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# INTERSITE ACTIVITY VARIABILITY IN LOOKOUT VALLEY AREA OF NORTHWEST GEORGIA

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Athens

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# CHAPTER I

# INTRODUCTION

## Problem Orientation

The use of lithic artifact data in the interpretation of activity variability has become an important part of archaeological research. If the research is conducted in a regional framework utilizing material dating to a defined period of prehistory, statements can be made concerning the nature of activity variability within the research area.

The Lookout Valley research project had as its original goal the investigation of the nature of activity variability in the Lookout Valley area of northwest Georgia during the Woodland Period (1000 B.C. - A.D. 1000). The discovery of several Woodland sites in the research area which were thought to be indicative of the range of activity variability in the region led to the formulation of a set of hypotheses concerning the nature of the intensity and diversity of activity among Woodland sites. Archaeological survey of the research area carried out during the summer of 1975 led to the location of over 50 prehistoric sites of which approximately 50 percent contained primarily Woodland artifacts. Most of the material collected during the survey was obtained from surface artifact scatters or small subsurface test excavations.

The end-product of the survey was the accumulation of a large quantity of flaked stone artifacts from sites distributed throughout the research area.

The research on which the results of the dissertation are founded is directed toward two primary goals: 1) the development of research techniques which can be utilized to identify, measure and analyze the nature of the variability of flaked stone tools and debitage at archaeological sites with respect to physiographic location, distance to chert resource areas, soil type on which a site is located, distance to water resources and other physical environmental variables; 2) the analysis of the diversity of intersite activity variability during a specific period of time to gain insight into the nature of cultural adaptation in the research area. Research has been directed toward the examination of the diversity of artifacts with respect to the above factors as well as the sources of that diversity at sites in the research area.

## Concepts and Assumptions

The concepts and assumptions used in this research project are partially based on research carried out in other parts of North America (SARG 1974, Struever 1968, Fish 1976b, Graybill 1973, Faulkner and McCollough 1973 and others). The following concepts are defined to add clarity and explicitness to the discussion of the problem of identifying and analyzing lithic artifact variability of sites in the research area.

## Model

Models have been described as pieces of machinery that relate observations to theoretical ideas. Models vary widely in the form of machinery they use, the class of observations focused on and the way in which the model relates the observations to the theory or hypotheses (Clarke 1972:1-2). Generally, models serve as organizational devices used in the manipulation of data; however, they may also be utilized as explanatory devices, normative devices, visualizing devices or devices for the construction and development of theory (Harvey 1969:141). Models are normally idealized representations of observations. They offer a particularly accurate predictive framework in a specified field of interest (Clarke 1972:2). In general, most philosophers of science cannot agree on a common definition of what a model is or how it is supposed to operate (Harvey 1969:147).

Models are important to archaeologists for several reasons. The archaeologist uses models as experimental analogies to which he compares archaeological data to test the "goodness of fit" between the two. If the model hypothesis fits the data, then the data fulfills the preconditions assumed in the model. If the model does not fit the data, the deviation is amplified, the model is altered and the data is retested. The process of model formulation and testing can be repeated in a continuous cycle (Clarke 1972:10-11).

Culture

The functions of cultures are to relate man to his environment. Culture may be thought of as an extrasomatic mechanism used by a specific animal species to make its life secure and continuous (White 1959:8). Culture can be interpreted as "a system of functionally interdependent parts in which change in one aspect is related in specifiable ways to changes in others" (Struever 1968:286). The material culture and the material by-products of living are related in a systematic way to the total culture. Binford has stated that culture has three major functional subclasses of material culture: technomic, socio-technic and ideo-technic. Technomic materials are those artifacts having a primary functional context in coping directly with the physical environment, socio-technic materials are associated with the social subsystem of the total culture and ideo-technic artifacts have their primary functional context in the ideological component of the social subsystem (Binford 1962:217-219).

Site

Site is defined as any location characterized by the deposition of the remains of human activity. Most settlement systems contain a number of different kinds of sites. A site is considered to be any locus of cultural material, artifacts or features (SARG 1974:110). Settlement systems contain various types of sites such as habitation sites and limited activity sites (Plog 1971).

There have been recent studies oriented toward the problem of detecting and explaining intra-site variability. Struever contends that there may be different types of activity areas within the site, each with a distinctive form based on co-occurring material cultural elements. Each activity area would be expected to have spatial extent. Activities tend to be localized and spatially segregated within the site. The analysis of the kind, number and distribution of material elements in the site may enable the analyst to isolate tool kits and activity areas. Sites which contain a particular configuration of exploitive and maintenance activities will contain a similar structure of material elements and be considered examples of a settlement type (Struever 1968:287).

## Settlement Pattern

Studies of prehistoric settlement patterns have been an ongoing concern for many archaeologists during the past 25 years. One of the first attempts to use settlement pattern data in archaeological research was by Gordon Willey in Prehistoric Settlement Patterns in the Viru Valley, Peru (1953) in which he defines settlement pattern as:

> "the way in which man disposed himself over the landscape on which he lived. It refers to dwellings, to their arrangement, and to the nature and disposition of other buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated, and the various institutions of social interaction and control which the culture maintained. Because settlement patterns are, to a large extent, directly shaped by widely held cultural needs, they offer a strategic starting point for the functional interpretation of archaeological cultures (Willey 1953:1).

Settlement System

A system is defined as a set of objects or components and the relationships between the components. The components in a settlement system are sites. The relationships between components in the system hold the system together. The relationships in a settlement system are those hypothetical kinds of interaction among population units occupying sites, based on the function of the component with respect to other components in the system. Attributes of the components are those variables determined to be critical in the location of the components of the system.

Subsistence System

Subsistence systems are defined as the actions relating to the procurement, processing and distribution of food resources. Man and the food resources are components of the subsistence system and are connected by subsistence oriented activities (Renfrew 1972:22).

Man has a very intense and active interaction with the physical environment through his search for food. Other cultural activities require the interaction of man and the environment, but these are more readily controlled by man and do not require the active participation with the ecosystem necessary in hunting, gathering or food production activities (Renfrew 1972:265).

Ideal Type

The terms "ideal type" and "diagnostic type" are used to describe those traditional lithic artifact types established using the normative or intuititive approach to lithic analysis. Projectile points with certain combinations of attributes have been found to commonly occur through time and over space and as a result have been labeled a type. Examples of these diagnostic types are Kirk, Morrow Mountain, Palmer and many others. The ideal or diagnostic type concept develops as a result of archaeologists referring to the most common or normal shape of a point (or any other artifact) as the "typical __________ point." This procedure leads to the exclusion of many projectile points from the "type" because they are not identical to the "typical" or "average" point shape. These variant points may represent the normal range of variation present in the manufacturing of the point, but are classified in a different category by the analyst. Non-objective classification of projectile points usually involves the comparison of a point to a variety of ideal point types, the point being placed in the group with the ones it most closely resembles (in the mind of the analyst). This practice ignores the great range of morphological variability that may exist as a result of time, space or cultural variation.

Cultural Adaptation

Cultural adaptation is the means by which man adjusts to changes in his physical or cultural environment to insure survival. The concept of cultural adaptation has been greatly influenced by work carried out by Julian A. Steward (1955). Steward viewed culture as a means of adapting to the nature of the environment and consisting of "core features" which are basic to the general structure of culture. Core features are largely associated with the technology and social structure of a society and develop in response to the adaptive requirements of a culture (Trigger 1971:326). Presumably, the range of artifact variability at sites within a research area will somewhat reflect the nature of a societies adaptation to the environment.

