximal end sections with small shaft portions. Stage 3E consisted of whole or mostly whole distal end sections with small shaft portions.

Stage 4 consisted of miscellaneous manufacturing byproduct or discard. Unlike Stage 2 specimens, items in this group were intuitively inferred to be a form of discard or manufacturing byproduct, but were unique specimens. Stage 4A consisted of various whitetail deer elements and element fragments. Stage 4B consisted of various modified turtle shell fragments.

Stage 5 consisted of specimens that were too fragmented to place in a manufacturing stage. Two indeterminate stages were created, 5A for metapodial fragments and 5B for all others. Because of the dearth of metapodial byproduct/discard, a separate indeterminate category was created for it.

Morphological Category

To examine tool forms a morphological classification can be employed. Many morphological classifications incorporate numerous features or variables to create types (e.g., Bader 1992). The objective of this study is not to create types but to look at the variation in the general form or shape of the bone tools from the three sites. At this initial level of analysis, broad categories or groups with some hierarchical divisions are simple enough for quick classification and contain enough basic information about the form of the objects in the collection. Morphological classifications with many variables are appropriate at a higher level of analysis when studying specific portions of the modified bone assemblage (Bader 1992; Knecht 1991,1993).

The broad morphological categories utilized in this study were drawn from the basic tool forms found in cursory studies of the collection. As Adams and Adams (1991:51-52,285-286) point out, there is a dialectical relationship between the entities being classified and the purposes of that classification. To classify them, we must be aware of what the variables and attributes are.

For the purpose of this study, four broad morphological categories were created to classify items considered *complete or reasonably whole tools*. These categories consisted of manufactured pointed objects, non-manufactured pointed objects, cylindrical objects, and acutely beveled objects. Two additional categories were utilized to classify the remaining non-implement material.

Category 1 objects have at least one manufactured pointed end. This category was further broken down into four subcategories. Category 1A consists of straight or slightly curved specimens with a single pointed tip. Items in these two categories are traditionally typed as awls, needles, hair pins, basketry tools, sacrificers, pressure flakes, bodkins, and projectile points (e.g. Faulkner and Graham 1966; Ingmanson and Griffin 1974; Lafferty 1981; Lewis and Kneberg 1946; Polhemus 1987; Robison 1986; Webb and Dejarnette 1948; Webb and Wilder 1951). Category 1B consists of specimens with a strongly curved u-shaped shaft and a single manufacture tip. These items are traditionally typed as fishhooks (Faulkner and Graham 1966:103; Ingmanson and Griffin 1974:57; Lewis and Kneberg 1946:125; Webb and Dejarnette 1948:60). Category 1C consists of manufactured points that consist only of fragmented tips. Category 1D consists of straight items with points at opposite ends. These items are traditionally typed as double-pointed or double tapered awls, projectile points, and cylindrical pins (Ingmanson and Griffin 1974:54; Lewis and Kneberg 1946:124).

Category 2 objects have at least one non-manufactured pointed end. This category was broken down into two basic groups, antler objects and mammalian teeth. The pointed antler objects were further subdivided into two groups. Category 2A consists of non-manufactured pointed antler objects. Items in this category are traditionally classified as pressure flakers and projectile points (Lewis and Kneberg 1946:124; Polhemus 1987:1027; Webb and Dejarnette 1948;63). Category 2B consists of non-manufactured fragmented antler tine tips. Category 2C consists of mammal teeth, generally canines that have a modified base. These items are traditionally classified as ornaments or beads (Faulkner and Graham 1966:105; Webb and Dejarnette 1948:56).

Category 3 items are cylinder shaped with flat planed ends. The category was subdivided into two subcategories, closed channel objects and open channel objects. Category 3A items consist of closed channel cylindrical objects that are shaped like a solid cylinder. This category includes items traditionally typed as drifts, rods, and billets. Category 3B consists of open channel cylindrical objects. These objects are a tube-like with the central core missing. This category contains items traditionally typed as beads, whistles, tubes or flutes.

Category 4 items are acutely beveled objects, having edged working portions of the tool. The category was subdivided into lateral beveled objects, distally beveled objects, and broken beveled portions. Category 4A consists of items with an acutely beveled longitudinal edge. This category contains items traditionally typed as beamers or scrapers (Parmalee et al., 1972; Prufer 1981). Category 4B items consist of acutely beveled edges on the distal or proximal end of the specimen. This category contains items traditionally typed as gouges or fleshers. Category 4C items consist of acutely beveled edge fragments.

Category 5 are unassigned objects. This category contains mostly manufacturing byproduct/discard. These items are not tools but are neither indeterminate fragments, and were classified as unassigned to keep them distinct.

Category 6, the indeterminate category, included all items that were too fragmented to place in one of the above categories.

Summary of Variables

Modified bone from a site can be described in a number of different ways. Table III - 5 lists the codes and descriptions for the variables used here. The approach taken here stresses basic description of the assemblage by examining raw material choices, manufacturing traces, manufacturing stages, and morphological categories. Functional studies generally concentrate on specific portions or aspects of a modified bone assemblage and do not often consider the assemblage as a whole. Because of that, function is not stressed or readily considered here (LeMoine 1994).

Table III - 5. Attributes Recorded for Modified Bone from the Widows Creek Site

Variable	Code Value and Attribute
1. Raw Material	OM - Other Mammal AN - Antler DB - Deer Bone BB - Bird Bone TS - Turtle Shell IN - Indeterminate Element Selected - Element Name
2. Manufacturing Traces	a. Grinding/Smoothing b. Groove and Snap c. Groove and Splinter e. Carving/Incising f. Chopping g. Drilling h. Notching i. Grooving k. Percussion Flaking n. Indeterminate
3. Manufacturing Stages	1. Complete Objects 1A - Complete 1B - Broken (Recent) 1C - Broken (Non-Recent) 2. Byproduct/Discard 2A - Fishhook Debris 2B - Fishhook - Aborted Manufacture 2C - Groove and Snap Debris - resulting from a tubular or groove occurring perpendicular to the longitudinal axis of the bone 2D - Groove and snap debris fragments 2E - Grooved specimens 2F - Turkey TMT reduction - fragments related to spur removal either spurs or tmt shafts 3. Metapodial Manufacturing Stages 3A - 1/2 Shaft Sections 3B - 1/4 Shaft Sections 3C - Splinter Fragments 3D - Proximal End Sections 3E - Distal End sections

Table III - 5. (continued)

Variable	Code Value and Attribute
3. Manufacturing Stages (continued)	4. Miscellaneous Byproduct/Discard 4A - Miscellaneous deer bones that appear as blanks or discarded debris but occur as unique specimens - unique in element and unpattered similar debris 4B - Miscellaneous Turtle - Modified turtle shell fragments
	5. Indeterminate 5A - Metapodial Fragments 5B - Other Fragments
4. Morphological Category	1. Manufactured Point Objects 1A - Straight 1B - Strongly Curved 1C - Broken Tip 1D - Bipointed
	2. Non-manufactured Point Objects 2A - Antler 2B - Antler. Tips 2C - Tooth with Modified Base
	3. Cylindrical Objects 3A - Closed Channel 3B - Open Channel
	4. Beveled Objects 4A - Lateral Beveled 4B - Distal Beveled 4C - Broken Beveled Portion
	5. Unassigned
	6. Indeterminate
	7. Bowl Shaped (Added for Regional Comparison)

CHAPTER IV

RESULTS

WIDOWS CREEK (1JA305) (N = 562)

Of the three sites in this study Widows Creek contained the greatest quantity of material assignable to time periods. In all, 562 modified bone specimens were analyzed from the Late Archaic (LA), Early Woodland (EW), and Middle/Late Woodland (MLW) contexts. Each time period is discussed separately.

Late Archaic (n = 38)

A total of 38 specimens was assigned to the Late Archaic component based on their provenience. The specimens were recovered from two features, five control column levels and six general cuts.

Raw Material

Table IV - 1 shows the distribution of the LA modified bone among the six broad material classes. The majority of the specimens belong to the miscellaneous mammal

Table IV - 1. Late Archaic period modified bone classified by raw material at Widows Creek.

Raw Material	Count	Percent
Misc. Mammal	26	68 %
Deer Bone	6	16 %
Bird Bone	3	8 %
Antler	2	5 %
Turtle Shell	1	3 %
Indeterminate	0	0 %
Total	38	100 %

category, followed in rank by the deer bone, bird bone, antler, and turtle shell categories. The whitetail deer specimens can further be subdivided by the element utilized. These elements include three metatarsals, two ulnae, two antlers, and one metapodial.

Manufacturing Traces

Manufacturing traces on the modified specimens show evidence of grinding, grooving and snapping, carving or incising, drilling, grooving, and percussion flaking, with 35 percent of the specimens exhibiting multiple traces. Table IV - 2 shows the frequency of the most pervasive or only manufacturing traces. The LA specimens were mostly manufactured and probably shaped by grinding as exhibited by the traces. However, much of the initial manufacture was groove and snap, carving or incising, drilling, grooving and percussion flaking.

Manufacturing Stage

Table IV - 3 shows the distribution of the LA specimens in the different possible stages of manufacture. The largest portion of the material was assigned to the indeterminate category. Of the assignable material, approximately 41 percent was placed in the various byproduct/discard categories. The patterned debris was dominated by various groove and snap discards, with some fishhook and metapodial manufacturing byproduct/discard present. Implements, in either a complete or broken form, were approximately 18 percent of the assemblage.

Morphological Category

Table IV - 4 shows the distribution of specimens assigned to morphological categories. Because this classification is limited to complete specimens, only seven objects

Table IV - 2. Late Archaic modified bone classified by primary manufacturing trace from Widows Creek.

Manufacturing Trace	Count	Percent
Ground/Smoothed	24	63 %
Groove and Snap	6	16 %
Carving/Incising	4	10 %
Chopped	0	0 %
Drilled	1	3 %
Grooved	2	5 %
Percussion Flaked	1	3 %
Indeterminate	0	0 %
Total	38	100 %

Table IV - 3. Late Archaic period modified bone classified by manufacturing stage from Widows Creek.

Manufacturing Stage	Count	Percent
Stage 1: Complete Objects		
1A. Unbroken	2	5 %
1B. Recent Break	1	3 %
1C. Non-recent Break	4	10 %
Stage 2: Byproduct/Discard		
2A. Fishhook Discard	2	5 %
2B. Fishhook - Aborted Manufacture	1	3 %
2C. Groove and Snap Discard - End	1	3 %
2D. Groove and Snap Discard - Fragment	3	8 %
2E. Grooved Only	4	10 %
2F. Groove and Snap Discard - Turkey	0	0 %
Stage 3: Deer Metapodial Manufacturing		
3A. Half Shaft Sections	1	3 %
3B. Quarter Shaft Sections	0	0 %
3C. Half or Quarter Section Fragments	1	3 %
3D. Proximal End	1	3 %
3E. Distal End	0	0 %
Stage 4: Misc. Byproduct/Discard		
4A. Whitetail Deer Elements	0	0 %
4B. Turtle Shell Fragments	1	3 %
Stage 5: Indeterminate		
5A. Metapodial Fragments	0	0 %
5B. Other Fragments	16	42 %
Total	38	101 %

Table IV - 4: Late Archaic period modified bone classified by morphological categories from Widows Creek.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	3	8 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	0	0 %
1D. Manufactured Point - Bipointed	0	0 %
2A. Non-manufactured Point - Antler	1	3 %
2B. Non-manufactured Point - Antler Tips	0	0 %
2C. Non-manufactured Point - Canines	0	0 %
3A. Cylindrical - Closed Channel	1	3 %
3B. Cylindrical - Open Channel	1	3 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	0	0 %
4C. Beveled - Fragment	1	3 %
5. Unassigned	15	39 %
6. Indeterminate	16	42 %
Total	38	101 %

(18 percent) were classifiable. The specimens belonged to the pointed forms (manufactured or non-manufactured points), cylindrical forms, and a beveled piece.

Late Archaic Summary

A small sample of 38 modified bone specimens was recovered from LA contexts at Widows Creek. Raw materials selected for modification include whitetail deer, miscellaneous mammals, and indeterminate bird, the majority being miscellaneous mammal. Manufacture of tools or items included several methods; the most common identified was grinding. Analyzed by manufacturing stage, most specimens were manufacturing byproduct/discard or completed tools. The specimens morphologically consist of pointed objects, cylindrical, and one beveled edge object. Most items were assigned to the unassigned or indeterminate categories 5 and 6. Figure IV - 1 shows a sample of the LA specimens assigned to manufacturing stage or morphological category.

Early Woodland (n = 122)

A total of 122 specimens was assigned to the Early Woodland component based on their provenience. The specimens were recovered from 13 features, 12 control column levels and 14 general cuts.

Raw Material

Table IV - 5 shows the distribution of the EW modified bone specimens among the raw material categories. The majority of the material is classified as miscellaneous mammal followed in rank order by antler, deer bone, bird bone and indeterminate

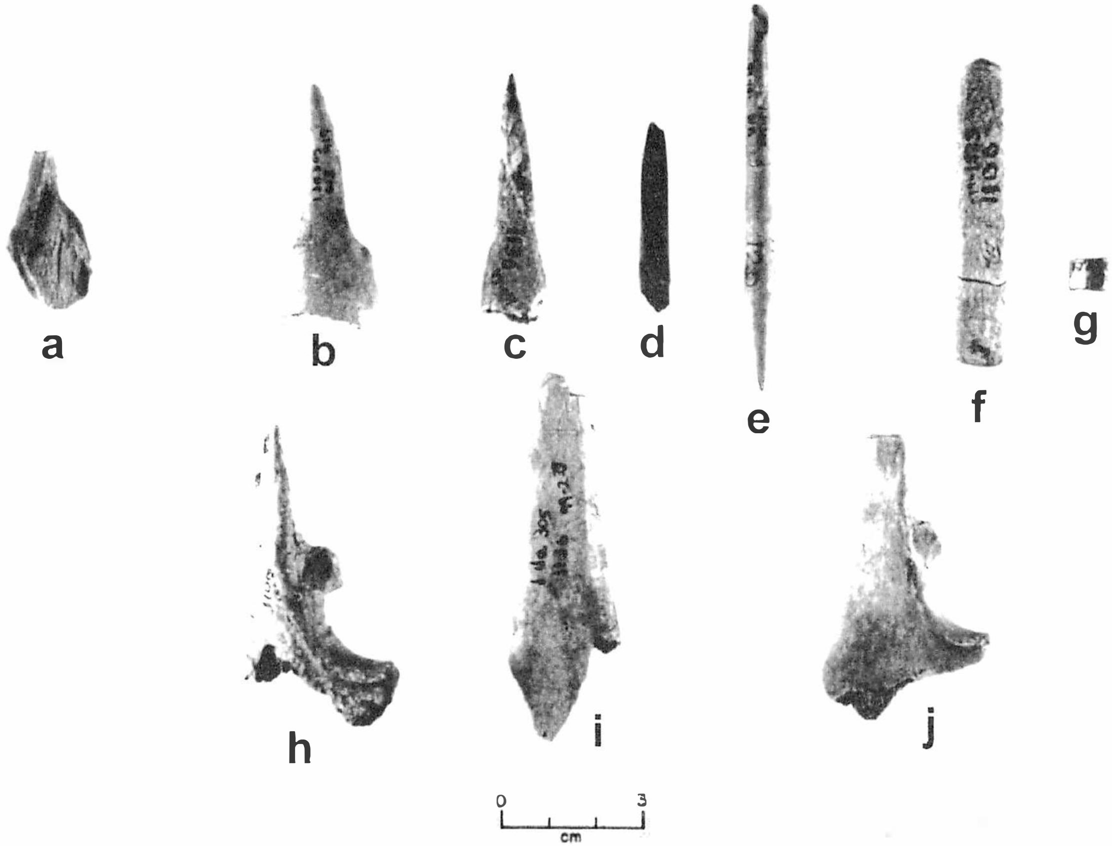

Figure IV - 1. Sample of LA modified bone specimens from the Widows Creek site. Morphological Category 1A - items c, d, and e; Morphological Category 2A - item b: Morphological Category 3A - item f, Morphological Category 3B - item g; Morphological Category 4C - item a; Manufacturing Stage 2A - items h and i; Manufacturing Stage 2C - item j.

Table IV - 5. Early Woodland period modified bone classified by raw material at Widows Creek.

Raw Material	Count	Percent
Misc. Mammal	79	65 %
Antler	14	11 %
Deer Bone	13	11 %
Bird Bone	10	8 %
Indeterminate	6	5 %
Turtle Shell	0	0 %
Total	122	100 %

categories. The number of specimens identified to a lower taxonomic level are 27 whitetail deer, 1 gray wolf (*Canis lupus*), and 1 indeterminate canid (*Canis* sp.). The whitetail deer specimens can further be subdivided by the element utilized; these include 14 antler, 4 metatarsals, 3 ulnae, 2 metapodials, 2 humeri, 1 radius, and 1 metacarpal.