# CHAPTER II

# ENVIRONMENTAL SETTING

## Location and Topography

The Lookout Valley research area is located on the edge of the Appalachian Plateau in extreme northwestern Georgia (Figure 1). The Appalachian Plateau Provenience, which extends from Central Alabama north to southern New York State, contains a complex pattern of mountain ranges interspersed with narrow, isolated river valleys running in a northeast-southwest direction. The Lookout Valley research area is situated within one of these valleys in the Cumberland Plateau, a southern subdivision of the Appalachian Plateau (Fenneman 1938:338).

Lookout Valley, part of which is located in Dade County, Georgia, and part in Hamilton County, Tennessee, is an isolated valley, oriented northeast-southwest and is bordered on the east by Lookout Mountain and on the west by Sand Mountain (Figure 2). The valley is generally less than 5.0 kilometers in width. Lookout and Sand Mountains are actually parallel mountain ridge systems ranging in altitude from 460.0 to 640.0 meters above sea level. Lookout Mountain averages about 150.0 meters higher than Sand Mountain. The floor of Lookout Valley ranges in altitude from approximately 200.0 meters above sea

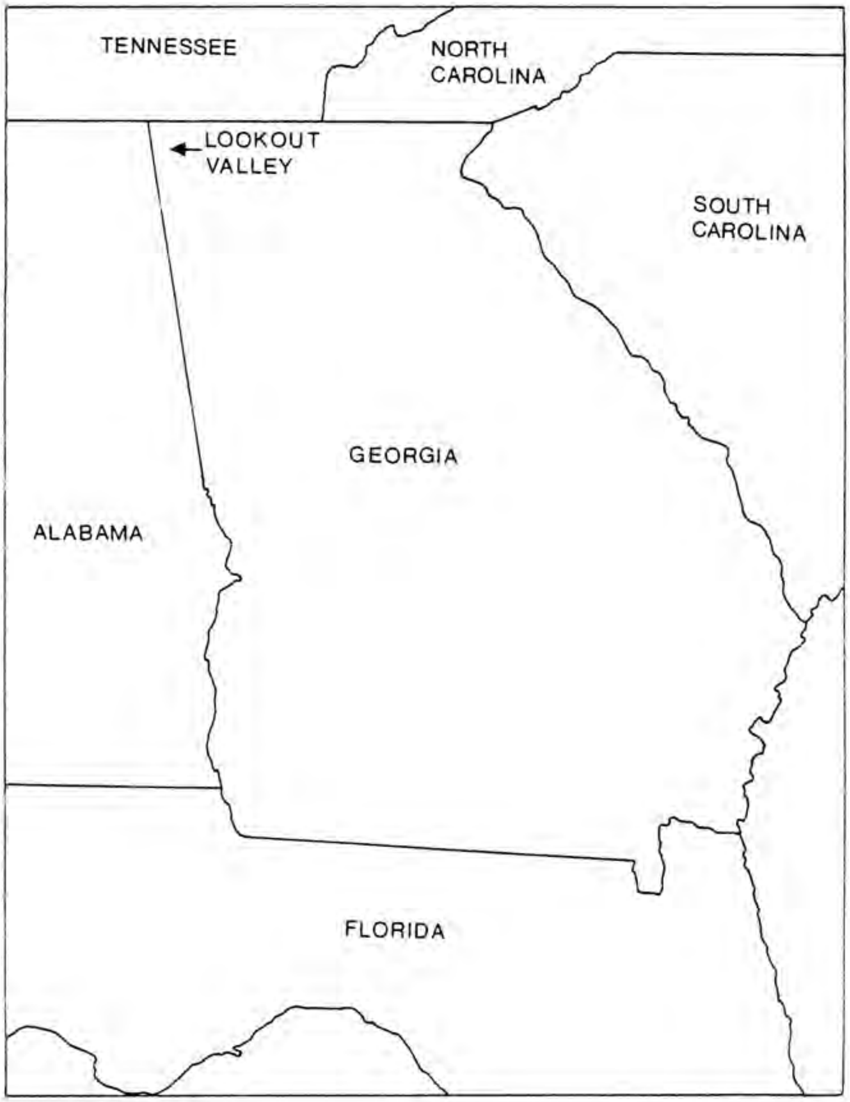


Figure 1. Location of the Lookout Valley Research Area.

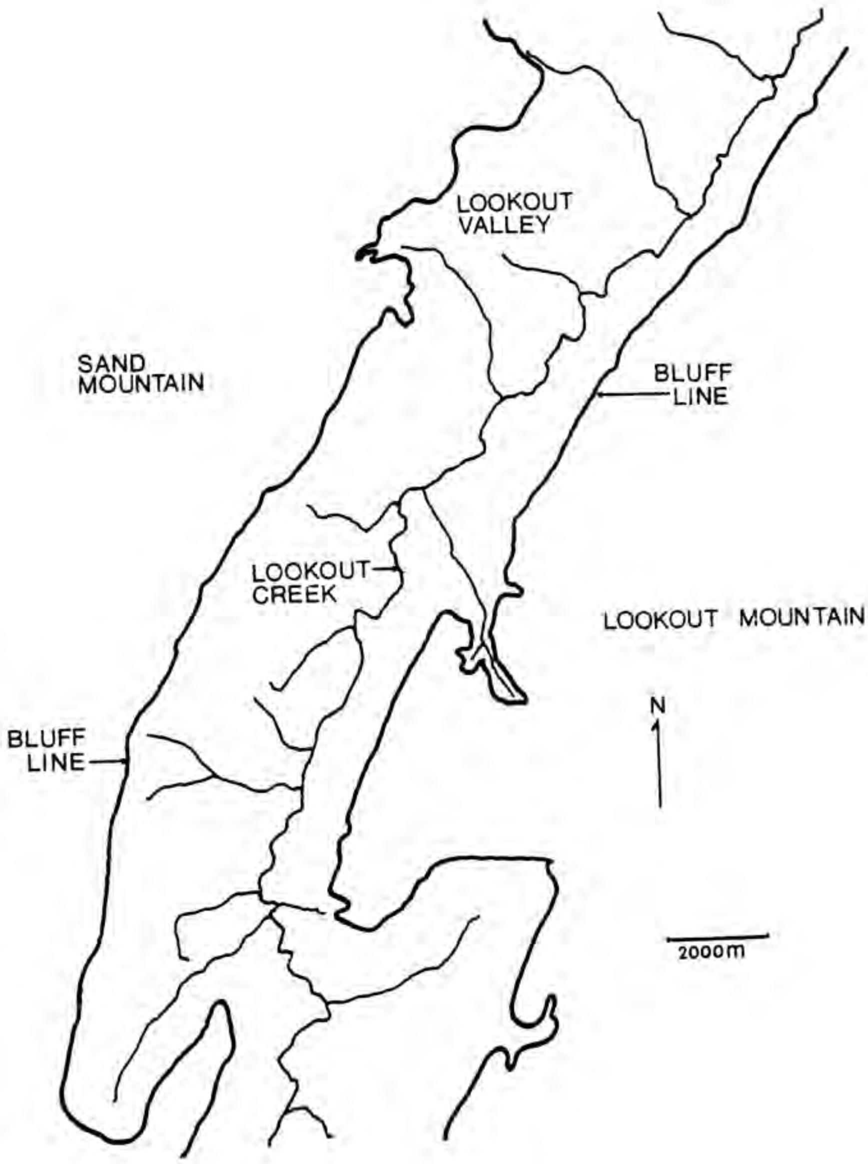


Figure 2. Major Physiographic Features in the Lookout Valley Research Area.

level where Lookout Creek crosses the Georgia-Tennessee border to 300.0 meters above sea level further southwest. The valley is bounded by very steep mountain slopes on both the east and west sides. A steep escarpment or bluff, often over 100.0 meters high, separates the mountain uplands from the slopes on the mountain side. The numerous chert ridges found throughout the valley average around 75.0 to 100.0 meters in elevation above the valley floor. These chert ridges are quite steep and narrow and are oriented northeast to southwest, parallelling the higher mountain ridge systems (Taylor, et. al. 1942:3).