Manufacturing Traces

Manufacturing traces on the modified specimens show evidence of grinding, groove and snap, carving or incising, chopping, drilling, grooving, notching, percussion flaking and indeterminate traces with 42 percent of the specimens exhibiting multiple traces. Table IV - 6 shows the frequency of the most pervasive or only manufacturing traces. The EW specimens were mostly manufactured and probably shaped by grinding, but carving and incising was also prevalent. Other traces present in small quantities were groove and snap, chopping, drilling, grooving, percussion flaking, and indeterminate traces.

Manufacturing Stage

Table IV - 7 shows the distribution of the EW specimens in the different possible stages of manufacture. The largest portion (56 percent) of material was assigned to the indeterminate category. Of the assignable material, approximately 29 percent were forms of complete objects. Broken objects dominated the complete implement group. The manufacturing byproduct/discard groups only consisted of 15 percent of the material. Most of the manufacturing byproduct/discard was groove and snap discard and fishhook manufacturing byproducts. Some metapodial and miscellaneous whitetail deer manufacturing debris was also present.

Table IV - 6. Early Woodland modified bone classified by primary manufacturing trace from Widows Creek.

Manufacturing Trace	Count	Percent
Ground/Smoothed	62	51 %
Groove and Snap	2	2 %
Carving/Incising	49	40 %
Chopped	1	1 %
Drilled	1	1 %
Grooved	1	1 %
Percussion Flaked	5	4 %
Indeterminate	1	1 %
Total	122	100 %

Table IV - 7. Early Woodland period modified bone classified by manufacturing stage from Widows Creek.

Manufacturing Stage	Count	Percent
Stage 1: Complete Objects		
1A. Unbroken	10	8 %
1B. Recent Break	1	1 %
1C. Non-recent Break	25	20 %
Stage 2: Byproduct/Discard		
2A. Fishhook Discard	2	2 %
2B. Fishhook - Aborted Manufacture	1	1 %
2C. Groove and Snap Discard - End	1	1 %
2D. Groove and Snap Discard - Fragment	4	3 %
2E. Grooved Only	2	2 %
2F. Groove and Snap Discard - Turkey	0	0 %
Stage 3: Deer Metapodial Manufacturing		
3A. Half Shaft Sections	2	2 %
3B. Quarter Shaft Sections	0	0 %
3C. Half or Quarter Section Fragments	1	1 %
3D. Proximal End	1	1 %
3E. Distal End	0	0 %
Stage 4: Misc. Byproduct/Discard		
4A. Whitetail Deer Elements	3	2 %
4B. Turtle Shell Fragments	0	0 %
Stage 5: Indeterminate		
5A. Metapodial Fragments	0	0 %
5B. Other Fragments	69	56 %
Total	122	100 %

Morphological Category

Table IV - 8 shows the distribution of specimens classified into morphological categories. Approximately 30 percent of the material was classified into morphological categories. Of these specimens, 18 percent were manufactured point objects; most of these consisting of broken tips. The non-manufactured point objects comprised nine percent of the assemblage; most of these were broken antler tips. Beveled objects consisted of three percent of the assemblage and the cylindrical objects were one percent of the assemblage.

Early Woodland Summary

One hundred twenty-two modified bone specimens were recovered from EW contexts at Widows Creek. Raw materials selected for modification include whitetail deer, miscellaneous mammals, bird bone, and indeterminate animals, the majority being miscellaneous mammals (65 percent). Manufacture of tools or items included several methods; the most common identified was grinding and carving. The manufacturing stages of these specimens consist mostly of completed items of some form with some manufacturing byproduct/discard present. Morphologically many of the assignable specimens are manufactured pointed objects. Figure IV - 2 shows a sample of the EW specimens assigned to manufacturing stage or morphological category.

Table IV - 8. Early Woodland modified bone classified by morphological categories from Widows Creek.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	7	6 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	13	11 %
1D. Manufactured Point - Bipointed	1	1 %
2A. Non-manufactured Point - Antler	4	3 %
2B. Non-manufactured Point - Antler Tips	6	5 %
2C. Non-manufactured Point - Canines	1	1 %
3A. Cylindrical - Closed Channel	1	1 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	1	1 %
4B. Beveled - Distal	2	2 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	17	14 %
6. Indeterminate	69	56 %
Total	122	101 %

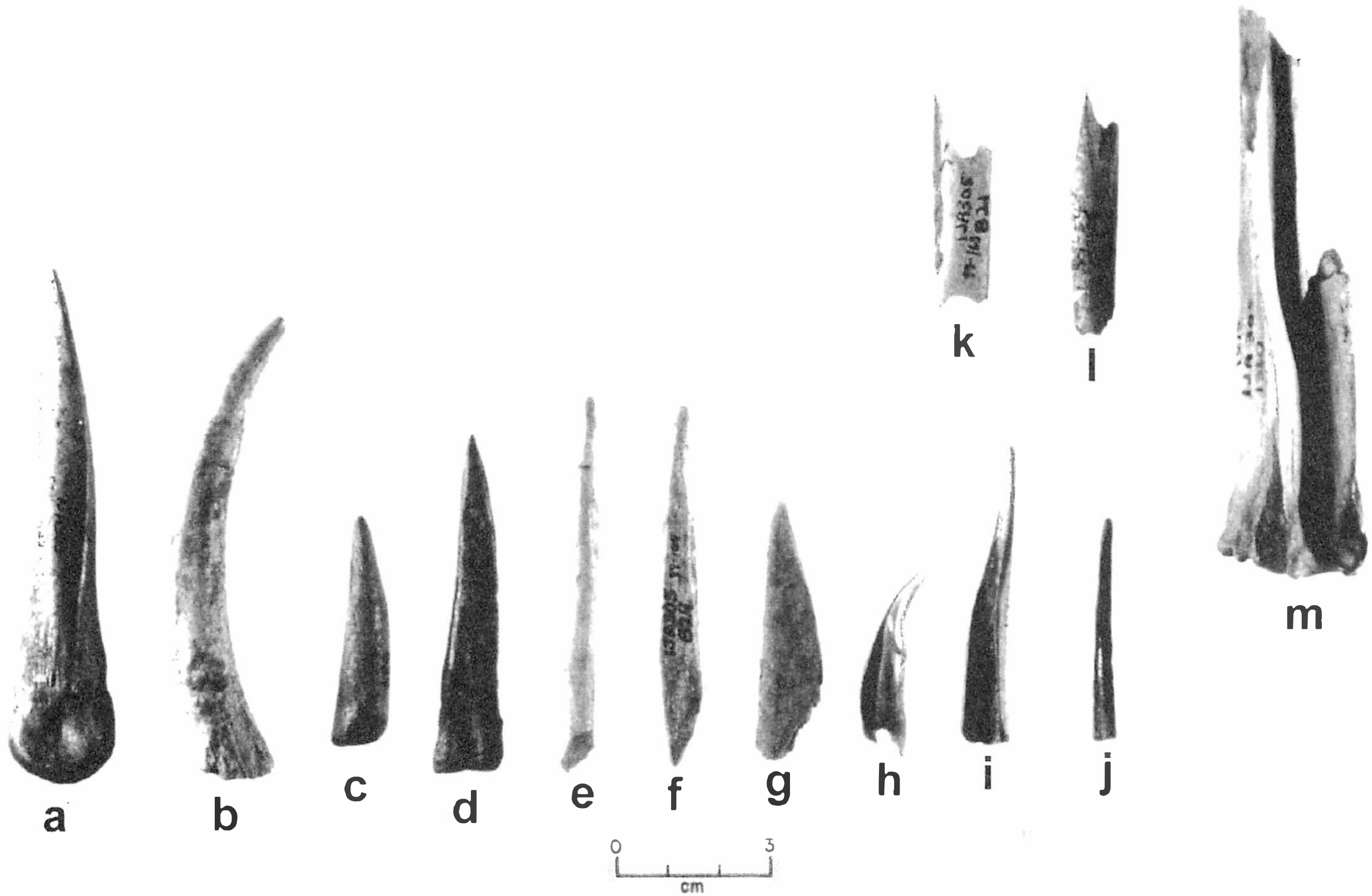

Figure IV - 2. Sample of EW modified bone specimens from the Widows Creek site. Morphhological Category 1 A - items a, d, e, f, g, i, j; Morphological Category 2A - items b and c; Morphological Category 2C - item h: Morphological Category 4A - item m; Manufacturing Stage 2A - items k and l.

Middle/Late Woodland (n = 402)

A total of 402 specimens was assigned to the Middle/Late Woodland component based on their provenience. The specimens were recovered from 36 features, 13 control column levels and 29 general cuts.

Raw Material

Table IV - 9 shows the distribution of the MLW modified bone among the six broad raw material categories. Approximately 51 percent of the material consists of miscellaneous mammal followed in rank by deer bone, antler, bird bone, turtle shell, and indeterminate categories. The specimens identified to a lower taxonomic level include 122 whitetail deer, 1 black bear (*Ursus americanus*), 2 raccoon (*Procyon lotor*), 1 beaver (*Castor canadensis*), 1 bobcat (*Lynx rufus*), 2 gray wolf (*Canis lupus*), 11 turkey (*Meleagris gallopavo*), and one eastern box turtle (*Terrapene carolina*). The whitetail deer specimens can be further subdivided by element. They include 45 antler, 42 metatarsals, 17 metapodials, 8 ulnae, 4 tibiae, 3 metacarpals, 1 humeri, 1 radius, and 1 phalange (Table IV - 10).

Manufacturing Traces

Manufacturing traces evident on the modified specimens include grinding, carving/incising, groove and snap, chopping, drilling, notching, grooving, percussion flaking, and indeterminate traces with approximately 58 percent of the specimens exhibiting multiple traces. Table IV -11 shows the frequency of the most pervasive or only manufacturing traces. The MLW specimens were mostly manufactured and probably shaped with carving/incising; and grinding was prevalent as well. Other manufacturing

Table IV - 9. Middle/Late Woodland period modified bone classified by raw material at Widows Creek.

Raw Material	Count	Percent
Misc. Mammal	206	51 %
Deer Bone	77	19 %
Bird Bone	49	12 %
Antler	45	11 %
Turtle Shell	21	6 %
Indeterminate	4	1 %
Total	402	100 %

Table IV - 10. Middle/Late Woodland period modified Whitetail deer bone tabulated by element at Widows Creek.

Element	Count	Percent
Antler	45	37 %
Metatarsal	42	34 %
Metapodial	17	14 %
Ulna	8	7 %
Tibia	4	3 %
Metacarpal	3	2 %
Humerus	1	1 %
Radius	1	1 %
Phalange	1	1 %
Total	122	100 %

Table IV - 11. Middle/Late Woodland modified bone classified by primary manufacturing trace from Widows Creek.

Manufacturing Trace	Count	Percent
Ground/Smoothed	100	25 %
Groove and Snap	33	8 %
Carving/Incising	236	59 %
Chopped	0	0 %
Drilled	2	1 %
Grooved	8	2 %
Percussion Flaked	20	5 %
Indeterminate	3	1 %
Total	402	101 %

techniques include groove and snap, percussion flaking, grooving, drilling, and indeterminate traces. Of these traces, groove and snap and percussion flaking were the most numerous.

Manufacturing Stage

Table IV - 12 shows the distribution of the MLW specimens among the possible stages of manufacture. Of the assignable material 31 percent or 125 specimens are considered whole or broken completed items. These items are mostly non-recently broken specimens. The byproduct/discard categories are 32 percent of the assemblage and consist mostly of metapodial manufacturing byproducts. Various groove and snap specimens and fishhook discard are also present.

Morphological Category

Table IV - 13 shows the distribution of MLW specimens assigned to morphological categories. Approximately 29 percent or 125 specimens were assignable to categories. The manufactured point objects were a majority of this assemblage (19 percent) with substantial quantities of non-epiphyseal based objects, broken tips, and bipointed objects. The closed channel cylindrical objects also comprised a number of objects as well as did the longitudinally beveled objects. The non-manufactured point objects consisted of the smallest portion of the assemblage.

<u>Middle/Late Woodland Summary</u>

Four hundred two modified bone specimens were recovered from MLW contexts at Widows Creek. Raw materials selected for modification included whitetail deer bone

Table IV - 12. Middle/Late Woodland period modified bone classified by manufacturing stage from Widows Creek.

Manufacturing Stage	Count	Percent
Stage 1: Complete Objects		
1A. Unbroken	34	8 %
1B. Recent Break	11	3 %
1C. Non-recent Break	80	20 %
Stage 2: Byproduct/Discard		
2A. Fishhook Discard	20	5 %
2B. Fishhook - Aborted Manufacture	0	0 %
2C. Groove and Snap Discard - End	9	2 %
2D. Groove and Snap Discard - Fragment	19	5 %
2E. Grooved Only	6	1 %
2F. Groove and Snap Discard - Turkey	4	1 %
Stage 3: Deer Metapodial Manufacturing		
3A. Half Shaft Sections	16	4 %
3B. Quarter Shaft Sections	11	3 %
3C. Half or Quarter Section Fragments	12	3 %
3D. Proximal End	2	1 %
3E. Distal End	3	1 %
Stage 4: Misc. Byproduct/Discard		
4A. Whitetail Deer Elements	4	1 %
4B. Turtle Shell Fragments	20	5 %
Stage 5: Indeterminate		
5A. Metapodial Fragments	2	1 %
5B. Other Fragments	149	37 %
Total	402	101 %

Table IV - 13. Middle/Late Woodland modified bone classified by morphological categories from Widows Creek.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	29	7 %
1B. Manufactured Point - Curved	3	<1 %
1C. Manufactured Point - Tip Only	34	8 %
1D. Manufactured Point - Bipointed	11	3 %
2A. Non-manufactured Point - Antler	2	<1 %
2B. Non-manufactured Point - Antler Tips	9	2 %
2C. Non-manufactured Point - Canines	1	<1 %
3A. Cylindrical - Closed Channel	16	4 %
3B. Cylindrical - Open Channel	1	<1 %
4A. Beveled - Longitudinally	6	1 %
4B. Beveled - Distal	10	2 %
4C. Beveled - Fragment	3	<1 %
5. Unassigned	126	31 %
6. Indeterminate	151	40 %
Total	122	100 %

and antler, miscellaneous mammal bone, bird bone, turtle shell, and indeterminate animals. The majority consisted of miscellaneous mammal bone (54 percent) followed by whitetail deer. Eighty-seven percent of the modified deer bone in this sample were metapodials, over 50 percent of those being metatarsals. Various manufacturing traces were evident; the most pervasive being carving/incising followed by grinding. Manufacturing stage classification showed that 32 percent of the material included patterned and unpatterned byproduct/discard. In addition, 31 percent of the specimens were completed objects. Morphologically, most of the assigned materials (29 percent) were manufactured point objects, with substantial numbers of closed channel cylindrical and longitudinally beveled objects. Figures IV - 3, IV - 4, IV - 5, IV - 6, IV - 7, and IV - 8 show samples of the MLW modified bone assigned to manufacturing stage or morphological category.

RUSSELL CAVE (1JA181) (N = 132)

Utilizing the published data (Ingmanson and Griffin 1974), 132 modified bone pieces recovered from Russell Cave were classified into morphological groups. Only morphological group classifications could be accomplished with the published data. An additional morphological category was added for this portion of the analysis. Category 7 was added to account for the morphology of a turtle shell bowl recovered from the Westmoreland Barber site.