The dramatic topographic relief of the area is the result of weathering and stream erosion acting on material with varying resistivity to erosional activities. Chert beds are highly resistant to such activities while the limestone and shale are less resistant. Limestone and chert formations are found below the valley floor along with small deposits of shale, sandstone and iron ore. The Fort Payne chert formation (Mississippian series) is the most extensively developed formation in the research area (Taylor, et. al. 1942:3-4).

Drainage of the eastern portion of Sand Mountain and the western side of Lookout Mountain flows into Lookout Creek. The creek is the only major drainage for this portion of the valley and flows northeast through the valley, eventually joining the Tennessee River near Chattanooga, Tennessee. There are few permanent streams in the mountains to either side of Lookout Valley, but many small intermittent streams exist that flow only during wet periods (Taylor, et. al. 1942:3-4). Streams on Lookout Mountain normally drain toward the interior of the plateau because of the upturned rim of sandstone located along the western edge of the mountain. Small semipermanent springs are found near some of the narrow gaps along the western edge of Lookout Mountain. The most numerous and most reliable sources of water in the research area are located on the valley floor (Sullivan 1942:5-8).

Vegetation

The area included in the Lookout Valley research area provides a wide range of plant resources due to the great variation of soil and elevation in the valley and mountains. The predominant vegetation supported in the sandy, well drained soil of Lookout and Sand Mountains includes red oak, chestnut oak, post oak, hickory, sweet and black gum and loblolly and Virginia pine. Vegetation found on the floor of Lookout Valley includes red cedar, black locust, white oak, red oak, black gum, loblolly pine, short leaf pine and hickory. The chert ridges in Lookout Valley support varieties of oak, pine and gum. Other less common trees include maple, wild cherry, birch, chinquapin, locust, ash, black walnut, butternut and elm (Taylor, et. al. 1942:52).

According to Shelford (1963) the area of Lookout Mountain is located on the border of the Temperate Deciduous Forest Biome (Northern) and the Temperate Deciduous Forest Biome (Southern). The area is described as having a mixture of climax deciduous trees distributed through the forest with an admixture of coniferous trees in the climax areas. There are approximately fifty species of deciduous shrubs and fifteen species of evergreen shrubs which are found in this forest zone (Shelford 1963:20).

Studies carried out on Lookout Mountain and adjacent parts of the Cumberland Plateau indicate that forest composition has changed considerably due to the effects of disease and lumbering activities. At the turn of the century, Lookout Mountain was described as follows: "the mountain was recently covered with a fine hardwood forest, chiefly oaks, and was noted for the abundance of white oak timber and tan bark oak" (Mohr 1901). Mohr reports that further west in Alabama in the Warrior tableland above 300.0 meters "tan bark or mountain oak largely prevails associated with black oak, occasionally with a scarlet oak, also with mockernut, pignut hickory and fine chestnut trees ..." (Mohr 1901). Yellow pine reportedly formed 20 to 30 percent of the timber at lower elevations, with loblolly pine in the areas of deficient drainage. Compared with the soils found on the surface of Lookout and Sand Mountains, the soils found on the valley floor are richer and deeper and have a small humus layer (Braun 1950:115).

Braun reports that in an area of the Cumberland Plateau 20 miles northwest of Lookout Mountain the forest is mixed mesophytic. Beech, tulip tree and basswood comprise nearly 60 percent of the overstory. Higher on the east, southeast and south facing slopes of the plateau, oaks and hickories are much more abundant with tulip tree, hickory and white oak comprising about 50 percent of the total (Braun 1950:115). While these aforementioned areas are not part of the research area, they are in nearby sections of the Cumberland Plateau and suggest what the region may have been like in the past. These examples also demonstrate that the type of vegetation which is predominant in the lower elevations of the research area differs from that found at higher elevations.

Further indications of the nature of the patterns of vegetation in the research area can be obtained from survey reports written during the early part of the nineteenth century and from paleoclimatic data. Witness tree records made during the survey of the Lookout Valley area in 1832 are quite useful in gaining insight into the nature of the compositon of the forest in the research area prior to modern cultural influence. Plummer (1975:4-5) has discussed the possible sources of bias associated with the selection of witness trees during these land lot surveys, however they can still be utilized as a valuable source of data. While witness trees may not be representative of all tree types in the forest community, analysis of the variability among those species selected for use as witness trees is still possible.

A 25 percent random sample of transects crosscutting the research area was selected for analysis. The sample of transects contained 346 witness trees from Section 4 of land lot District 11 located near the center of the research area. The land lot section is nearly equally divided between upland mountainous area (54%) and valley area (46%). The percentage of each tree type represented by witness trees selected for analysis and the percentage distribution between upland and valley zones were calculated and are present in Table 1.

Table 1. Percentage Distribution of Witness Trees in the Research Area.

| Tree Type | Percentage of all Witness Trees | Percentage in Uplands | Percentage in Valley |
|---|---|---|---|
| Chestnut | 8% | 82% | 18% |
| Black Oak | 17% | 60% | 40% |
| Red Oak | 8% | 59% | 41% |
| White Oak | 25% | 60% | 40% |
| Post Oak | 3% | 42% | 58% |
| Chestnut Oak | 3% | 30% | 70% |
| Hickory | 8% | 50% | 50% |
| Gum | 6% | 53% | 47% |
| Pine | 8% | 45% | 55% |
| Dogwood | 4% | 36% | 64% |
| Ash | 3% | 10% | 90% |
| Other | 7% | 35% | 65% |

There is an apparent tendency for the chestnut and various species of oak to be found in the upland areas of the research area. The nineteenth century forest composition characteristics represented in Table 1 are a good indication of the composition of the forest in the research area prior to the introduction of modern cultural factors such as lumbering and disease. According to ethnohistorical sources, chestnuts were a very important food resource during the early historic period (Hudson 1976:286). It is highly likely that chestnuts were utilized as a food source by the Woodland population in the research area. If such were the case, the mountain tops would be expected to have been extensively exploited during the fall of the year when chestnuts, as well as other varieties of nuts, were available. Acorns and chestnuts also served as an important food source for certain animals which were exploited by the aboriginal population. It would be expected that these animal species would also be present on the mountain tops during the periods of maximum yield of these trees.

Palynological studies conducted on Pigeon Mountain, a subdivision of Lookout Mountain, have contributed valuable data concerning the paleoclimatic conditions during the late Pleistocene to late Holocene Epochs. The results of these studies have indicated that by the early part of the Holocene Epoch, the upland portion of the research area was dominated by an oak-chestnut-hickory-black gum forest. These species represent the modern flora which became established during the early Holocene Epoch and have remained the dominant species until the introduction of European cultural influences in the early part of the nineteenth century. The top 20 centimeters of the pollen profile show an increase in the ragweed pollen which is probably an indicator of forest clearance during the early historic or late prehistoric period (Watts 1975:290-291). It is likely that the vegetation found on the mountains during the land lot surveys in the 1830's closely resembled that present during much of the period of prehistoric occupation.