To classify the bone implements into groups, photographs of shapes and written descriptions were used to determine morphological group affiliation. This technique

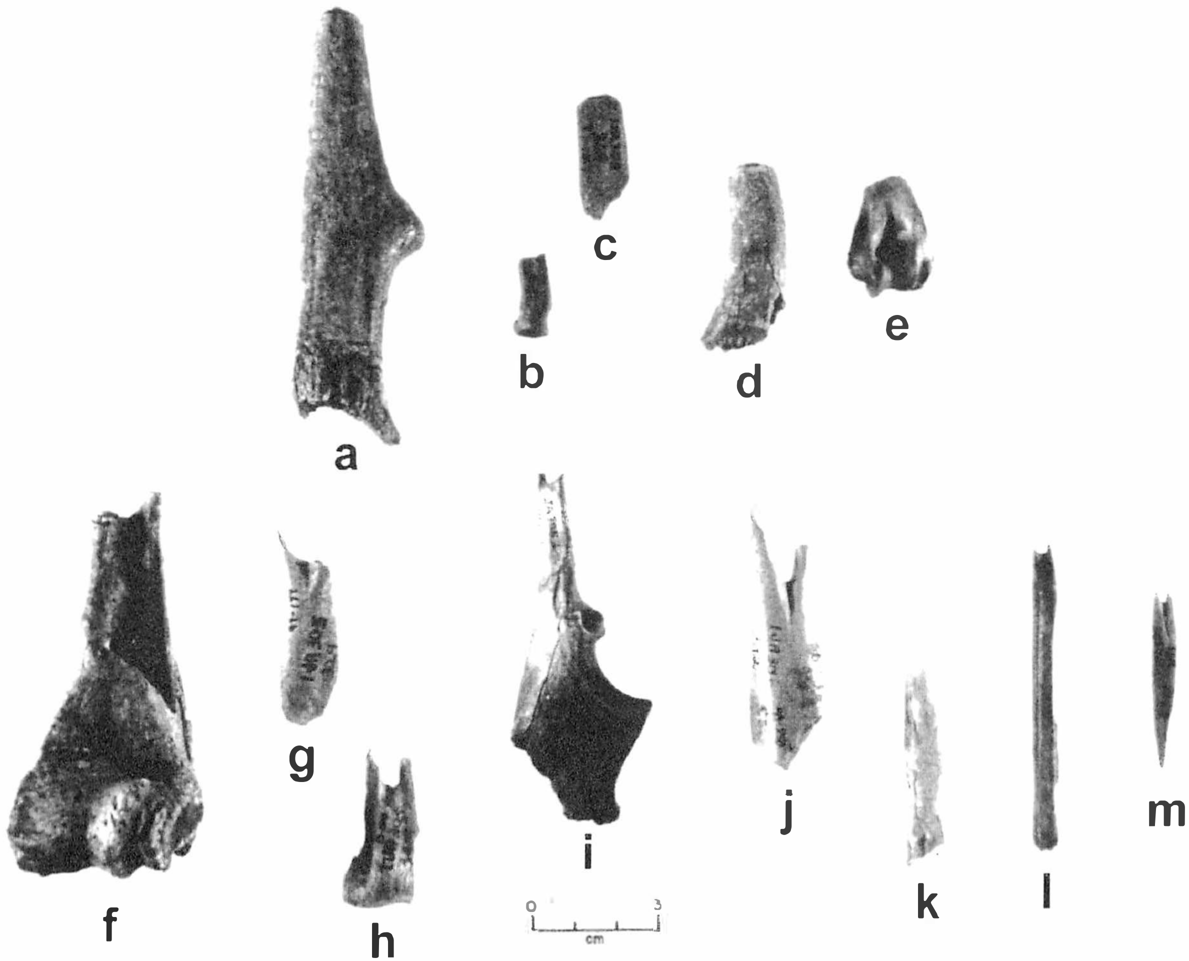

Figure IV - 3. Sample of MLW modified bone specimens from the Widows Creek site. Manufacturing Stage 2A - items f thru m; Manufacturing Stage 2C - a thru e.

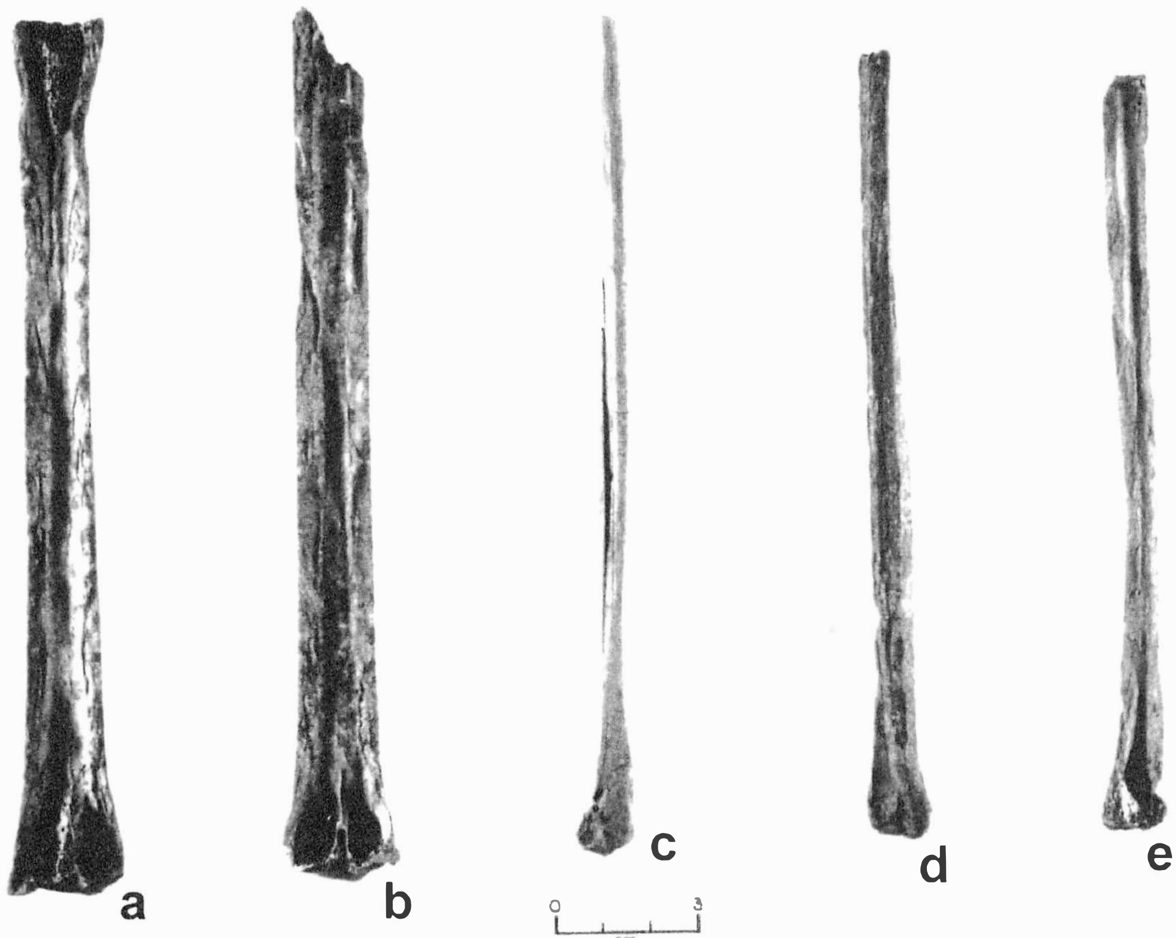

Figure IV - 4. Sample of MLW modified bone specimens from the Widows Creek site. Manufacturing Stage 3A - items a and b; Manufacturing Stage 3B - items c, d, and e.

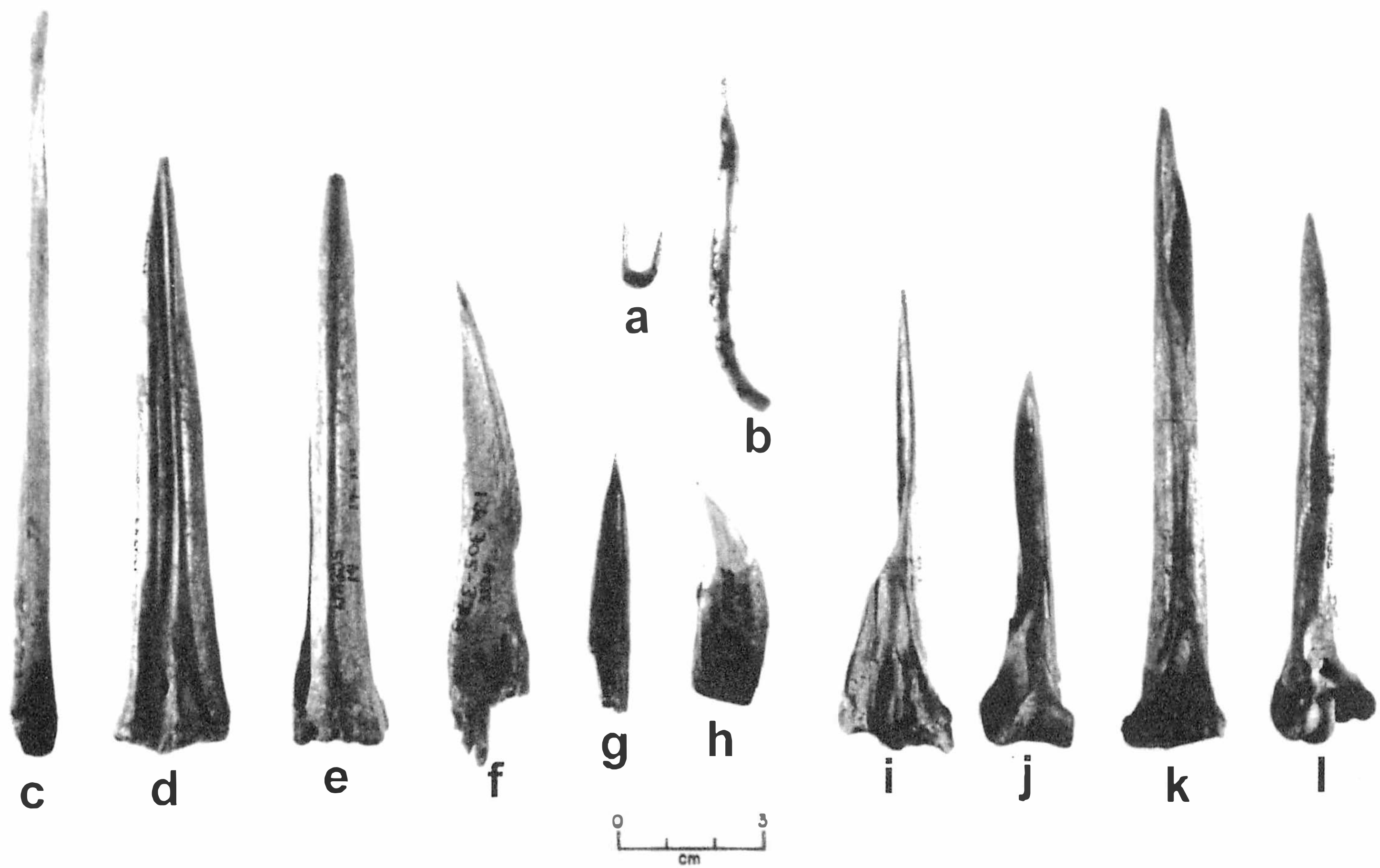

Figure IV - 5. Sample of MLW modified bone specimens from the Widows Creek site. Morphological Category 1A - items b, c, d, e, f, g, i, j, k, l; Morphological Category 1B - item a; Morphological Category 2C - item h.

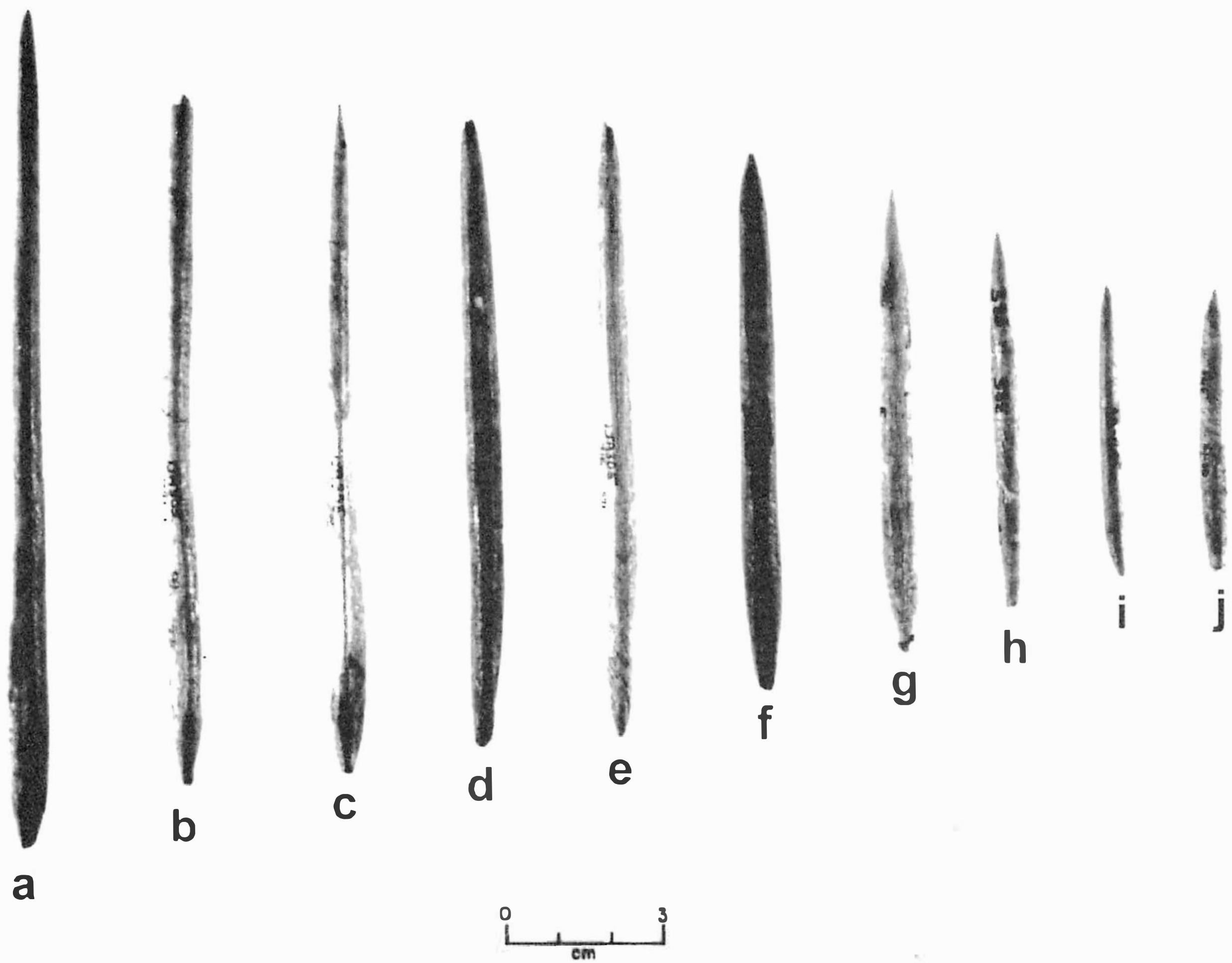

Figure IV - 6. Sample of MLW modified bone specimens from the Widows Creek site. Morphological Category 1D - items a thru j.

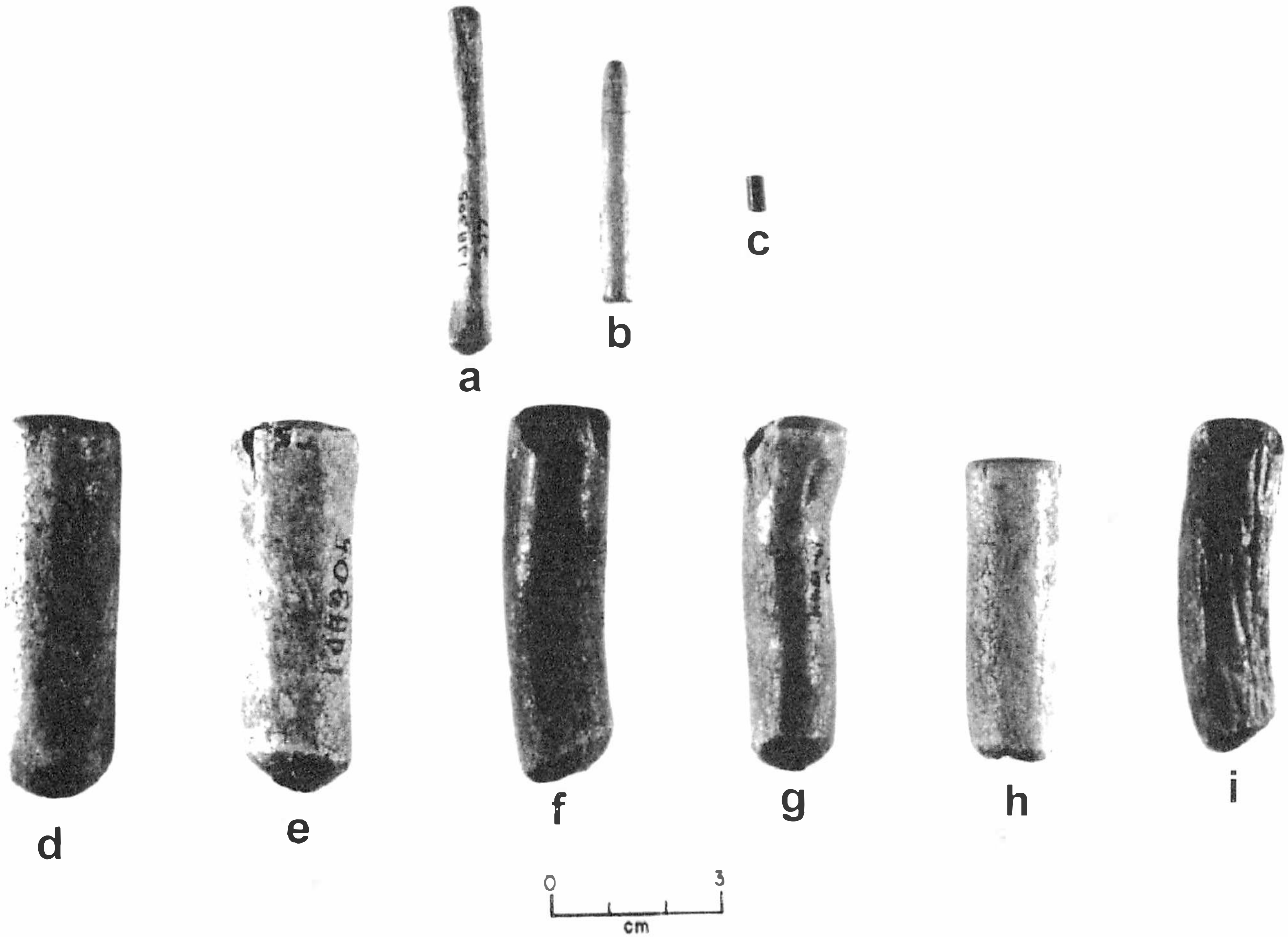

Figure IV - 7. Sample of MLW modified bone specimens from the Widows Creek Site. Morphological Category 3A - items a, b, d, e, f, g, h, i; Morphological Category 3B - item c.