Faunal Resources

The faunal composition of the Lookout Valley area has not been thoroughly or systematically investigated, making any attempt to discuss the differential distribution of various animal species a matter of conjecture. Even if contemporary data were available for analysis, the comparability of the contemporary faunal population with the prehistoric population would be speculative.

Faulkner and McCollough (1973) have conducted a detailed investigation into the nature of the faunal composition of the upper Duck River (Normandy Reservoir) located approximately 60 miles northwest of the Lookout Valley research area, near the western edge of the Cumberland Plateau. The physiography of the Duck River area is roughly analogous to that found in the Lookout Valley area and may serve as the basis of a general model for discussing the composition and distribution of animal resources in the research area.

Faulkner and McCollough found that a wide variety of animals were distributed throughout the various valley and upland zones of the portion of the Duck River under investigation. The floodplain zone contained numerous animal species associated with the wet environment of the rivers and streams including mollusks, fish, aquatic turtles, aquatic birds and aquatic mammals which could be exploited as a food source. In addition to aquatic animals, most of the other mammals exploited by the prehistoric population were also present in the floodplain.

The valley slopes and bluff zones are located between the valley zone and upland zone and could have been exploited by groups occupying either of these adjacent areas. The upland zone contained mammals which are adapted to a drier forest environment. Since chestnuts were an important food source for the wild turkey and deer, it might be expected that these species would be more numerous in the upland zone during the fall and winter (1973:41-49). Faulkner and McCollough state that based on the availability of all natural resources such as wild plant and animal resources, the presence of a dependable supply of potable water and raw material for tools, the valley floor would have been most suitable for habitation during the prehistoric period. Other zones in the area could be easily exploited from the valley bottom habitation sites (1973:49). It would be expected that the distribution and availability of animal resources in the Lookout Valley research area would roughly parallel that described by Faulkner and McCollough for the upper Duck River area.

Climate

The Lookout Valley research area has a continental climate with long summers and relatively short mild winters. The average frost free period is 212 days extending from March 30 to October 28. The mean temperature ranges between 41.2 F (5.1 C) in January and 78.4 F (25.7 C) in July. The annual mean temperature is 60.4 F (15.8 C). The average rainfall for the county is 51.61 (1311 mm.) inches. This total is evenly distributed throughout the year. Heavy fogs in the valleys often modify the temperature sufficiently to allow crops to escape some of the earlier killing frosts in the fall and later frosts in the spring (Taylor, et. al. 1942:5-6).

Palynological studies conducted on Pigeon Mountain indicate that paleoclimatic conditions may have changed at the end of the Pleistocene. Evidence gathered from pollen cores taken from a lake swamp on the mountain reveal that a mesophytic forest was widespread at the end of the Pleistocene, but became more restricted giving way to more xeric species of an oak-chestnut forest during the Holocene. If the above conditions can be further substantiated, it would point to an increasingly drier climate during the Holocene (Watts 1975:291). It is likely that the climatic conditions experienced during the Woodland Period (1000 B.C. - A.D. 1000) did not differ greatly from those found in the research area today.

Soils

The soils throughout the Lookout Valley area are light in color because the soil has developed in a forest environment that did not favor the accumulation of much organic material. Approximately 60 percent of the land in Dade County is steep ranging between 15-30 degree slope. Soils in the county have been classified according to contemporary land use criteria. Best soils in the area are currently classified as second class soils (28 percent of the total area in the county) which are considered to be good to fair for crops. These soils are located on the floodplains and terraces of the valley floor. Third class soils (8%) are on steeper slopes than second class soils. Fourth class soils (17%) are difficult to cultivate because of increased slope, impervious subsoil or stoniness. Fifth class soils (47%) consist of rough, stony and mountainous areas and are presently best suited for forests (Taylor, et. al. 1942:58-59).

Soils in the area also have been placed in three groups based on parent material and physiographic relationships: (1) those developed from sandstone and shale on Lookout, Sand and Fox Mountains (61%); (2) those developed from limestone, sandstone, chert and shale materials in Lookout and smaller valleys (20%); (3) those soils formed from alluvial materials located in the valleys (19%) (Taylor, et. al. 1942:59-60). While these soil characteristics and classification schemes are based on twentieth century observations which have been influenced by modern cultural factors such as agriculturally induced erosion, the general tendencies described above probably were not greatly different from those which existed during the prehistoric period. Soils most suitable for agricultural purposes are located on the valley floor. Soils situated on the ridge tops and plateau tops are normally rocky and/or quite steep. The alluvial soils in the first bottoms and on the terraces and smooth uplands were the first cultivated by early European settlers because of their accessibility and ease of cultivation. It would be expected that these factors were also critical in the choice of agricultural land by the prehistoric inhabitants, even though the technology associated with agriculture differed between the two inhabiting populations.

# CHAPTER III

## DESCRIPTION OF THE RESEARCH AREA

### Choice of Research Area

The selection of the Lookout Valley area for the site of the research project was based on both physiographic and archaeological variables. The Lookout Valley area is large enough to offer a variety of environmental zones where different settlement types reflecting various activities or sets of activities could operate, yet small enough to permit intensive survey of a large portion of the region. The problem of establishing the boundaries of the project area was somewhat alleviated by the physiographic characteristics of the valley. The steep bluffs on the sides of the mountains flanking both sides of the valley present natural barriers to transportation and communication. Historical and ethnographic data indicate that movement in and out of the valley was severely restricted on the east and west sides of the valley by these escarpments. The north and south boundaries of the research area are defined as a matter of convenience; that is, an area was delineated for analysis that was largely unaffected by the processes of twentieth century urbanization and industrialization.

Extensive archaeological investigation had been conducted in the Tennessee River Valley and its major tributaries in connection with the development of the region by the Tennessee Valley Authority. Much of the research was conducted under the auspices of the University of Tennessee in more recent years. Lookout Valley represents a relatively small and isolated physiographic area in the Tennessee River system that is conducive to the application of a regional research design. Archaeological investigation in the Lookout Valley area had been on a very restricted level prior to the excavation of the Tunacunnhee site in 1973. Archaeological investigation conducted at the Tunacunnhee site (9Dd25) disclosed the existence of a major Woodland mortuary and habitation site having abundant evidence of an affiliation with the pan-Eastern Hopewellian complex. Numerous smaller sites having Woodland Period occupations had been reported from nearby portions of the research area by local informants.

Boundaries of the Research Area

The research universe for the purposes of the project was initially defined as a 15 kilometer section of Lookout Valley, bounded on the northwest and southeast perimeter by a line on top of Lookout and Sand Mountains 1500 meters from the edge of the bluff. The northeast and southwest perimeters were formed by lines crossing Lookout Valley perpendicular to the longitudinal axis of the valley. The research area encompassed an area of approximately 158 square kilometers which included portions of all distinctive physiographic zones in the region.

Physiographic Variability of the Research Area

Prior to the initiation of the research project, the study area was divided into six strata or zones based on environmental and physiographic attributes (Table 2). The six strata were later consolidated into three strata for the purpose of analysis of settlement variability in the research area. The three strata divided the area into geographic units sharing common physical characteristics which can be used to facilitate the comparison of archaeological sites and their contents. The nature of the subdivisions of the three strata will be discussed in Chapter IV. The description of the three primary physiographic strata (Figure 3) used in the project is as follows:

a) Floodplain stratum - the zone is located adjacent to creeks and streams on the valley floor and forms approximately 11 percent of the total area of the research area. The stratum generally has the best soils for agricultural purposes, the easiest access to chert resources used in stone tool manufacturing, the easiest access to aquatic resources, a continuous supply of drinking water and quick access to communication and transportation routes through the area.

b) Valley Uplands stratum - the stratum includes the ridges and hills situated on the floor of Lookout Valley and forms

Table 2. Physiographic Composition of Environmental Strata Used in Surface Survey of Lookout Valley.

| Primary Strata | Percentage of Area | Secondary Strata |
|---|---|---|
| I. Floodplain | 11% | A. Primary Floodplain - located adjacent to Lookout Creek on valley floor forming approximately 6% of the research area. |
| | | B. Secondary Floodplain - located adjacent to tributary streams of Lookout Creek. The stratum represents approximately 5% of the research area. |
| II. Valley Upland | 22% | Valley Upland - low ridges and elevated portions of the valley floor constituting about 22% of the research universe. |
| III. Upland Plateau | 67% | A. Mountain Top - located on the top of Lookout Mountain and Sand Mountain within 1500 meters of the bluff and constitutes 40% of the total area of the research universe. |

Table 2. (continued)

B. Bluff Area - a narrow stratum located at the edge of the mountain top forming approximately 5% of the research area.

C. Plateau Slope - located on the side of Lookout and Sand Mountain between the bluff and the valley floor. The stratum forms 22% of the total area.

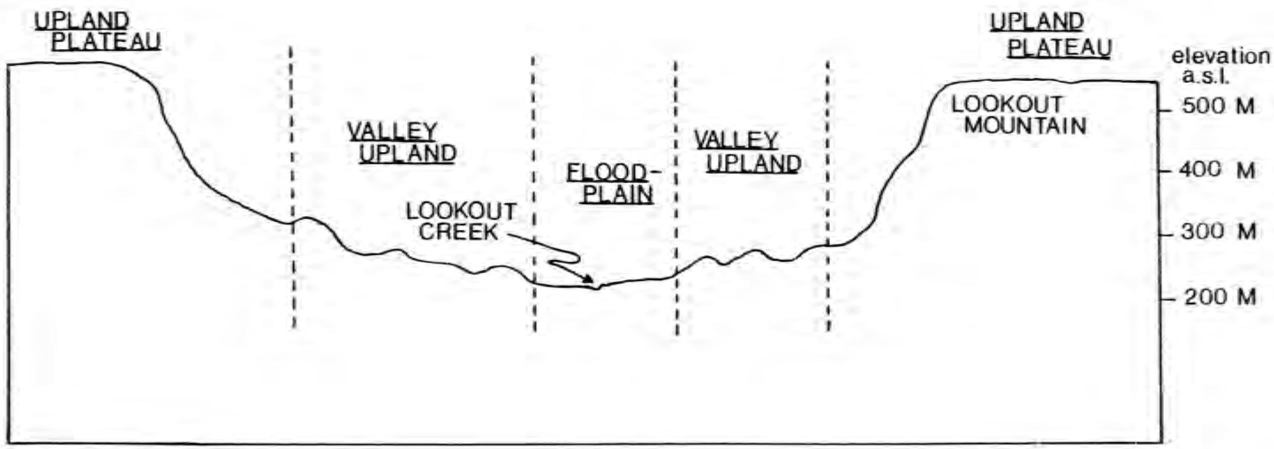


Figure 3. Cross Section of Lookout Valley Showing the Major Physiographic Zones.

approximately 22 percent of the research universe. The valley upland stratum is situated further from the resources of the floodplain, but these resources would be quite accessible to inhabitants of the valley uplands with little expenditure of energy or time.

c) Upland Plateau stratum - the stratum is located on the top and upper slopes of Lookout and Sand Mountains and constitutes approximately 67 percent of the total area included in the research universe. The area included in the stratum extends 1500 meters back from the edge of the bluff toward the interior of the mountains. Resources available in the upland plateau zone would be expected to include certain types of plant resources such as hickory nuts, acorns, and chestnuts, as well as various species of animals which feed on these plant resources including deer, turkey and bear. The upland plateau stratum is also the most remote area in the research universe to the resources available in the floodplain. Access to the upland plateau from the floodplain can only be achieved with considerable difficulty.

The three physiographic strata described above were the basic units utilized in discerning patterns of activity variability among Woodland Period archaeological sites located in the research area. The strata are uniformly distributed through the research area parallel to the longitudinal axis of the valley.

Previous Archaeological Investigation in the Research Area

The Tennessee River and its tributaries have long been an area of great interest to archaeological research. Whiteford noted that the area contained numerous prehistoric sites that were easy to locate and full of artifacts. Through the years, many of these sites in the Tennessee Valley area have been plundered and destroyed by the local gentry in search of "Indian relics" (Whiteford 1952:207).

Some of the earliest work conducted in the region was done by J. W. Emmert. Emmert, in 1885, carried out a series of excavations for the Bureau of American Ethnology in the Little Tennessee River basin in eastern Tennessee. The research was part of a Bureau of American Ethnology (BAE) program under the direction of Cyrus Thomas which had as its primary goal to prove that the mounds in the region could be attributed to the American Indians (Whiteford 1952:207).

In 1915, C. B. Moore performed a series of excavations along the Tennessee River which led to the publication of a descriptive report of his findings. Mark A. Harrington, working in the Tennessee River Valley between the mouths of the Little Tennessee and Hiawassee Rivers during the 1920's attempted to define the archaeological complex associated with the Cherokee Indian tribe (Whiteford 1952:207).

The organization and orientation of archaeological research in the Tennessee Valley region was altered by the creation of the Tennessee Valley Authority and the tremendous amount of funding by the Federal government that was made available through the Federal Emergency Relief Act and the Works Progress Administration. Prior to the creation of these Federal agencies, archaeology in the Tennessee Valley had largely been conducted by individuals who were primarily concerned with the excavation of sites and the description of the more exotic material recovered from these projects. The TVA and WPA brought together large amounts of Federal money, a large inexpensive labor pool and the management personnel to make possible the first large scale "regional" research projects. The extensive and continuous archaeological excavations which were possible under these programs resulted in the accumulation of a large data base and the formulation of many theories concerning the development of prehistoric cultures in the Southeast (Whiteford 1952:208). The primary goal of much of the fieldwork performed during the 1930's was to establish trait lists composed of cultural attributes. These attributes were divided into cultural complexes which were eventually used to assign sites to a specific cultural complex on the criteria of the presence or absence of designated traits. Archaeological research projects conducted during this period included the Norris Basin (1938), Wheeler Basin (1939), Chickamauga Basin (1941) and Pickwick Basin (1941). The Chickamauga Basin project, located near

Chattanooga, Tennessee, is the closest of these projects to the Lookout Valley research area. In more recent years, the University of Tennessee has conducted much of the archaeological research in response to proposed TVA construction projects.