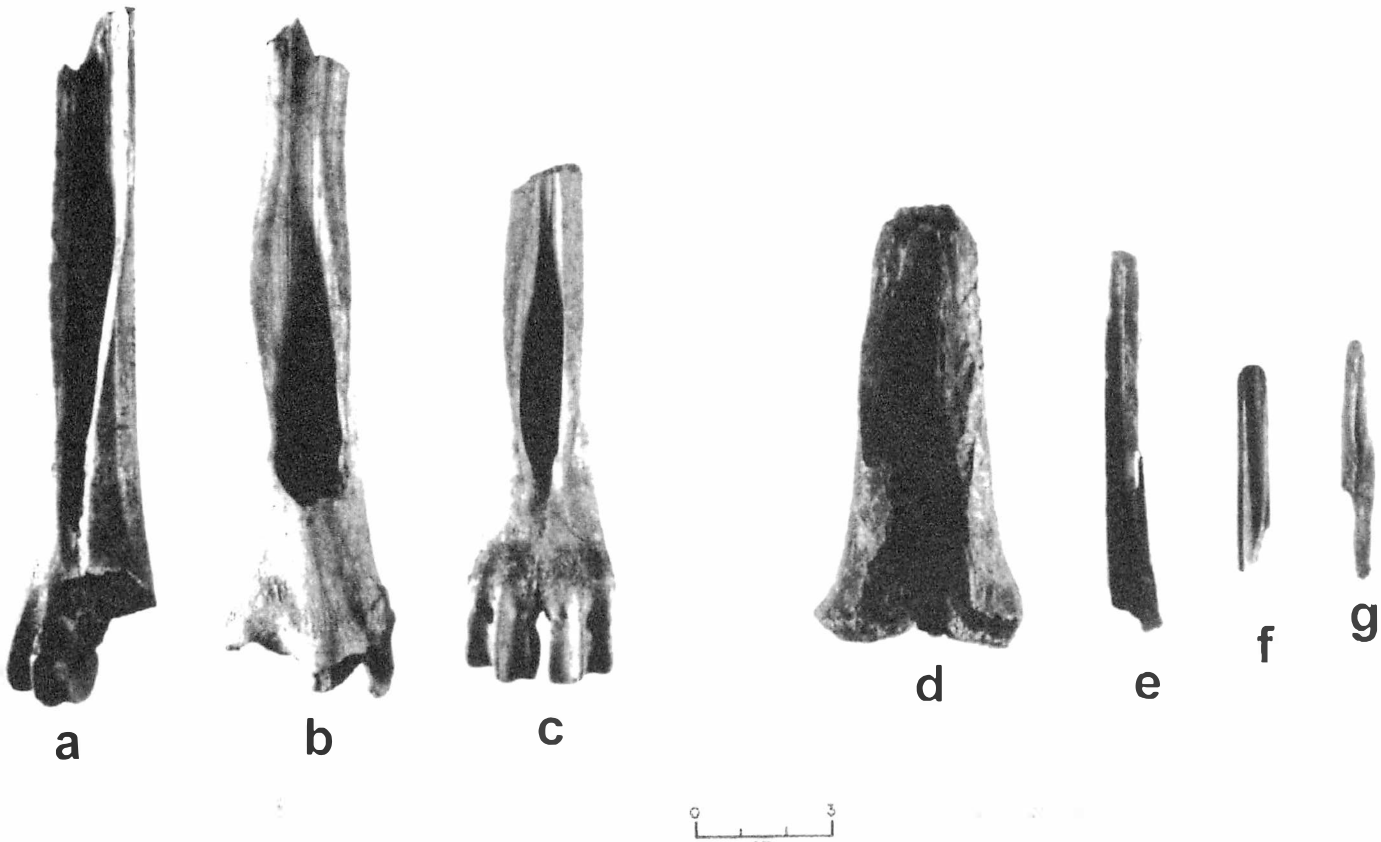

Figure IV - 8. Sample of MLW modified bone specimens from the Widows Creek Site. Morphological Category 4A - items a, b, and c; Morphological Category 4B - items d thru g.

assumes that all typed items (i.e. bone pins) that fall into a morphological group are complete items or nearly complete items. This assumption is not supported, but it is argued that there is still value in comparing these assemblages in this manner.

The modified bone assemblage from Russell Cave consists of a total of 132 specimens. Of these, 49 are from the LA layer E, 30 are from the EW layer D, and 53 from the MLW layers B and C.

Late Archaic (n = 49)

Table IV - 14 shows the distribution of the LA specimens assigned to morphological categories. The majority of the assemblage (76 percent) consisted of manufactured point objects from category 1A. Small quantities of items were present from the non-manufactured point objects, open channel cylindrical items and beveled end specimens.

Early Woodland (n = 30)

Table IV - 15 shows the distribution of the EW specimens assigned to morphological categories. A majority of the material (66 percent) consisted of manufactured point specimens, but these included u-shaped and bipointed items as well as straight items. Also, a quantity of pointed mammal teeth with modified bases were present.

Table IV - 14. Late Archaic modified bone classified by morphological categories from Russell Cave.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	37	76 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	0	0 %
1D. Manufactured Point - Bipointed	0	0 %
2A. Non-manufactured Point - Antler	3	6 %
2B. Non-manufactured Point - Antler Tips	0	0 %
2C. Non-manufactured Point - Canines	1	2 %
3A. Cylindrical - Closed Channel	0	0 %
3B. Cylindrical - Open Channel	3	6 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	3	6 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	1	2 %
6. Indeterminate	1	2 %
7. Bowl	0	0 %
Total	49	100 %

Table IV - 15. Early Woodland modified bone classified by morphological categories from Russell Cave.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	16	53 %
1B. Manufactured Point - Curved	1	3 %
1C. Manufactured Point - Tip Only	0	0 %
1D. Manufactured Point - Bipointed	3	10 %
2A. Non-manufactured Point - Antler	2	7 %
2B. Non-manufactured Point - Antler Tips	0	0 %
2C. Non-manufactured Point - Canines	6	20 %
3A. Cylindrical - Closed Channel	1	3 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	0	0 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	1	3 %
6. Indeterminate	0	0 %
7. Bowl	0	0 %
Total	30	99 %

Middle/Late Woodland (n = 53)

Table IV - 16 shows the distribution of MLW specimens assigned to morphological categories. A majority of the specimens (68 percent) consisted of straight manufactured point specimens and bipointed specimens. Closed channel cylindrical objects were also recovered.

WESTMORELAND-BARBER (40MI11) (N = 205)

Two hundred five bone items from culturally designated features and levels recovered from Westmoreland-Barber were analyzed. The LA contained 30 items, EW 107 items, and the MLW 68 items.

Late Archaic (n = 30)

Table IV - 17 shows the distribution of LA specimens assignable to morphological categories. A majority of the specimens could be assigned to category 1A (27 percent). The only other assignable material included broken manufacture and non-manufactured tips.

Early Woodland (n = 107)

Table IV - 18 shows the distribution of the EW specimens assigned to a morphological category. A majority of the material is manufactured point specimens, with

Table IV - 16. Middle/Late Woodland modified bone classified by morphological categories from Russell Cave.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	34	64 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	0	0 %
1D. Manufactured Point - Bipointed	2	4 %
2A. Non-manufactured Point - Antler	2	4 %
2B. Non-manufactured Point - Antler Tips	1	2 %
2C. Non-manufactured Point - Canines	1	2 %
3A. Cylindrical - Closed Channel	5	9 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	2	4 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	3	6 %
6. Indeterminate	3	6 %
7. Bowl	0	0 %
Total	53	101 %

Table IV - 17. Late Archaic modified bone classified by morphological categories from Westmoreland-Barber.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	8	27 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	1	3 %
1D. Manufactured Point - Bipointed	0	0 %
2A. Non-manufactured Point - Antler	0	0 %
2B. Non-manufactured Point - Antler Tips	1	3 %
2C. Non-manufactured Point - Canines	0	0 %
3A. Cylindrical - Closed Channel	0	0 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	0	0 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	17	57 %
6. Indeterminate	3	10 %
7. Bowl	0	0 %
Total	30	100 %

Table IV - 18. Early Woodland modified bone classified by morphological categories from Westmoreland-Barber.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	9	8 %
1B. Manufactured Point - Curved	1	1 %
1C. Manufactured Point - Tip Only	11	10 %
1D. Manufactured Point - Bipointed	1	1 %
2A. Non-manufactured Point - Antler	0	0 %
2B. Non-manufactured Point - Antler Tips	4	4 %
2C. Non-manufactured Point - Canines	1	1 %
3A. Cylindrical - Closed Channel	3	3 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	0	0 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	74	69 %
6. Indeterminate	3	3 %
7. Bowl	0	0 %
Total	107	100 %

most of those being broken tips, and straight specimens. Also recovered were non-manufactured point specimens and closed channel cylindrical specimens.

Middle/Late Woodland (n = 68)

Table IV - 19 shows the distribution of MLW specimens assignable to a morphological category. A majority of the specimens consist of straight manufactured point specimens. Also recovered were non-manufactured point specimens and a turtle shell bowl.

Table IV - 19. Middle/Late Woodland modified bone classified by morphological categories from Westmoreland-Barber.

Morphological Category	Count	Percent
1A. Manufactured Point - Straight	6	9 %
1B. Manufactured Point - Curved	0	0 %
1C. Manufactured Point - Tip Only	2	3 %
1D. Manufactured Point - Bipointed	1	1 %
2A. Non-manufactured Point - Antler	1	1 %
2B. Non-manufactured Point - Antler Tips	3	4 %
2C. Non-manufactured Point - Canines	0	0 %
3A. Cylindrical - Closed Channel	0	0 %
3B. Cylindrical - Open Channel	0	0 %
4A. Beveled - Longitudinally	0	0 %
4B. Beveled - Distal	0	0 %
4C. Beveled - Fragment	0	0 %
5. Unassigned	48	71 %
6. Indeterminate	6	9 %
7. Bowl	1	1 %
Total	68	100 %

CHAPTER V

ASSEMBLAGE COMPARISONS

WIDOWS CREEK: LA VS. EW VS. MLW

A total of 562 pieces of modified bone was recovered from contexts assignable several cultural periods at the Widows Creek site. The MLW component of the site had the largest assemblage of modified bone fragments with 385 pieces, followed by EW (n = 122) and the LA (n = 37). The small size of the LA assemblage suggests that differences noted between assemblages may be due to sample size alone. However, despite the sample size problem, it is argued that there is still value in comparing the assemblages.

Raw Material Categories

Table V - 1 summarizes the basic raw material groups for each component. Although the groups are general, a number of trends are apparent. Miscellaneous mammal bone represents the largest quantity of modified material for all three periods. Deer bone

Table V - 1. Modified bone raw materials from the LA, EW, MLW components of the Widows Creek site.

Raw Material	LA Count	LA Percent	EW Count	EW Percent	MLW Count	MLW Percent
Misc Mammal	26	68	79	65	206	51
Deer Bone	6	16	13	11	77	19
Antler	2	5	14	11	45	11
Bird Bone	3	8	10	8	49	12
Turtle Shell	1	3	0	0	21	5
Indeterminate	0	0	6	5	4	1
Total	38	100	122	100	402	99

was ranked second highest in the MLW and LA. Antler ranked second in the EW. It is estimated that much of the miscellaneous mammal bone is probably fragmented deer elements but lacks the necessary landmarks for identification. In all components the quantity of antler and bird bone is roughly equivalent. Again, all components present little to no quantity of indeterminate modified fragments, and only the MLW has any sizable quantity of turtle shell. Visually there appears to be little difference in the pattern of raw material utilization among the three cultural periods.

Species Utilization

The MLW component shows a higher diversity of species than the other components. This higher diversity is probably directly related to the increase in sample size from the LA to MLW. The MLW assemblage also shows that elements of the heavier boned carnivores tend to be utilized before those of other mammals. The turkey is the most heavily utilized bird. Much of the indeterminate bird bone is probably turkey bone, lacks diagnostic landmarks for species identification.

Whitetail Deer Element Utilization

The large quantity of identifiable whitetail deer allows the exploration of element preference for modification. Table V - 2 summarizes the element data. As is expressed through the broad morphological groupings in Table V - 1, antler is a heavily utilized and modified element. In both the EW and MLW antler is ranked the highest, and in the LA it is ranked second. The second most utilized element was the metatarsal. If the metatarsals are combined with the metacarpals and metapodials, this metapodial group outranks the antler utilization. Only during the EW does this not occur. The choice of metapodials,

Table V - 2. Whitetail deer elements utilized for modification from the LA, EW, and MLW components of the Widows Creek site.

Skeletal Element	LA Count	LA Percent	EW Count	EW Percent	MLW Count	MLW Percent
Metatarsal	3	50	4	31	42	55
Metapodial	1	17	2	15	17	21
Ulna	2	33	3	23	8	10
Humerus	0	0	2	15	1	1
Metacarpal	0	0	1	8	3	4
Radius	0	0	1	8	1	1
Tibia	0	0	0	0	4	5
Phalange	0	0	0	0	1	1
Total	6	100	13	100	77	98

especially during the MLW, seems to represent a specific industry for the modification of this material and was very regular and patterned. Beyond the metapodials, ulnae were preferred over many of the other elements for all components. Again, the slightly greater diversity of elements utilized during the MLW may be related to the greater sample size.

In summary, the overall raw material choices being made by the LA, EW, and MLW groups at Widows Creek are very similar. All three chose mammal bone and, specifically, whitetail deer bone for modification into tools. The MLW period has a higher diversity of species utilized and elements modified, than the LA and EW periods, possibly the result of unequal sample sizes. One point of interest is the very high usage of metapodials and specifically metatarsals during the MLW period. This usage appears to be very patterned; much of the metapodial material was sorted into the metapodial byproduct categories. This probably represents a specific industry that is not present or as apparent during the EW or LA.

Modification Attributes

Table V - 3 summarizes the most pervasive modification attribute found on the specimens from each period. Although many had multiple attributes, only the primary attribute was considered here. Multiple attributes probably relate to different stages of manufacture and are an area that requires further study. Here, the most pervasive attribute is qualified. As Table V - 3 shows, despite differences in sample size, all components have similar diversity of modification attributes. The LA materials have combinations of six attributes, the EW have combinations of eight and the MLW

Table V - 3. Comparison of primary manufacturing traces on modified bone from the LA, EW, and MLW components of the Widows Creek site.

Primary Manufacturing Trace	LA Count	LA Percent	EW Count	EW Percent	MLW Count	MLW Percent
Ground/Smoothed	24	63	62	51	100	25
Groove and Snap	6	16	2	2	33	8
Carving/Incising	4	10	49	40	236	59
Chopped	0	0	1	1	0	0
Drilled	1	3	1	1	2	1
Grooved	2	5	1	1	8	2
Percussion Flaked	1	3	5	4	20	5
Indeterminate	0	0	1	1	3	1
Total	38	100	122	101	402	101

materials have a combination of six attributes. All groups show high pervasive attributes of grinding and carving/incising. The major difference is the high percentage of carving/incising used in the MLW assemblage. This implies a frequent use of flake stone tools in the manufacturing process. This emphasis on carving/incising in the MLW is contrasted against the more balanced use of grinding/smoothing and carving/incising in the EW. Also, during the MLW, there is a somewhat greater emphasis on percussion flaking of bone. The increase in flaking is associated with the metapodial byproducts. In the MLW assemblage of the 44 specimens assigned to metapodial byproducts 25 (57 percent) exhibit percussion flaking.