Most of the traditional cultural framework for the main Tennessee Valley was formulated by Lewis and Kneberg (1946) and Lewis and Lewis (1961). Much of the archaeological investigation conducted during the 1940-1965 period was oriented toward the development of hypotheses concerning the processes of cultural change based on the traditional descriptive model that viewed culture changes as the consequence of the "interaction" among the various cultural groups occupying the Tennessee Valley. Few studies had considered the relationships between the physical environment and the cultural adaptation of the populations occupying the region (Faulkner and McCollough 1973:1). The publication of recent reports of research conducted by the University of Tennessee (Faulkner and McCollough 1973) have focused on the articulation between settlement and subsistence within a regional framework and serve as an indicator of the paradigm shift currently underway among some of the archaeologists in the Southeast.

The prehistory of the Lookout Valley region of northwest Georgia is largely unknown outside of the inferences which can be made on the basis of the research conducted in the peripheral areas discussed above. Considerable research has been conducted along the Tennessee River and its major tributaries and abundant amounts of data are available with respect to the prehistory of that area. As far as can be determined, no formal archaeological research was conducted in the Lookout Valley area prior to 1957. In that year, James A. Brown excavated half of a small rockshelter on the western bluff of Lookout Mountain disclosing the presence of two stratigraphically distinct cultural components. The lower component was interpreted as being a Middle Woodland storage and processing camp. Material recovered from the Woodland component included the remains of a desiccated tuber tentatively classified as Ipomoea pandurata. Brown has hypothesized that the Woodland component may have been a collecting way-station utilized for seasonal gathering and processing of plant foods. The upper component contained Mississippian Period cultural material (Brown 1975:11-13).

The second major archaeological research project in the Lookout Valley area was the excavation of the Tunacunnhee site (9Dd25) during the summer of 1973. The Tunacunnhee site (Figure 4) may be viewed as having two parts: the mound group, located on a slightly elevated area between two limestone outcroppings against the western slope of Lookout Mountain; and the habitation area, situated on a level field between Lookout Creek and the mound group. The mound group covered an area of about one acre and consisted of three circular limestone mantled earth mounds, a large stone mound and at least two burial pits located outside of the mound structures. Burials in the mounds were associated

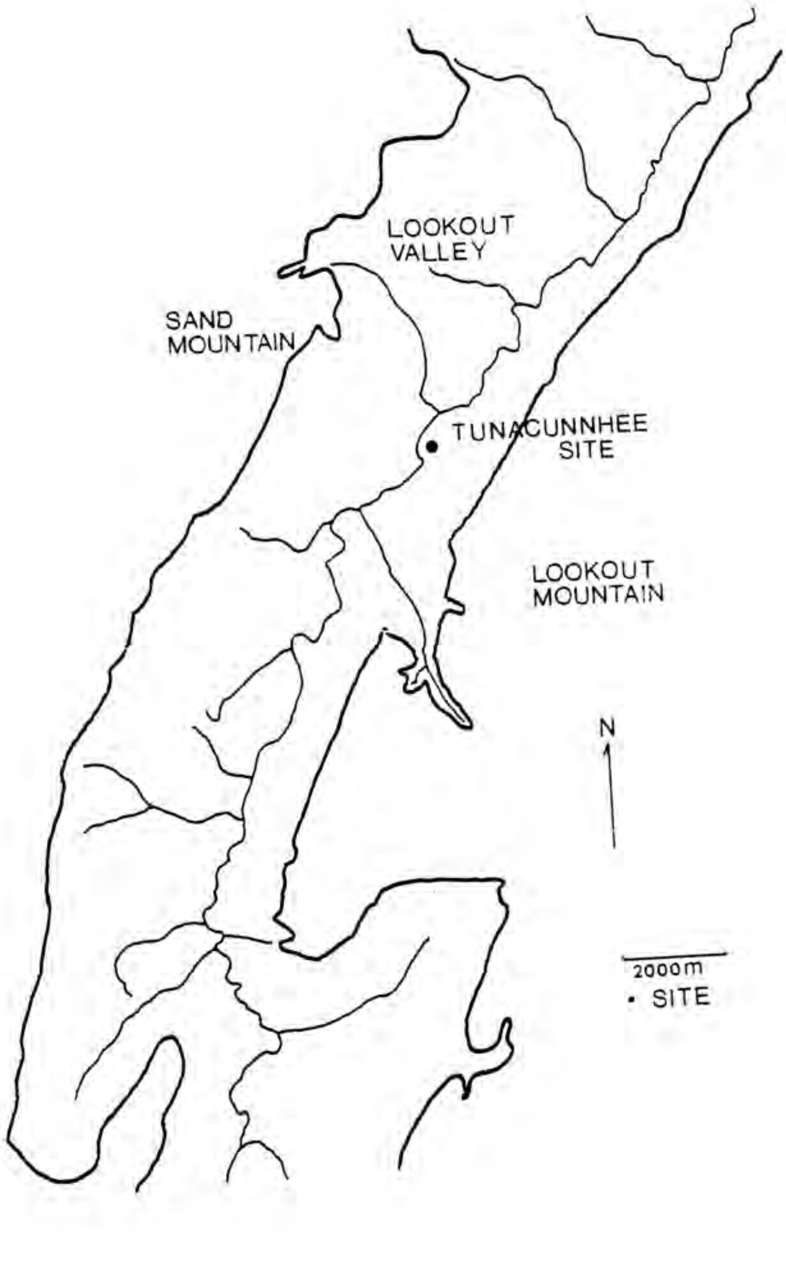


Figure 4. Location of the Tunacunnhee Site (9Dd25) in Lookout Valley.

with a wide variety of exotic raw material and artifacts which are associated with the Hopewellian manifestation that existed during the Middle Woodland Period through the Eastern United States (Jefferies 1976).

Excavation of the habitation area disclosed numerous subsoil features including pits and postmolds. A diverse assemblage of flaked stone tools was collected from the surface of the habitation area during the excavation of the site and during subsequent surface reconnaissance of the site at a later time. Radiocarbon determinations and artifact similarities indicate that the mounds and the habitation area were contemporary and date to approximately A. D. 200.

Chronological Framework and Cultural Adaptation in the Research Area

The earliest evidence of aboriginal presence in the Lookout Valley research area dates from the Paleo-Indian Period. Local informants have reported finding scattered examples of Paleo-Indian projectile points (Cumberland fluted) in the study area which date to the pre-8000 B.C. period. The traditional interpretation of the settlement/subsistence system of the Paleo-Indian population in the Eastern United States has been one of migratory hunting groups, however recent research throughout much of eastern North America has disclosed evidence that these groups might not have been as mobile as once thought (MacDonald 1968). The presence of sparsely scattered indications of Paleo-Indian presence in the research area does not contradict the hypothesis of a migratory hunting population.

An Early Archaic occupation has been indicated by the presence of several bifurcated base projectile points in the research area. Specimens collected during the surface reconnaissance of the research area resembled Lecroy points which date to approximately 6000 B.C. Additional material which is similar to projectile point types traditionally labeled Kirk and Palmer also suggest the presence of an Early Archaic population in the study area. Projectile points which are traditionally assigned to Middle and late Archaic types such as Morrow Mountain and Appalachian points have also been reported from the area. The settlement/subsistence system of the Archaic Period traditionally has been described as fully exploiting the available resources present in the physical environment through a seasonally regulated schedule of population movements. It is highly probable that there was an intermittent, if not continuous occupation during the Archaic Period from 7500 B.C. to 1000 B.C. in the Lookout Valley area.

The most extensive and intensive occupation or exploitation of the research area appears to have taken place during the Woodland Period which was defined as extending from approximately 1000 B.C. to A.D. 1000 for the purposes of the research project. Projectile points and ceramics were used as temporal indicators of Woodland Period occupations. Woodland sites or components were the largest and most numerous of the archaeological occurrences in the research area based on the results of the surface reconnaissance carried out in the study area.

Early Woodland (1000 B.C. - 200 B.C.) cultural material recovered from sites in the research area consisted of a very few limestone tempered, fabric impressed sherds commonly labeled as Long Branch Fabric Marked in this part of the Southeast. The appearance of the widespread use of pottery is a hallmark of the Woodland Period in the Southeast, but there was generally a paucity of ceramic material on the surface of sites having Woodland projectile points. Faulkner and McCollough have noted a complete absence of an early ceramic series on the surface of sites in the Normandy Reservoir in Tennessee (1973:422). This condition was true for most sites located in the Lookout Valley study area and may have been caused by the predominance of limestone tempered ceramics which do not appear to preserve well once exposed to the natural elements. Faulkner and McCollough have also pointed out that Long Branch Fabric Marked pottery seems to have been manufactured into the Middle Woodland Period. The earliest Woodland phase in the Normandy Reservoir did not have any temporally distinctive projectile point types (Faulkner and McCollough 1973:422).

The Middle Woodland Period (200 B.C. - A.D. 500) is very well documented in the Lookout Valley research area. Excavation of the Tunacunnhee site (9Dd25) has resulted in the acquisition of a large data base concerning the technological and ceremonial sectors of the society. Hopewellian material recovered from the burial mounds at Tunacunnhee indicate that the population, or a portion of the population, of the research area was interacting at some level with other distant Middle Woodland populations in the Eastern United States. Diagnostic utilitarian items from the Middle Woodland Period include Candy Creek Cord Marked, Wright Check Stamped, Cartersville Simple Stamped and variations of brushed ceramics. Projectile points characteristic of the period include McFarland Triangular, Copena Triangular, Bakers Creek, Greeneville and others (Faulkner and McCollough 1973).

The Late Woodland (A.D. 500 - A.D. 1000) Period is characterized by the Hamilton Phase in eastern Tennessee (Faulkner and McCollough 1973:427). Smaller triangular projectile points commonly found in association with Hamilton cultural material are a relatively infrequent occurrence in the research area. Ceramics which may be attributed to the Late Woodland Period occupation have been found at several sites in Lookout Valley. There appears to be a tendency toward the occurrence of fewer sites in the research area during the later part of the Woodland Period. A similar pattern was noted by Faulkner and McCollough in the Normandy Reservoir (1973:427). The subsistence base of the Woodland population in much of the Southeast has been attributed to the hunting of wild animals and gathering of native plants, with the role of agriculture becoming increasingly more important through the period. Settlements would be expected to be larger and exist for more extended periods of time than during the Archaic Period. Large habitation areas would be expected to become more strongly associated with good agricultural soils as the Woodland Period progressed.

Little evidence of Mississippian (A.D. 1000 - Historic) occupation has been recovered from the research area. Scattered examples of shell tempered ceramic material were collected from the surface of a few sites, but no major occupations were encountered. The Mississippian subsistence base was hypothetically founded on the principle of floodplain agriculture, supplemented by the exploitation of available native plant and animal resources. Conditions suitable for large scale floodplain agriculture are not generally found in the research area. Such conditions exist along the main course of the Tennessee River and its major tributaries. Large Mississippian Period occupations have been located in these areas. Faulkner and McCollough have found a similar situation in the Normandy Reservoir on the Upper Duck River in Tennessee (1973: 428). If the Mississippian population was exploiting the upper portion of these smaller tributaries of the Tennessee River, such as the Duck River and Lookout Creek, it was probably of a more restricted nature than during the preceding periods. Data collected during the surface survey of the research area supports the hypothesis that the section of Lookout Valley under investigation has been exploited at varying intensities and for various purposes for the last 10,000 years.

## CHAPTER IV

## ARCHAEOLOGICAL SURVEY AND ENVIRONMENTAL VARIABILITY

### Introduction

A research team from the Department of Anthropology, University of Georgia, conducted an archaeological surface reconnaissance of the Lookout Valley watershed during an eight week period from mid-June through mid-August, 1975. The nature of the prehistoric occupation and utilization of the Lookout Valley area in northwest Georgia was relatively unknown prior to the excavation of the Tunacunnhee site (9Dd25) in 1973. The excavation of the site brought to light a major Woodland occupation in the valley and initiated a range of questions concerning the full extent of settlement variability in the research area during the Woodland Period. It would be expected that in addition to a major ceremonial center such as the Tunacunnhee site, there would be a full range of exploitive and maintenance sites to acquire and process the resources necessary to support the population in the region.

The goal of the archaeological survey was to systematically locate archaeological sites in a designated research area and collect information to be utilized as a data base in the formulation and testing of specific hypotheses concerning behavioral variability during the

Woodland Period (1000 B.C. - A.D. 1000). A total of 56 prehistoric sites were identified during the initial phase of investigation. Thirty of these sites have been classified as having primarily Woodland occupations on the basis of the presence of diagnostic Woodland material. The selection of the Lookout Valley area was an attempt to analyze locational and lithic variability of prehistoric settlements within a regional framework. The research area offered a wide variety of unique environmental areas where various exploitive and maintenance settlement types would be expected to operate.

Survey Procedures

Prior to the commencement of the surface reconnaissance of the survey area, local artifact collectors and amateur archaeologists were interviewed and available artifactual material was examined. Information collected from these informants was utilized in the formulation of the various hypotheses concerning behavioral variability in the Lookout Valley area.

The research universe for the purposes of the project was defined as a 15.0 kilometer section of Lookout Valley. The area was initially divided into six units or strata. The criteria for stratification was based on environmental and physiographic factors since the hypotheses to be tested were concerned with the prehistoric man-land articulation. The six strata were later combined into three larger strata for the purposes of analyzing settlement variability. The three primary strata and six secondary strata used during the survey are presented in Table 2. The physiographic strata are linearly distributed through the research area parallel to the longitudinal axis of the valley.

A sampling strategy was divised which would insure the coverage of a representative portion of the research area and would result in the location of prehistoric sites which operated in the various physiographic strata. It is quite difficult to determine the percentage of the surface of each of the three strata which was covered during the survey. An estimation of areal coverage in the range of 10-15 percent would seem to be appropriate. The percentage of cleared land surveyed in each stratum is much higher.

The sampling scheme initially utilized in the selection of the areas of the research universe to be surveyed was transect sampling. The universe was divided into 500 meter-wide transects oriented perpendicular to the axis of the valley. Due to the irregular boundaries and small areas of some of the strata, it was more efficient to use transects as sampling units than quadrats. Judge, Elbert and Hitchcock working in Chaco Canyon and Plog working in Oaxaca, Mexico, have found that transects were more effective sampling units than quadrats in this type of physiographic situation (Mueller 1974:30). Since the strata are uniformly distributed through the universe, a transect would contain a proportional area of each of the strata as is present in the research universe. The individual transects to be surveyed were chosen using a random numbers table. The research design called for the sample to include 40 percent coverage of the research universe. The initial plan required that the entire transect selected for survey be covered on foot by five crew members 50 meters apart.