In summary, there appears to be some differences in the modification attributes found on specimens between components. There also appears to be greater carving/incising of material occurring in the MLW than the EW. The EW has a more balanced use of grinding/smoothing and carving/incising.

Manufacturing Stage

Table V - 4 summarizes data on manufacturing stage. All three assemblages contain large proportions of specimens indeterminate to manufacturing stage, with the LA and MLW hovering around 40 percent and the EW rising to 56 percent. Of the assignable specimens, the EW and MLW have similar frequencies (29 percent and 31 percent, respectively) of completed implements. The LA assemblage is much lower at 18 percent. In all three assemblages the completed specimens break down in similar

Table V - 4. Comparison of manufacturing stage data for the LA, EW, MLW components of the Widows Creek site.

Manufacturing Stage	LA Count	LA Percent	EW Count	EW Percent	MLW Count	MLW Percent
Stage 1: Complete Objects						
1A. Unbroken	2	5	10	8	34	8
1B. Recent Break	1	3	1	1	11	3
1C. Non-recent Break	4	10	25	20	80	20
Stage 2: Byproduct/Discard						
2A. Fishhook Discard	2	5	2	2	20	5
2B. Fishhook - Aborted Manufacture	1	3	1	1	0	0
2C. Groove and Snap Discard - End	1	3	1	1	9	2
2D. Groove and Snap Discard - Fragment	3	8	4	3	19	5
2E. Grooved Only	4	10	2	2	6	1
2F. Groove and Snap Discard - Turkey	0	0	0	0	4	1
Stage 3: Deer Metapodial Manufacturing						
3A. Half Shaft Sections	1	3	2	2	16	4
3B. Quarter Shaft Sections	0	0	0	0	11	3
3C. Half or Quarter Section Fragments	1	3	1	1	12	3
3D. Proximal End	1	3	1	1	2	1
3E. Distal End	0	0	0	0	3	1
Stage 4: Misc. Byproduct/Discard						
4A. Whitetail Deer Elements	0	0	3	2	4	1
4B. Turtle Shell Fragments	1	3	0	0	20	5
Stage 5: Indeterminate						
5A. Metapodial Fragments	0	0	0	0	2	1
5B. Other Fragments	16	42	69	56	149	37
Total	38	101	122	100	402	100

proportions. The highest ranked category is non-recent broken specimens, followed by complete specimens and recently broken specimens.

The manufacturing byproduct/discard categories show some differences between the periods. Combining all byproduct/discard categories, the LA period has the highest frequency of material (41 percent), followed by the MLW (32 percent) and EW (15 percent). The increase in the proportion of byproduct and discard specimens in the LA is at the expense of completed or finished items. The loss of manufacturing byproduct/discard specimens in the EW is at the gain of the indeterminate material. The MLW has fairly even proportions of completed specimens, byproduct/discard, and indeterminate specimens.

Differences among the three periods are seen in the manufacturing byproduct/discard data. The fishhook manufacturing discard and aborted fishhook specimens are present in all three periods, although actual fishhooks may not have been recovered. The actual debris or discard (category 2A) is interesting because of the quantity of material, especially during the MLW. Webb and Dejarnette (1948:Figure 31, 65) discuss the different stages of manufacture. The hook is carved from the distal portion of the blank and then removed. The remaining proximal portion of the blank is bifurcated. One side of the bifurcation is pointed from carving, the point of the fishhook. The other side is a knob from carving the shank of the fishhook. Assuming that the actual hook could not exceed the breadth of the bifurcated discard, the discards can be measured and fishhook size estimated. A sample of fishhook discards was measured from the three time periods. Table V - 5 presents the breadth measurement data. As can be seen, the two LA

Table V - 5. Fishhook discard width data for the LA, EW, and MLW period components of the Widows Creek site.

Specimen #	Width (mm)	Raw material
LA Discard (n = 2, $\overline{X}$ = 15.96)		
019-1562	15.44	Deer bone
099-0233	15.94	Misc mammal
EW Discard (n = 3, $\overline{X}$ = 9.38)		
019-1605	6.64	Antler
099-0054	8.80	Misc mammal
099-0163	12.70	Misc mammal
MLW Discard (n = 18, $\overline{X}$ = 10.55)		
199-0021	4.29	Bird bone
199-0023	4.89	Bird bone
099-0001	5.55	Misc mammal
019-1605	6.64	Deer bone
199-0018	6.75	Bird bone
199-0039	7.58	Bird bone
199-0029	7.87	Bird bone
019-1542	8.13	Deer bone
019-1528	11.58	Deer bone
019-1617	11.58	Deer bone
019-1618	12.06	Deer bone
099-0144	12.93	Misc mammal
099-0164	13.95	Misc mammal
099-0165	14.11	Misc mammal
099-0122	14.24	Misc mammal
099-0250	14.92	Misc mammal
019-1516	16.27	Deer bone
099-0333	16.50	Misc mammal

specimens are similar in size, while the three EW exhibit more variation. The sample of 18 from the MLW shows a great deal of variation, with approximately a 12 mm difference between the smallest and the largest. Examining the data, there do seem to be two groups of discard, those above 11 mm and those below 9 mm. This dichotomy may imply a difference in preferred hook size for certain species or sizes of fish.

The grooved and groove and snap byproduct/discard was recovered from all three assemblages. The use of groove and snapping bone appears early in the manufacturing sequence for blank or preform preparation. Proportionally the LA assemblage has the highest percentage of groove and snap discard, followed in rank by the MLW and EW. The LA assemblage consisted of simply grooved specimens, while both the EW and MLW assemblage contained mostly grooved and snap debris fragments. In the MLW some of the perpendicular groove and snap debris was associated with antler sections (6 out of 9 specimens). This may represent the preparation of blanks for the antler closed channel cylindrical objects. The final category of groove and snap debris that seems limited to the MLW is that related to turkey spur removal. This is probably part of the reduction sequence of the tarsometatarsus manufactured into a pointed implement.

The metapodial manufacturing byproduct/discard is one of the most interesting portions of this assemblage. It was apparent from cursory examination of the collection that patterned modification of metapodials and, specifically, metatarsals were present in the collection in quantity. Although some of this patterned byproduct/discard was present in the LA and EW, the overwhelming majority was from MLW contexts. The MLW period has material assigned to all five classes of manufacture.

Considering the metapodial debris recovered, a specific sequence of manufacture was present. The sequence starts with the metapodial, usually metatarsals, split in half lengthwise either medio-laterally or dorsal-ventrally. A sample of class 3A or the half shaft sections was examined and categorized based on bone landmarks to either ventral/dorsal, or medial/lateral. Of the 20 shaft sections categorized, 18 were ventral/dorsal, with the remaining two being medial/lateral. It has often been assumed that the vascular groove provided an ideal initial groove to split the bone into medial and lateral sections. However, this assumption is probably unwarranted. It appears that the initial split separated the dorsal and ventral faces. Then the groove and snap method was applied to the vascular groove to split the half shaft into quarters.

The quarter shaft sections were examined for their placement in quarters, either medial/lateral ventral sections or medial/lateral dorsal sections. Of the 14 sections examined, 11 were either the medial/lateral ventral sections and the remaining three were medial/lateral dorsal sections. Whether this implies that, by their absence, the dorsal quarter sections were preferred for manufacture or that the ventral sections were less preferred, is unclear. The quarter sections intuitively appear to represent blanks or preforms for bipointed objects (Morphological Category 1D). Although no middle step between a blank and a bipointed object was noted, the overall shape of the quarter section would lend itself to rounding and pointed tip manufacture. Also, some of the bipointed objects were identified as metapodials based on the presence of remnant vascular grooves. This connection implies that, although only 11 complete bipointed objects were recovered from MLW contexts, substantial effort and time were invested in the manufacture of these objects.

The final byproduct/discard group is a non-patterned group of items intuitively felt to be a byproduct or discard. These items did not occur in quantity or exhibit regular patterning to create specific manufacturing stages. All three periods had something in the group; either whitetail deer specimens or turtle shell specimens. The abundance of this material during the MLW, as compared to the LA and EW, is due to the quantity of modified turtle shell fragments. Although the specimens are intuitively related to bowl production, most are too fragmented to classify.

Overall, the assemblages at the Widows Creek site contain some interesting patterns. The overall frequency of completed objects, manufacturing byproducts/discard, and indeterminate materials have implications for transport of tools on or off the site. The LA pattern (high byproduct/discard, low completed implements, and a moderate amount of indeterminate material) implies onsite manufacture of tools for use and possible discard or loss at other sites. The EW pattern, high frequency of completed implements, low manufacturing byproduct/discard, and high indeterminate has a couple of implications. First, it can imply that many already manufactured tools were brought into the site and discarded with little onsite manufacture. Secondly, the high quantity of indeterminate material may imply that there is more onsite production occurring, but the production is not as structured, producing large patterned byproduct/discard categories. The MLW assemblage exhibits fairly equal amounts of debris, tools, and indeterminate material. This implies that tools were produced and used for onsite or near site activities. This pattern is emphasized by the patterned debris categories that may relate to several of the morphological tool categories. Overall, several sequences or kinds of manufacture occur during all three periods. However, only during the MLW do large assemblages of patterned byproduct/discard occur, implying a few specialized industries that were promulgated during this time.

Morphological Category

Table V - 6 summarizes the morphological category data by component. Overall, the sample size differences create an impression of greater diversity in the MLW period than the other two periods. Despite this sample size problem, some trends are apparent among the three periods. The morphological categories are discussed by each broad category.

Category 1: Manufactured Point Implements

Category 1 contains 101 specimens: 3 LA, 21 EW and 77 MLW. Examples of these specimens are shown in Figures IV - 1, IV - 2, and IV - 5 for each of the respective components. Implements in this category consist of a variety of items with a manufactured pointed end.

Category 1A items represent a large category of items commonly referred to in the literature as awls, needles, pins, and projectile points. Awls are straight pointed implements that are traditionally classified based on their taxa, shaft and base manufacture. Specimens c thru e in Figure IV - 1; a, d - g, i, and j in Figure IV - 2; b - g and i - l in Figure IV - 5 have been referred to as a large single class termed single-pointed

Table V - 6. Comparison of the modified bone morphological classification for the LA, EW and MLW components of the Widows Creek site.

Morphological Category	LA Count	LA Percent	EW Count	EW Percent	MLW Count	MLW Percent
1A. Manufactured Point - Straight	3	8	7	6	29	7
1B. Manufactured Point - Curved	0	0	0	0	3	1
1C. Manufactured Point - Tip Only	0	0	13	11	34	8
1D. Manufactured Point - Bipointed	0	0	1	1	11	3
2A. Non-manufactured Point - Antler	1	3	4	3	2	0.5
2B. Non-manufactured Point - Antler Tips	0	0	6	5	9	2
2C. Non-manufactured Point - Canines	0	0	1	1	1	0.25
3A. Cylindrical - Closed Channel	1	3	1	1	16	4
3B. Cylindrical - Open Channel	1	3	0	0	1	0.25
4A. Beveled - Longitudinally	0	0	1	1	6	1
4B. Beveled - Distal	0	0	2	2	10	2
4C. Beveled - Fragment	1	3	0	0	3	1
5. Unassigned	15	39	17	14	126	31
6. Indeterminate	16	42	69	56	151	40
Total	38	101	122	101	402	101

awls (Lewis and Kneberg 1946:124) or variably split or splinter awls (Ingmanson and Griffin 1974:54). In some cases the split and splinter awls are presented as different classes (Webb and Dejarnette 1948:58). Often, if the skeletal element was identifiable, classes were created like deer ulna awls (Webb and Dejarnette 1948:58), small mammal awls (Ingmanson and Griffin 1974:54), bird bone awls (Ingmanson and Griffin 1974:54; Webb and Dejarnette 1948:58), or raccoon baculum awls (Lewis and Kneberg 1946:125; Polhemus 1987:Figure 11.21). The function of these tools is implied by their class title as awls. However, Webb and Dejarnette (1948:58-59) present a discussion of different functions or possibly multiple functions of the bird bone awls. They estimate that these may have functioned as hairpins or awls or possibly both.

Needles and pins are straight pointed implements that are classified based on their morphology. These objects are generally more finely made and thinner in shaft diameter than awls. In the case of needles, there is often a hole drilled through the section opposite the pointed end (Webb and Dejarnette 1948:60). Of the specimens analyzed from Widows Creek, fragments that may have been needles were recovered, but no complete specimens. The function of these specimens is again implied by their type designation. Faulkner and Graham (1966:102-103) identify needles as needles by their morphology (hole at one end) which allows sinew to be threaded. The pins are described as being ornamental and probably worn in some as evidenced by the high polish and refined workmanship.

Although category 1A appears to be a conglomeration of a vast array of material, all are single pointed objects. Also, it can be argued that many of these traditional categories are infused with functional distinctions that may be invalid.

The Widows Creek assemblages all have similar proportions of category 1A objects. Although further distinction and comparison of tools in this broad class might be insightful, this would constitute a separate study not appropriate here.

Category 1B items represent a small category of objects commonly referred to as fishhooks (Faulkner and Graham 1966:103; Ingmanson and Griffin 1974:57; Lewis and Kneberg 1946:125; Webb and Dejarnette 1948:60). Specimen a in Figure IV - 5 represents this category. The morphology of these fishhooks is nearly identical to modern types and the functional distinction seems obvious. Although very few complete fishhooks were recovered, the presence of the manufacturing discard suggests that use of these tools was common on the site in all the time periods.

Category 1C items simply represent broken tips of these various pointed objects. This represents the highest proportion of material for the EW and MLW periods.

Category 1D objects represent bipointed straight bone objects often circular or oval in crossection. Figure IV - 6 shows examples of these variously sized items. These specimens are commonly referred to in the literature as double-pointed or double tapered awls (Griffin 1974:54; Lewis and Kneberg 1946:124), as projectile points (Polhemus 1987:Figure 11.17; Webb and Dejarnette 1948:60) and as cylindrical pins (Polhemus 1987:Figure 11.21). Of these differing classes, only Lewis and Kneberg describe the function of the double-pointed awls as being projectile points. They base the assessment on Tyzzer's (1936) work on bone projectiles and a historical description of Powhatan bone projectiles (Lewis and Kneberg 1946:125).

In the Widows Creek assemblages these items are most common in the MLW assemblage. These items are more than likely the end product of the metapodial manufacturing sequence. The high proportion of both complete implements and the quantity of manufacturing remains suggest that this industry is important at the site probably for a specific task.

In summary, **Category 1** items represent the largest category of classifiable objects for all three time periods. The EW and MLW frequencies of these specimens are equable. The higher diversity of represented classes in the MLW can be attributed to sample size. However, the presence of the bipointed objects in the MLW period is a significant difference. These items are probably the end product of the patterned metapodial manufacturing process and represent a significant specialized industry at this site. Also, many of the broken tips give the impression of being parts of the bipointed items.

Category 2: Non-manufacture Pointed Implements

Category 2 contains 24 specimens: 1 LA, 11 EW, and 12 MLW. Examples of these are shown in figures IV - 1, IV - 2, and IV - 5 for each of the respective components. Implements in this category consist of items that exhibit a natural, non-manufactured point.

Category 2A consists of antler implements that had the tine tip present and were probably used as is with little or no modification. These items are generally classified in the literature as projectile points or pressure flakers.

Projectile points are straight pointed implements that are classified based on their morphology and raw material. One form recognized is the socketed antler projectile point (Lewis and Kneberg 1946:124; Polhemus 1987:Figure 11.18; Webb and Dejarnette 1948:63). Some drilled antler fragments were present, but no complete or recognizable projectile points were present. The base usually has a hole drilled longitudinally up into the base to create the socket. Lewis and Kneberg (1946:124) interpreted the function of these items based on their resemblance to arrows described in a historic ethnographic account.

Pressure flakers are fairly straight pointed specimens, classified based on their raw material and morphology. These specimens are typically antler tines removed from the beam with little or minor modification (Ingmanson and Griffin 1974:57; Lafferty 1981:290; Lewis and Kneberg 1946:124; Webb and Dejarnette 1948:63). Specimen b and c in Figure IV - 5 and possibly specimen b in figure IV - 1 represent examples of this category. The function of these items as pressure flaking tools in flaked stone tool production process is well documented through modern experimental studies (see Inizan et al. 1992:88 and Lafferty 1981:290). Lewis and Kneberg (1946:124) also discuss alternate uses of these tools as club-heads, comparing them to historic descriptions of Powhatan tools.

Category 2C represents pointed mammal teeth, in this case all canines that have modified bases. These items are commonly designated in the literature as pendants or ornaments (Faulkner and Graham 1966:105; Webb and Dejarnette 1948:56). Although not usually classified as pointed objects, the overall shape is pointed and nothing rules out their possible use as piercing tools. Very few of these items were recovered, only one from the EW (item h, Figure IV - 2) and MLW (item h , Figure IV - 5) assemblages.

In summary, **Category 2** represents some items that are differentiated by a non-manufactured or natural point. The largest frequency of this material is antler tine objects, and in most cases the highest quantity is represented by broken tips. Of the three periods the LA assemblage has the lowest frequency of material.

Category 3: Cylindrical Implements

Category 3 contained 19 implements: 2 LA, 1 EW and 16 MLW. Examples of these specimens are shown in figures IV - 1 and IV - 7. Implements in this category consist of cylindrical or tube-like implements. **Category 3A** represents closed channel cylindrical items commonly referred to in the literature as antler drifts, antler flakers and punches, and bone cylinders.

Antler drifts are straight antler beam sections that have both ends ground flat or nearly flat (Faulkner and Graham 1966:106; Ingmanson and Griffin 1974:57; Lafferty 1981:293; Webb and Dejarnette 1948:63). Specimens d thru i in Figure IV - 7 are examples. Lafferty (1982:290-293) places drifts in the functional category of flaking tools and specifically percussion flakers. Many of these tools are described as being ground or having spalling at one end from use in flint knapping.

Antler flakers (Lewis and Kneberg 1946:123, Plate 76) and punches (Lafferty 1982:293; Webb and Dejarnette 1948:63) are split and ground straight sections of antler that has ground flat ends. Specimen f in Figure IV - 1 is an example of this item. Lafferty (1982:290-293) classifies these as flaking tools for flaked stone tool manufacture.

Bone cylinders (Ingmanson and Griffin 1974:57) are ground cylinders of bone with blunt ends. Specimens a and b in Figure IV - 7 are examples of these. However, no function has been discussed for these items.

In the Widows Creek assemblages these morphological categories are most common in the LA and MLW. The MLW has a significant number of the antler cylinders, again possibly representing a significant industry of manufacture during this period.

Category 3B represents open channel cylindrical items or tubes such as items commonly referred to in the literature as beads, bone tubes, or rings (Ingmanson and Griffin 1974:57; Lewis and Kneberg 1946:125; Polhemus 1987:1033; Webb and Dejarnette 1948:56). Bone and antler beads are small sections of bone and antler that have been either drilled out or cleaned out and the end ground flat. Bone beads are often made of bird bone which is naturally hollow and requires little modification. Specimen g in Figure IV - 1 and c in Figure IV - 7 were the only specimens found at Widows Creek. No bone tubes or rings were found in the Widows Creek assemblage.

In summary, **Category 3** items represent a small sample of objects. There is an observable difference in quantity between the EW and the MLW and LA periods. This difference relates most significantly to the quantity of category 2A items, specifically antler cylinder production.

Category 4: Beveled Implements

Category 4 contains 23 implements: 1 LA, 3 EW and 19 MLW. Specimen a in Figure IV - 1, specimen m in Figure IV - 2 and Figure IV - 8 show examples of these objects. Implements in this category have beveled working edges.

Category 4A consists of items with beveled surfaces on the anatomically longitudinal edges. These items are commonly called beamers in the literature (Parmalee et al. 1972:50, Figure 13; Prufer 1981:44). Beamers were usually modified whitetail deer or elk metatarsals with the longitudinal center area removed. This process leaves the two epiphyseal ends bridged by the ventral or dorsal bone surface. Specimen m in Figure IV - 2 and specimens a thru c in Figure IV - 8 are probably broken examples of this category. One complete specimen was recovered from Widows Creek but not photographed. Beamers were thought to have functioned as hide scrapers used in a drawing motion (Griffin 1966). Complete or identifiably complete beamers are rare or absent from the region. Some broken items may be present but they have been reworked into Category 3B items (Webb and Wilder 1951).

The Widows Creek assemblages only contained items of this category from the MLW and EW proveniences; most of these items were recovered from the MLW assemblage.

Category 4B items have a proximal or distal end with an acutely beveled edge and are commonly referred to in the literature as fleshers, gouges (Lafferty 1982:302; Webb and Dejarnette 1948:56), scrapers (Lewis and Kneberg 1946:125), and blunt-bitted or bitted awls (Faulkner and Graham 1966:103-104; Ingmanson and Griffin 1974:56-57). Examples of these are specimens d thru g in Figure IV - 8. Though appearing like a number of different types, these are only different names for the same object. Lewis and Kneberg (1946:125) interpret the function of these tools as scraping or gouging tools for hides or wood materials. Some of these implements may be broken and then reworked Category 4A implements.

These items were recovered only in EW and MLW proveniences at Widows Creek; they made up the largest portion of the MLW assemblage within Category 4.

Category 4C specimens are miscellaneous beveled edge fragments. An example of this object is specimen a in Figure IV - 8. In the Widows Creek assemblages fragmented beveled edges were recovered from the LA and MLW but not in EW contexts.

In summary, **Category 4** items represent a small but possibly significant sample of material. The presence of category 4A items in the MLW and EW period seems unique or rare for the region.

Category 5: Unassigned

Category 5 specimens were those specimens that were considered some form of a complete specimen but were not necessarily considered implements. Subsequently, the byproduct/discard material was assigned to this category. This material does constitute significant portions of the assemblages.

Category 6: Indeterminate

Category 6 specimens were those specimens that were incomplete or too fragmented to assign to a morphological class. In all three assemblages this constitutes a large portion of the assemblages. Many of these fragments are probably portions of broken tools but have become too fragmented to classify.

THE WIDOWS CREEK ASSEMBLAGES SUMMARY

A comparison of the three assemblages shows several differences that have implications for activities occurring at the site and the overall site function. The raw materials used during all three cultural periods was fairly similar, with most differences being in the proportions of the different whitetail deer elements utilized. In this case, the marked increase was in whitetail deer metapodial utilization during the MLW period. Manufacturing traces or techniques utilized at the site are present in all the time periods. However, their frequency of use does change, implying that carving and incising are used more in the MLW than the other periods. The manufacturing stage classification brings out the most implications for site function and tool production. The manufacturing stage data imply that more tools were being made and then removed from the site during the LA period. A reverse trend is apparent during the EW period. The MLW assemblage shows that tools are being made and deposited at the site or nearby, due to the fairly equal portions of completed tools and manufacturing byproduct/debris. Also, a couple of specific industries are concentrated on at this time; these include metapodial production into bipointed objects, fishhook production, and antler cylindrical objects. The morphological categories show that all the components have large portions of manufactured pointed implements. The presence of bipointed implements in the MLW assemblage shows an increase over the other components. The presence of the antler cylindrical implement (Category 3A) and the longitudinally beveled implements also separates the MLW modified bone objects from the other assemblages

Overall, there appears to be a change from a general use of the site during the LA and EW periods to focused use of the site during the MLW. This statement is based not on presumed tool functions, but differences in the assemblages based on manufacturing activities. The concentration on the manufacture of specific objects, in quantity, during the MLW suggest that the site is being used for more specific activities than during the preceding cultural periods. The general use of the site during the LA and EW is different in that the LA groups seem to gear up at the site with modified bone items, while EW groups seem to be bringing them in from elsewhere.

RUSSELL CAVE VS. WESTMORELAND-BARBER VS. WIDOWS CREEK

Comparison of the Widows Creek assemblages to other regional assemblages may show interesting relationships and elicit information on the function of the Widows Creek site during certain occupations. Although limited to comparisons of modified bone quantity and morphological group, there is still value in making these comparisons.

Comparison of Recovery

Although assumption ridden, the simplest comparison is to examine the quantity of modified bone per component per site. Table V - 7 shows both the count data and percentage data for each of the three components at their respective sites.

One thing that stands out about the data in Table V - 7 is the paucity of MLW material at Westmoreland-Barber compared to Widows Creek. Submitting the data to a

Table V - 7. Comparison by count and frequency of modified bone from LA, EW, and MLW components of Russell Cave (RC), Westmoreland-Barber (WB), and Widows Creek (WC).

	Component			
Site	LA	EW	MLW	Total
RC	49 (37 %)	30 (23 %)	53 (40 %)	132 (100 %)
WB	30 (15 %)	107 (52 %)	68 (33%)	205 (100 %)
WC	38 (7 %)	122 (22%)	402 (71 %)	562 (100 %)

chi square test, a value significant at a = .05 ($p<.001$) is achieved with a Cramer's *V* value ($V = .310$). The Cramer's *V* value indicates that although the p-value is significant, this may be due to sample size differences. Russell Cave shows a moderate amount of modified bone from all culture periods. However, it also shows a decrease in modified bone in the EW period and has the highest frequency of LA period modified bone of all three sites.

There are some distinct differences between the amount of modified bone recovered at these sites. One reason for these differences is the variable recovery methods. At Widows Creek, material was recovered by waterscreening of the control columns and features through .635 cm (.25 in.) and .025 cm (.0625 in.) hardware cloth and trowel sorting the general level material. These techniques allowed for the recovery of many small fragments that would not have been recovered through regular dry screen or trowel sorting. At Westmoreland-Barber, material was recovered through trowel sorting and sample flotation of the soil matrix. From discussions in the 1966 report it is unclear what sampling strategy was applied, but floatation is the reason the small bone tools from Feature 50 were recovered (Faulkner and Graham 1966;18,19,100-101). This discussion implies that the sample size difference between Widows Creek and Westmoreland-Barber may be due in part to recovery differences.

Differences between Widows Creek and Russell Cave material recovery may be more problematic. At Russell Cave soil matrix was first dry-screened through .635 cm (.25 in.) hardware cloth, but as the soil became wetter and more plastic the material was then waterscreened through .635 cm (.25 in.) hardware cloth. This implies that the material recovery from Widows Creek and Russell Cave is similar. However, a difference may be the loss of material from Russell Cave smaller than .635 cm. At Widows Creek the waterscreening through the .635 cm and .025 cm hardware cloth did obtain a smaller class of material than probably obtained at Russell Cave.

To create a more equable comparison of materials among the sites, the Widows Creek indeterminate morphological material can be withdrawn and then sample sizes compared. This indeterminate material was often small and fragmentary and probably consists of material that under conditions of dry screening or trowel sorting would be lost.

Table V - 8 shows the modified counts for Widows Creek as compared to the other two sites. Submitting the data to a chi square test a value significant at a = .05 (p<.001) is achieved with a Cramer's V value (V = .354). The Cramer's V value still indicates, that although the p-value is significant, this may be due to sample size differences. Observationally, Widows Creek still has a larger quantity of MLW material than Westmoreland-Barber or Russell Cave. Westmoreland-Barber now has more EW material than Russell Cave or Widows Creek. Russell Cave is still ranked highest in LA material.

From these data it can be inferred that there are differences in site function among the three sites during the various cultural periods. These differences probably relate to settlement patterns. The difference in the distribution of MLW and EW materials between Westmoreland-Barber and Widows Creek is probably related to variable uses of these sites in their respective settlement systems. This difference is interesting because of the similar geography and topography of these sites.

Table V - 8. Comparison by count and frequency of modified bone from LA, EW, and MLW components of Russell Cave (RC), Westmoreland-Barber (WB), and Widows Creek (WC). Modified bone in the indeterminate morphological category has been removed from the the Widows Creek assemblage.

	Component			
Site	LA	EW	MLW	Total
RC	49 (37 %)	30 (23 %)	53 (40 %)	132 (100 %)
WB	30 (15 %)	107 (52 %)	68 (33%)	205 (100 %)
WC	22 (7 %)	53 (16 %)	251 (71 %)	326 (100 %)

The increase in the LA material at Russell Cave compared to Westmoreland-Barber and Widows Creek may represent two phenomena, the first being more frequent reoccupation by LA cultures. The second may actually be due to differential recovery within the Russell Cave excavations. It is not clear from the report at which point in the excavations (stratigraphically) waterscreening was initiated. There might be a more pronounced difference in the MLW material recovery and LA material recovery if waterscreening had been used initially.

Comparison of LA Morphological Categories among the Sites

Table V - 9 shows the different morphological classes from the three sites. Proportionately, the three LA assemblages are very different. Overall, the Russell Cave assemblage shows the greatest diversity of whole classifiable implements. The Russell Cave assemblage is also heavily dominated by category 1A implements, at 76 percent. The Westmoreland-Barber site exhibits the greatest difference with only three tool categories represented. Like Russell Cave, the assemblage is dominated by category 1A. Widows Creek is similar to Russell Cave in the diversity of categories of classified materials. However, Widows Creek does not exhibit the skewed distribution towards category 1A items, seen at Russell Cave. Interestingly, the Russell Cave assemblage does not contain many items in the unassigned and indeterminate categories, for any time period. In comparison, the Westmoreland-Barber assemblage has a sizable portion of the assemblage assigned to these groups.

Table V - 9. Comparison of the LA assemblages of modified bone classified morphologically from Widows Creek (WC), Westmoreland-Barber (WB), and Russell Cave (RC).

Morphological Category	WC Count	WC Percent	WB Count	WB Percent	RC Count	RC Percent
1A. Manufactured Point - Straight	3	8	8	27	37	76
1B. Manufactured Point - Curved	0	0	0	0	0	0
1C. Manufactured Point - Tip Only	0	0	1	3	0	0
1D. Manufactured Point - Bipointed	0	0	0	0	0	0
2A. Non-manufactured Point - Antler	1	3	0	0	3	6
2B. Non-manufactured Point - Antler Tips	0	0	1	3	0	0
2C. Non-manufactured Point - Canines	0	0	0	0	1	2
3A. Cylindrical - Closed Channel	1	3	0	0	0	0
3B. Cylindrical - Open Channel	1	3	0	0	3	6
4A. Beveled - Longitudinally	0	0	0	0	0	0
4B. Beveled - Distal	0	0	0	0	3	6
4C. Beveled - Fragment	1	3	0	0	0	0
5. Unassigned	15	39	17	57	1	2
6. Indeterminate	16	42	3	10	1	2
7. Bowl	0	0	0	0	0	0
Total	38	101	30	100	49	100

Differences between the sites in actual morphological categories consist of an absence of beveled and cylindrical objects from Westmoreland-Barber. Russell Cave exhibits the greatest number of beveled distal end implements, absent at Westmoreland-Barber and Widows Creek.

The LA assemblages show a pattern that suggests that bone implements of a variety of types were important for a number of tasks at Russell Cave, more so than Westmoreland-Barber and somewhat more so than at Widows Creek. If the distribution of materials in the unassigned category is representative across the three sites, then it implies that bone implement manufacture was more prominent at Westmoreland-Barber and Widows Creek than at Russell Cave. Possibly tools were manufactured at these lowland sites and transported for use at the upland location at Russell Cave.

Comparison of EW Morphological Categories among the Sites

Table V - 10 shows the different morphological classes from the three sites for EW period. Overall, Russell Cave has the most dissimilar assemblage of the three. Russell Cave has the smallest assemblage of the three sites and is dominated by category 1A implements and has very little unassigned and indeterminate material. In contrast, the Widows Creek and Westmoreland-Barber EW assemblages are fairly similar in both quantity and distribution of materials.

The Widows Creek and Westmoreland-Barber assemblages have similar amounts of categories 1, 2, and 3. However, Category 4, beveled edge implements, is absent from Westmoreland-Barber. One interesting difference between these two sites is the large

Table V - 10. Comparison of the EW assemblages of modified bone classified morphologically from Widows Creek (WC), Westmoreland-Barber (WB), and Russell Cave (RC).

Morphological Category	WC Count	WC Percent	WB Count	WB Percent	RC Count	RC Percent
1A. Manufactured Point - Straight	7	6	9	8	16	53
1B. Manufactured Point - Curved	0	0	1	1	1	3
1C. Manufactured Point - Tip Only	13	11	11	10	0	0
1D. Manufactured Point - Bipointed	1	1	1	1	3	10
2A. Non-manufactured Point - Antler	4	3	0	0	2	7
2B. Non-manufactured Point - Antler Tips	6	5	4	4	0	0
2C. Non-manufactured Point - Canines	1	1	1	1	6	20
3A. Cylindrical - Closed Channel	1	1	3	3	1	3
3B. Cylindrical - Open Channel	0	0	0	0	0	0
4A. Beveled - Longitudinally	1	1	0	0	0	0
4B. Beveled - Distal	2	2	0	0	0	0
4C. Beveled - Fragment	0	0	0	0	0	0
5. Unassigned	17	14	74	69	1	3
6. Indeterminate	69	56	3	3	0	0
7. Bowl	0	0	0	0	0	0
Total	122	101	107	100	30	99

percentage of the material categorized as unassigned when compared to Widows Creek. Even if some of the material was reassigned to Category 6, Westmoreland-Barber would still have more of this material than Widows Creek.

Category 1 shows that the Russell Cave assemblage consists of mostly implements in category 1A with some in 1B and 1D but none in 1C. At Westmoreland-Barber and Widows Creek Category 1 implements consist of mostly 1C, followed in rank by 1A. Westmoreland-Barber has one implement in Category 1B (fishhooks), with none present in the Widows Creek EW assemblage.

In Category 2 it is interesting to note that the Widows Creek assemblage has specimens in all three categories while Westmoreland-Barber has only tips (2B) and teeth (2C). Russell Cave only has specimens in category 2B and 2C. The modified teeth at Russell Cave are attributed to six woodchuck (*Marmota monax)* teeth; estimated to have been from one necklace (Ingmanson and Griffin 1974:57).

Category 3 has limited amounts of material in all three assemblages. In each assemblage only closed channel cylindrical specimens are represented.

Category 4 is interesting because specimens are found only at the Widows Creek site during the EW. The Widows Creek material includes one longitudinally beveled and two distally beveled implements.

The EW assemblages show a pattern that suggests three different uses for the sites. Russell Cave data suggest that activities centered around pointed implements, both manufactured and non-manufactured. The assemblages at Widows Creek and Westmoreland-Barber suggest a broader base of activities occurred at these sites.

Differences between the Widows Creek and Westmoreland-Barber assemblages include the absence of Category 4 implements and the increase in unassigned (probably byproduct/discard) at Westmoreland-Barber.

Comparison of MLW Morphological Categories among the Sites

Table V - 11 shows the distribution of specimens among the morphological categories for the three sites. As expected from the sample size differences, Widows Creek exhibits the greatest diversity of assigned specimens. Interestingly, Russell Cave exhibits a greater diversity of categorized specimens than does Westmoreland-Barber.

Examining the morphological categories among sites, some patterns emerge. Overall, both the Russell Cave assemblage and the Widows Creek assemblage are dominated by pointed specimens, but include some cylindrical and beveled specimens. The Westmoreland-Barber assemblage differs because it consists largely of pointed specimens and the turtle shell bowl, but no cylindrical or beveled specimens.

The distribution of items in these general categories also exhibits some interesting patterns. In Category 1, despite the differences in assemblage size, Russell Cave contains more 1A specimens than Widows Creek. However, at Widows Creek by the amount of material found in Categories 1B, 1C, and 1D is very high compared to Russell Cave. In fact, the broken tip category at Widows Creek contains more than Category 1A. The Westmoreland-Barber Category 1 assemblage compares better to the Widows Creek assemblage, because of the presence of the broken tips. Category 1B is of interest because it represents fishhooks that are only present at Widows Creek.

Table V - 11. Comparison of the MLW assemblages of modified bone classified morphologically from Widows Creek (WC), Westmoreland-Barber (WB), and Russell Cave (RC).

Morphological Category	WC Count	WC Percent	WB Count	WB Percent	RC Count	RC Percent
1A. Manufactured Point - Straight	29	7	6	9	34	64
1B. Manufactured Point - Curved	3	1	0	0	0	0
1C. Manufactured Point - Tip Only	34	8	2	3	0	0
1D. Manufactured Point - Bipointed	11	3	1	1	2	4
2A. Non-manufactured Point - Antler	2	1	1	1	2	4
2B. Non-manufactured Point - Antler Tips	9	2	3	4	1	2
2C. Non-manufactured Point - Canines	1	0	0	0	1	2
3A. Cylindrical - Closed Channel	16	4	0	0	5	9
3B. Cylindrical - Open Channel	1	0	0	0	0	0
4A. Beveled - Longitudinally	6	1	0	0	0	0
4B. Beveled - Distal	10	2	0	0	2	4
4C. Beveled - Fragment	3	1	0	0	0	0
5. Unassigned	126	31	48	71	3	6
6. Indeterminate	151	40	6	9	3	6
7. Bowl	0	0	1	1	0	0
Total	402	101	68	99	53	101

The absence of Category 1B items from Westmoreland-Barber seems surprising because of its location on the river. However, the real difference in this category is not the absence of fishhooks, but the absence of the bifurcated discard found in quantity at Widows Creek. Examining both the text description and photographic plates from the 1965 and 1966 Westmoreland-Barber reports, no mention of this kind of modified bone is present. It is also apparent from Figure IV - 3 that this discard is not necessarily so small or unrecognizable as to have not been recovered. This absence implies that the activities associated with fishhooks were not practiced in a similar way at Widows Creek or were not done at Westmoreland-Barber, implying a difference in site function.

Category 1D is also underrepresented at Westmoreland-Barber compared to Widows Creek. The bipointed specimens are more numerous at Russell Cave than at Westmoreland-Barber. The large quantity of manufacturing debris at Widows Creek, compared to the paucity these materials at Westmoreland-Barber and Russell Cave, implies specialized production and associated activities at the site.

In Category 2 the assemblages are fairly similar. The main difference among the assemblages is the dominance of completed antler specimens at Russell Cave compared to Widows Creek and Westmoreland-Barber. At Widows Creek and Westmoreland-Barber, Category 2 was dominated by broken antler tips.

In Category 3, the major difference is the absence of specimens assigned to this category at Westmoreland-Barber. Both Widows Creek and Russell Cave have specimens assigned to this category. In both cases, closed channel cylindrical objects constitute most of the category. Only at Widows Creek was an open channel cylindrical specimen recovered.

Patterns in Category 4 implements show differences among the three sites. Again, the assemblage from Westmoreland-Barber is different because of the absence of materials in this category. Russell Cave proportionately has the same amount of material as Widows Creek but is not represented by the same diversity within the category. At Widows Creek the presence of the longitudinally beveled specimens (beamers) is unique to the region. Not only are these specimens not found at Westmoreland-Barber or Russell Cave, but a review of other sites in the Guntersville Basin shows that they are absent in other assemblages (Futato 1977; Webb and Dejarnette 1948; Webb and Wilder 1951). The Russell Cave specimens are limited to distally beveled specimens.

Category 5 is more problematical. It has not been discussed in the LA or EW sections very thoroughly because of the absence of these artifacts at Russell Cave. The assignment of specimens to this category at Westmoreland-Barber is based on the description of the specimens. The descriptions implied that a number of them were byproduct or discard. However, at Russell Cave very few of the specimens described fit into this category. Only 10 specimens total for the whole site fit in this category. This implies that bone tool manufacture was not often done at Russell Cave or that tools were brought into the cave. This would be true of all time periods.

Category 7 is only found at Westmoreland-Barber during the MLW and is represented by a turtle shell bowl. Some of the modified turtle shell at Widows Creek could represent parts of bowls but they are too fragmented to classify.

The patterns emerging from the distribution of MLW specimens show a pattern of differential site functions. The Widows Creek site has both quantities of certain categories of implements or discard that seem to represent specialized or specific kinds of activities. These specialized activities are related to the fashioning of fishhooks, bipointed objects, and longitudinally beveled specimens. Of these categories only the bipointed specimens and their associated byproducts are found in any quantity at Westmoreland-Barber (see Faulkner and Graham 1966, Plate XXVII for an illustration of metapodial byproducts). Some bipointed specimens are found at Russell Cave but no associated byproducts. The Westmoreland-Barber site has a different distribution of materials than Widows Creek, implying that the site functioned differently in the settlement system. Russell Cave represents a different kind of site based on the amount of whole specimens and paucity of manufacturing byproducts.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This thesis is an analysis of a previously unreported assemblage of modified bone and how it relates to other assemblages in the Guntersville Basin. To accomplish this task a framework and methodology for analysis was developed to approach modified bone from a technological perspective.

Chaine operatoire and organization of technology were presented as two technological frameworks that can be applied to a modified bone assemblage. Archaeologists employ these approaches to flaked stone materials and attempt to infer cultural behavior. An organization of technology framework was applied to modified vertebrate remains fauna for several reasons. An organization of technology approach emphasizes the analysis of a culture's technological strategies, developed within its social, economic, and environmental setting. Archaeologists hope to determine how technological changes can reveal changes in other behavioral aspects of culture. A study of technological organization can concentrate on one or several levels of analysis as shown in figure II - 1. This study examined the level of activity distribution both diachronically and synchronically. At this level, patterns of bone modification are used to make inferences about prehistoric settlement systems and lifeways.

THE WIDOWS CREEK MODIFIED VERTEBRATE FAUNA

The raw materials utilized for the LA, EW, and MLW groups at Widows Creek are very similar through time (Figure VI - 1). In all periods the raw material categories are dominated by miscellaneous mammals. Deer bone, antler, bird bone, turtle shell, and indeterminate pieces follow in decreasing numbers. The only exception is the slightly increased use of bird bone over antler during the MLW.

Because of the large quantity of identifiable deer bone, element choice was also examined. Figure VI - 2 shows the frequency of elements utilized, excluding antler. In all periods, antler was modified most frequently, followed by the metatarsal. In the case of the MLW this is followed in rank order by a large quantity of indeterminate metapodial specimens. The ulna is the third most modified element in LA and EW, and it is ranked fourth in the MLW. Patterns of raw material choice are very similar for all time periods.

Patterns of modification show some similarities and differences among the three assemblages. Overall, traces of both grinding/smoothing with stone and carving/incising with flaked stone tools are the most common patterns found on the modified bone regardless of time period. In the case of the LA and EW periods, grinding/smoothing

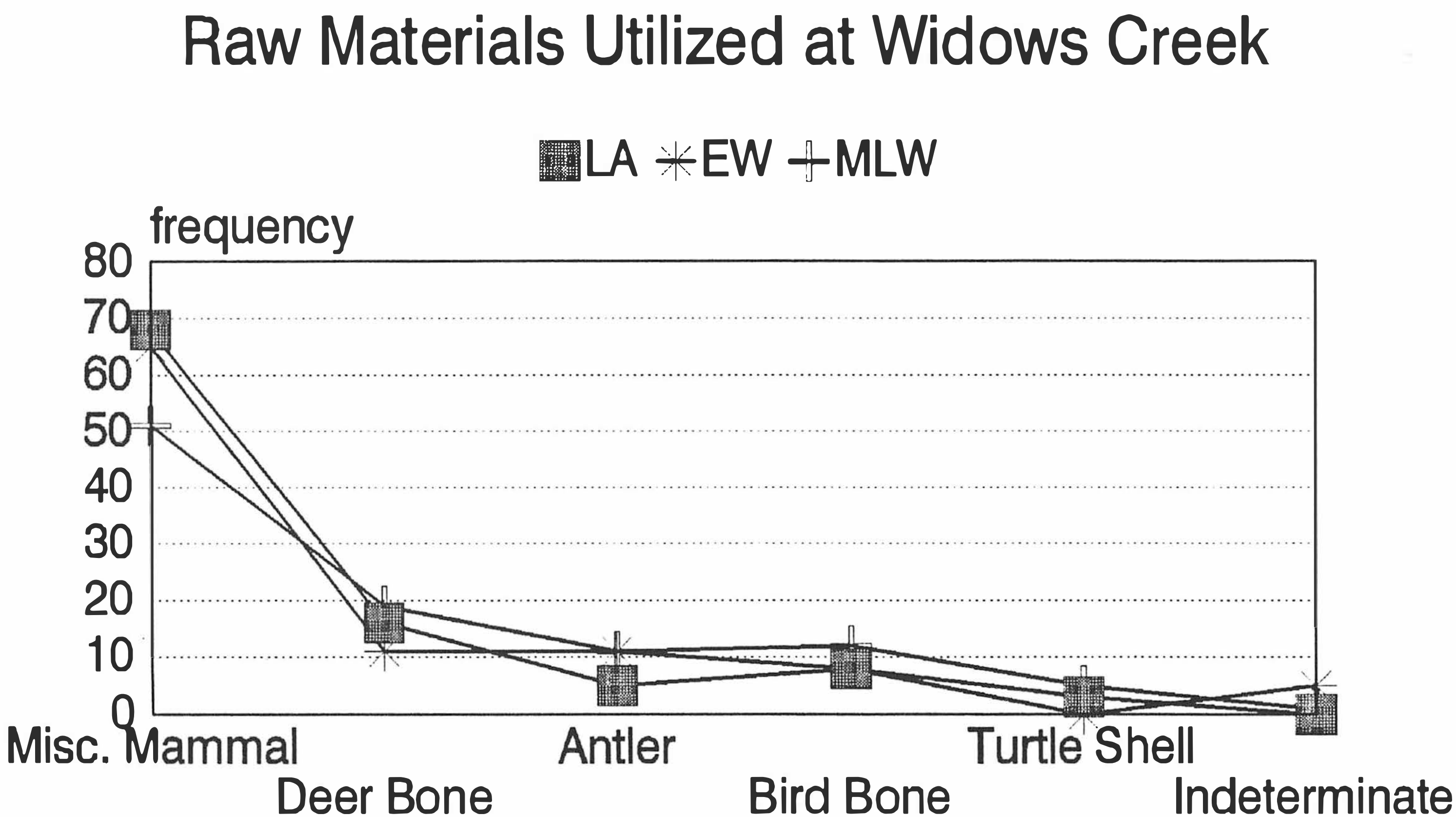

Figure VI - 1. Comparison of the raw materials utilized during the LA, EW, and MLW occupations of the Widows Creek Site.

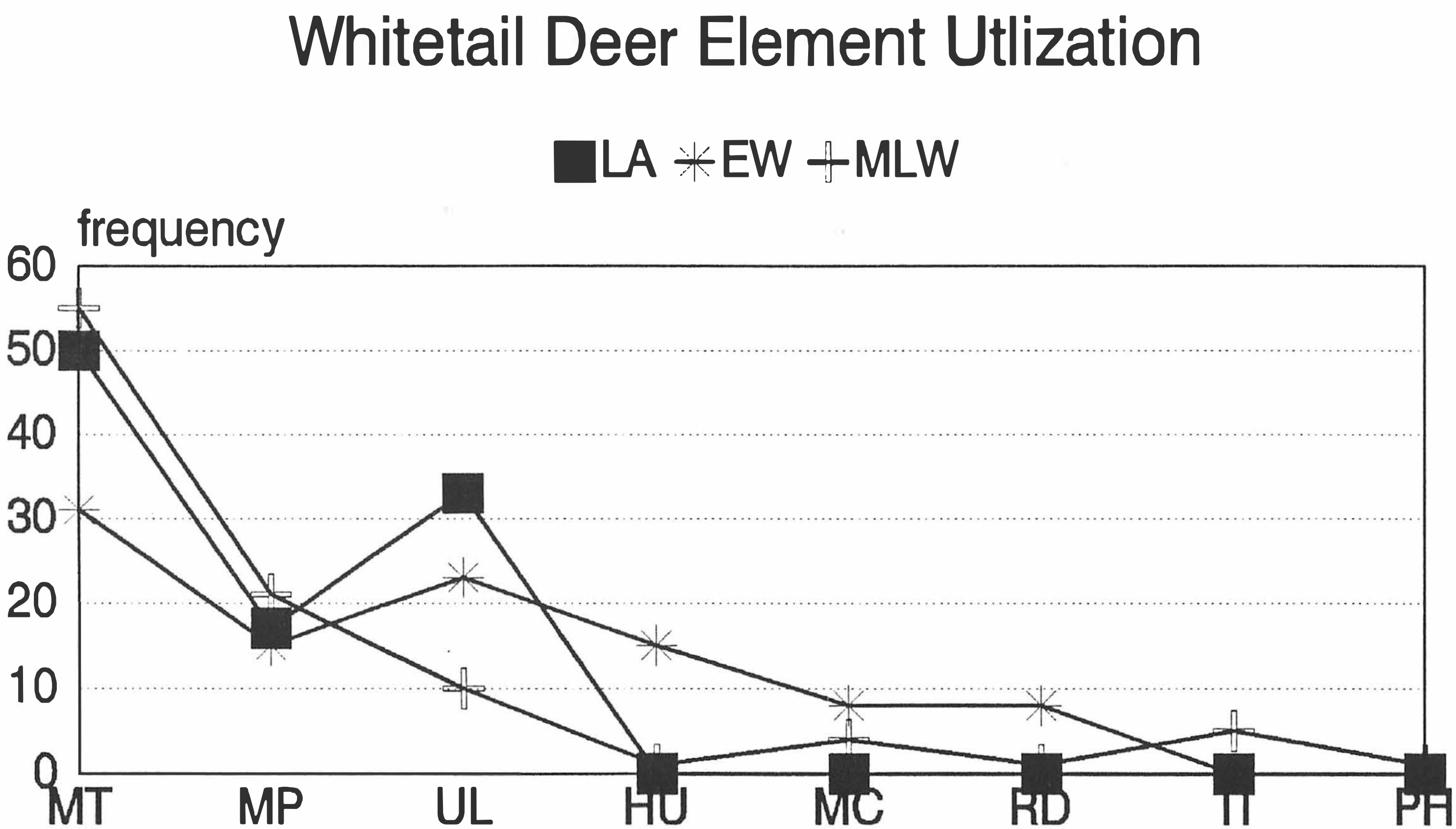

Figure VI - 2. Comparison of the frequencies of whitetail deer elements utilized during the LA, EW, and MLW occupations of the Widows Creek site. X axis labels are: MT - metatarsal, MP - Metapodial, UL - Ulna, HU - Humerus MC - Metacarpal, RD - Radius, TI - Tibia, and PH Phalange.

dominates but in the MLW carving/incising dominates. Another interesting pattern is the high occurrence of percussion flaking on metapodial specimens during the MLW period.

The manufacturing stage data present some of the most interesting information of the study. Using previously published data, and building intuitively from the data, a series of manufacturing stages was defined and material classified. The first interesting pattern is the difference in frequency of completed items to manufacturing byproduct/discard (Figure VI - 3). The LA assemblage has a low frequency of completed implements and high frequency of byproduct/discard. The EW exhibits a low proportion of byproduct/discard compared to completed implements. The MLW period has almost equal proportions of completed implements and byproduct/discard. These patterns suggest that the site function, in terms of manufacture and use, is changing through time. During the LA more tools are being discarded or lost offsite. In contrast, the EW pattern suggests that most of the tool production is occurring offsite and completed implements are brought onsite. The MLW pattern suggests that tools are being made and used onsite, with a high probability of being deposited onsite.

Examining specific classes of byproduct/discard suggest several patterns. It is clear that prehistoric inhabitants manufactured fishhooks during all three periods and in relatively large quantity during the MLW. An estimate of fishhook size can be taken by measuring the breadth of the bifurcated discard. The MLW period sample is represented by a bimodal distribution (Figure VI - 4), possibly reflecting two general fishhook sizes for

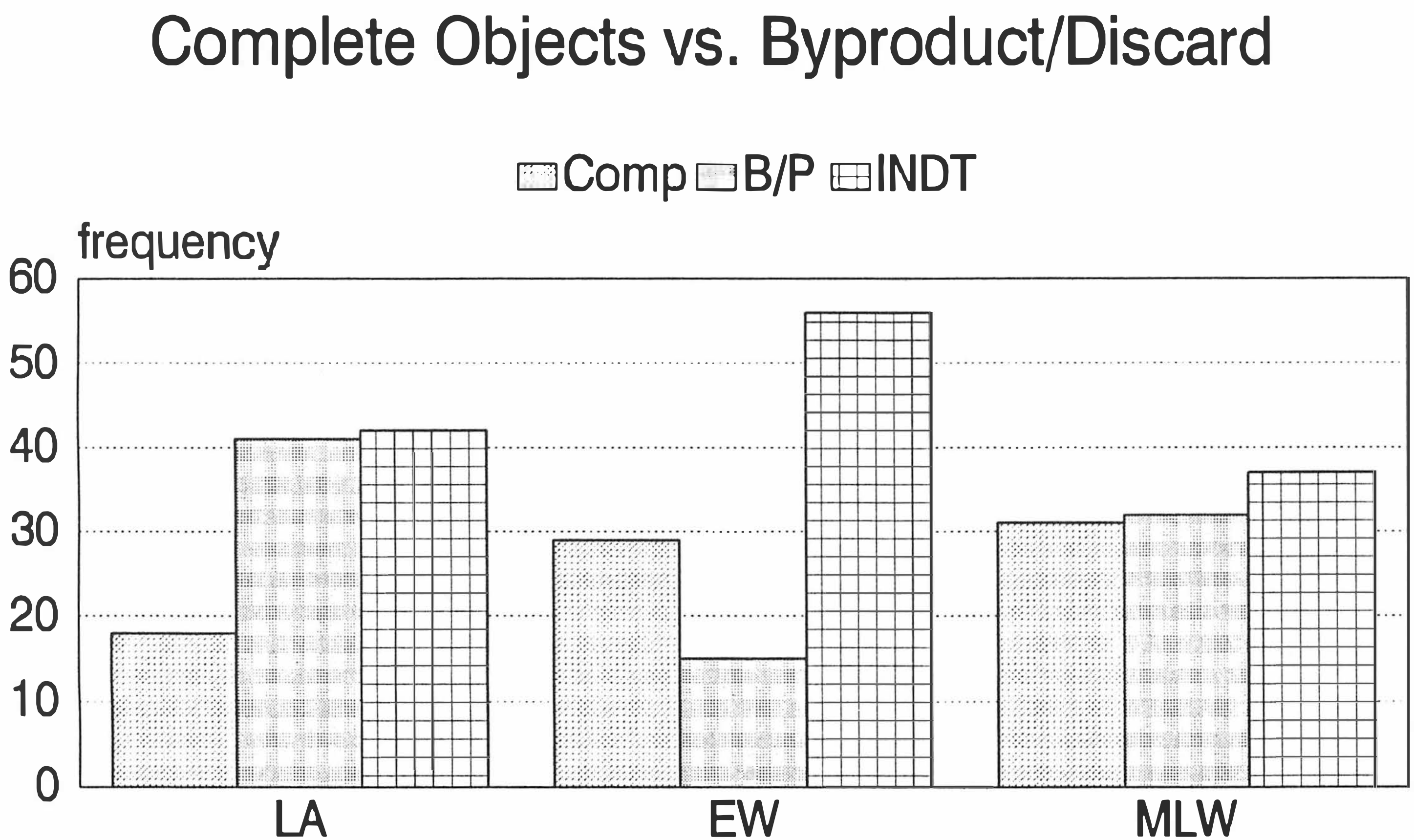

Figure VI - 3. Comparison of the frequency of complete objects, byproduct discar, and indeterminate objects from the LA, EW, and MLW occupations of the Widows Creek site.

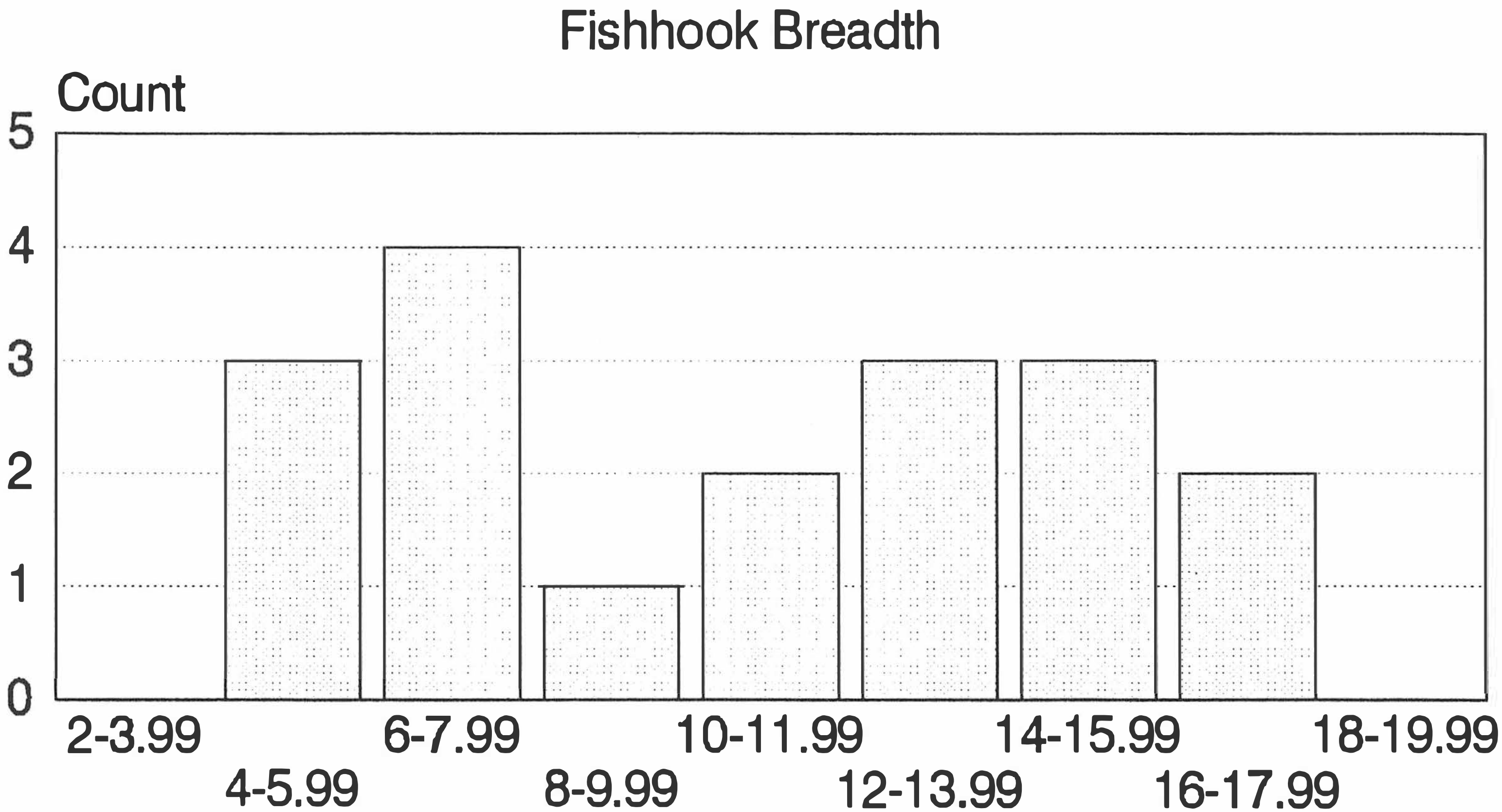

Figure VI - 4. Number of fishhook discard specimens in 2 mm breadth measurement groups from the MLW occupations at Widows Creek.

different fish or fishing activities. This information is significant considering only a single complete fishhook was recovered. The large quantity of manufacturing discard indicates that these items were made at the site and then taken offsite for use.

Metapodial manufacturing debitage products are present during all three time periods, occurring in large quantity during the MLW period. This material represents patterned steps of metapodial modification leading to a specific endproduct, probably bipointed specimens. The metapodial, more often the metatarsal, was quartered longitudinally, leaving four long blanks or preforms to carve or grind down into pointed or bipointed specimens. The quantity of this material during the MLW period suggests concentrated production of these items for a specific task.

Items that were considered complete or identifiable portions of complete objects were classified into morphological classes. Overall, similar kinds of tools are found in all three components; including pointed, cylindrical, and beveled edge objects. Also, in each time period pointed tools, either manufactured point or non-manufactured point objects dominate. One difference between the LA and other periods is the absence of broken tips, both manufactured and non-manufactured. This reinforces the inference that tools were manufactured on the site and removed for use elsewhere.

The diversity of categories increases from the LA to MLW periods. Items occurring in increasing frequency through time include bipointed implements (1D), longitudinally beveled (4A) and distally beveled implements (4B).

Comparison of Widows Creek assemblages suggests different activities occur at the site in terms of tool manufacture and tool use either on or offsite. The MLW assemblage suggests an intensification of bone tool manufacture into a variety of forms, but emphasis on intense production of some forms. This emphasis on certain tool forms is indicated not only through the presence of complete tools but also the manufacturing byproducts and discard from their related manufacturing sequences. These differences in the assemblages stand in contrast to the similarity in raw material choices both at general level and whitetail deer element preference.

THE WIDOWS CREEK SITE IN A REGIONAL PERSPECTIVE

Comparisons of the Widows Creek assemblages to those at Westmoreland-Barber and Russell Cave suggest that these sites serve differing roles in the settlement system. In terms of quantity of material MLW materials are greatest at Widows Creek, EW materials are greatest at Westmoreland-Barber, and LA material greatest at Russell Cave. The LA period is the closest of the three periods to having an even distribution of modified bone among the three sites.

Examining the distribution of items in the morphological categories shows differences among the assemblages. The LA assemblages exhibit some differences related to the distribution of classes within categories. Russell Cave has the largest assemblage of LA material. It is heavily dominated by Category 1A (straight manufactured point items) specimens with some specimens in Category 2 (non-manufactured point objects), 3 (cylinder items), 4 (beveled edge items), and 5 (unassigned). Westmoreland-Barber is largely dominated by Category 5 (unassigned) material, followed by Category 1 (manufactured point) and 2 (non-manufactured) specimens. The Westmoreland-Barber assemblage does not contain Category 3 (cylindrical) or Category 4 (beveled edge) specimens. The LA assemblage from Widows Creek represents a mix of the two other assemblages with a large amount of Category 5 (unassigned) material, a moderate amount of Category 1 (manufactured point) and an even distribution among Categories 2 (non-manufactured point), 3 (cylindrical), and 4(beveled edge). The paucity of unassigned or debris material at Russell Cave implies that tools were transported into the cave to use or at least manufactured outside the cave boundaries. The LA material suggests that modified bone implements were important in upland locations although their manufacture may have been accomplished at riverine locations like Westmoreland-Barber or Widows Creek. Westmoreland-Barber has a smaller variety of tool forms than Widows Creek, implying differences in their respective site functions in the settlement system.

The EW assemblages exhibit some patterns related to the distribution material within morphological categories. The Westmoreland-Barber assemblage has a greater quantity of material in Category 5 (unassigned) when compared to Widows Creek. This pattern implies that tool manufacture was occurring in higher frequency at Westmoreland-Barber than Widows Creek. Also, the classifiable tools at Widows Creek may represent items transported into the site. Widows Creek is the only EW assemblage containing Category 4 (beveled edge) specimens implying specialized activities at the site. Again Russell Cave exhibits low quantities of Category 5 (unassigned) specimens and a dominance of pointed specimens included manufactured point and non-manufactured point. Based on the distribution of materials among the morphological groups, the three sites have similar distributions among the categories but are very uneven within the categories. This unevenness represents different emphases in site function for tool use and tool manufacture.

The MLW period is represented by the largest assemblage of materials for any of the time periods. Subsequently, a number of patterns appear that relate to settlement systems. The Widows Creek assemblage is represented by the greatest number of morphological categories. The distribution of materials within these categories is uneven, indicating several specialized industries. These industries are represented by fishhook and metapodial debris. The Widows Creek assemblage is unique for the presence of longitudinally beveled specimens; a bone tool (beamer) type unique for the region as well. Westmoreland-Barber has few morphological categories; beveled specimens, cylindrical specimens and fishhook manufacturing discard are totally lacking. However, a turtle shell bowl was found only at the Westmoreland-Barber site. Russell Cave exhibits a greater diversity of morphological categories than Westmoreland-Barber, but has very few Category 5 (unassigned) specimens, thus suggesting offsite manufacture.

In the case of the MLW assemblage, it is interesting to compare these data to Walthall's (1980:134-135) model of Flint River culture (Late Woodland) settlement systems. Although Walthall's settlement model is strictly for Late Woodland occupations, and the data presented here are combined Middle and Late Woodland material, there is still comparative value in this exercise.

Walthall's model of Flint River settlement consists of four site types: summer-fall habitations, high ridges or cave camps in winter, temporary hunting camps, and a winter-spring base camps. Walthall characterizes Westmoreland-Barber as a summer-fall settlement. Considering differences in modified bone between Widows Creek and Westmoreland-Barber, Widows Creek appears to be a different kind of site in the settlement system. However, the winter-spring base camp is characterized as a small site, similar to the Cartwright site (1MS109) described by Webb and Wilder (1951:155). Based on the description and pictures of the Cartwright site, Widows Creek is even more dissimilar to this site type. The Widows Creek site either represents a new site type in the Flint River settlement system or a summer-fall settlement like Westmoreland-Barber that contained a larger aggregate group. The greater quantity of material and the concentrated manufacture of some of the tools imply a difference between the two riverine sites.

Lastly, Russell Cave is described by Walthall as a temporary hunting camp. The MLW modified bone assemblage supports this, at least partially, with the paucity of manufacturing debris in the cave. However, the distribution of the different morphological classes implies a wide range of activities, especially when compared to Westmoreland-Barber. Russell Cave may better represent an upland cave camp for a domestic family based on the greater diversity of tool forms.

Comparisons of modified bone among the Widows Creek, Westmoreland-Barber and Russell Cave sites show that the distribution of modified bone attributes through space and time can elicit information on prehistoric settlement systems and lifeways. This was accomplished by the analysis or description of the modified bone in a technological framework, in this case an organization of technology framework. The overview of the modified bone literature shows that most of the literature is fairly dichotomized. One side of the literature concentrates on specific portions or tool groups in an assemblage, often investigating implement function. The other side describes collections of bone artifacts using traditional typologies that are often inconsistent between regions or within regions, making comparisons difficult. Even in the Guntersville Basin (compare Curren et al. 1977; Faulkner and Graham 1966, and Ingmanson and Griffin 1974) some inconsistencies occur in implement classification. Also, a number of studies combine this with individual descriptions of tools that are lengthy and difficult to sort through if certain aspects of the tools need to be studied. This study attempts to move away from this dichotomy and find a middle of the road description that is also in a sense analytical.

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