Despite a carefully planned research design, numerous problems developed when the plan was operationalized in the field. The same physiographic attributes that first attracted attention to the research area created a multitude of problems during the survey. Initially, there was a problem of locating the transect lines on the ground surface. The use of aerial photographs and U.S.G.S. quadrangle maps facilitated finding the general location of each line on the ground surface, but the actual laying out of the lines across the research area was still a very time consuming process. These problems were caused by the inability to traverse parts of the survey area because of the very rough terrain and the lack of visibility created by dense ground cover. These same two problems, poor ground surface visibility and rough terrain, combined with the difficulties associated with having to obtain individual private land owners' permission to cross property lines, greatly hindered the actual archaeological reconnaissance of the designated transect areas. It became obvious during the first few weeks of the project that the research design was very inefficient as far as the cost-benefit ratio was concerned. In other words, a lot of time and money was being expended to find a very few sites. It is realized that the goal of the research plan was not solely to locate sites; however, evaluation of the plan revealed that the cost of continuing the program would allow only a very small portion of the research universe to be surveyed.

From experienced gained in the aforementioned portion of the project it was obvious that the great majority of sites located were found in areas where there was good visibility of the ground surface. No sites, with the exception of cave sites and rockshelters, had been located in the forested areas, and the only sites located in areas of heavy grass cover were found through subsurface testing. The research plan was revised in that only the portions of the research area that had relatively good ground surface visibility would be initially surveyed and the areas having dense ground cover would be sampled for testing in a later stage of investigation. Obviously, certain biases were created through this action, but if a sufficiently large sample of sites was to be located in the research area within the allocated time and budget, adjustments had to be made. A conscientious effort was made to insure that representative portions of each of the strata were searched for sites.

When sites were located during the survey, the limits of the surface artifact scatter was established and artifacts in the designated area were collected. Collection of artifacts involved the use of transect sampling. Crew workers were lined up 3-4 meters apart and traversed the site until the entire surface of the site was covered. All visible artifacts were collected at most sites due to the relatively small number of artifacts present. An estimation of site size and the relationship of the site to physiographic, hydrologic and other aspects of the physical environment was made. All sites were plotted on U.S.G.S. topographic maps.

Cultural material collected from sites located during the survey was divided into ceramic and lithic categories for further analysis. Projectile points were classified according to traditional projectile point classification schemes which were applicable to the research area to obtain an indication of the period of site occupation (Faulkner and McCollough 1973, Cambron and Hulse 1964). Debitage was divided into two categories based on the amount of cortex present on the outer surface of the flake. These two classes of debitage were further divided in a sample of sites for further analysis. Artifacts having intentional retouch were placed in one of 25 tool categories for further analysis.

## Distribution of Woodland Sites in the Research Area

The data used in the research project was derived from two distinct sources. Physiographic and environmental data served as one primary source of data. A discussion of the role and relative importance of these attributes has already been presented. The second source of data used in the analysis consisted of cultural material collected from sites located during the archaeological survey of the research universe.

A total of 56 prehistoric archaeological sites was located during the surface reconnaissance of the Lookout Valley research area (Figure 5). The physiographic distribution of these sites through the research area is presented in Table 3.

Table 3. Percentage Distribution of Sites Located During the Surface Reconnaissance of the Lookout Valley Research Area.

| Physiographic Strata | All Sites | | Woodland Sites | |
|---|---|---|---|---|
| | Number of Sites | Percentage of Sites | Number of Sites | Percentage of Sites |
| Floodplain | 38 | 68% | 21 | 70% |
| Valley Upland | 8 | 14% | 2 | 7% |
| Upland Plateau | 10 | 18% | 7 | 23% |
| Total Sites | 56 | 100% | 30 | 100% |

The percentage distribution of Woodland sites roughly parallels the percentage distribution of all sites through the three physiographic strata in the research universe. The only major deviation from the pattern is found in the valley upland stratum where 14 percent of all sites were located, but only seven percent of the Woodland sites were found in the stratum. Part of the difference can be explained by the lack of culturally diagnostic artifacts recovered from the valley upland sites.

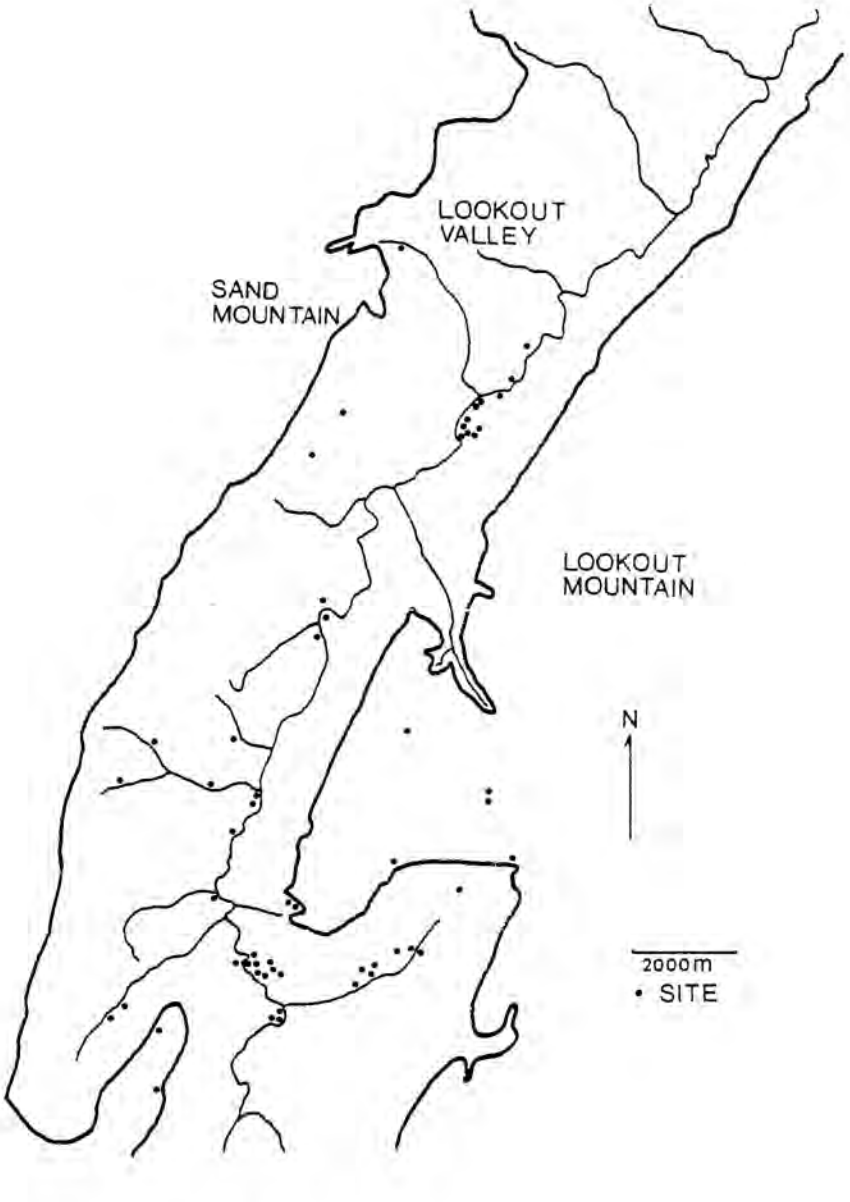


Figure 5. Distribution of All Sites Located in Lookout Valley.

Woodland sites (Figure 6) formed 55 percent (n=21) of the total number of sites located in the Floodplain physiographic stratum. Woodland sites represented 25 percent (n=2) of the total in the valley upland stratum and 70 percent (n=7) of the total number of sites in the upland plateau stratum. Archaeological sites having exclusively or primarily Woodland Period cultural material represented 54 percent (n=30) of all sites located during the survey of the research area.

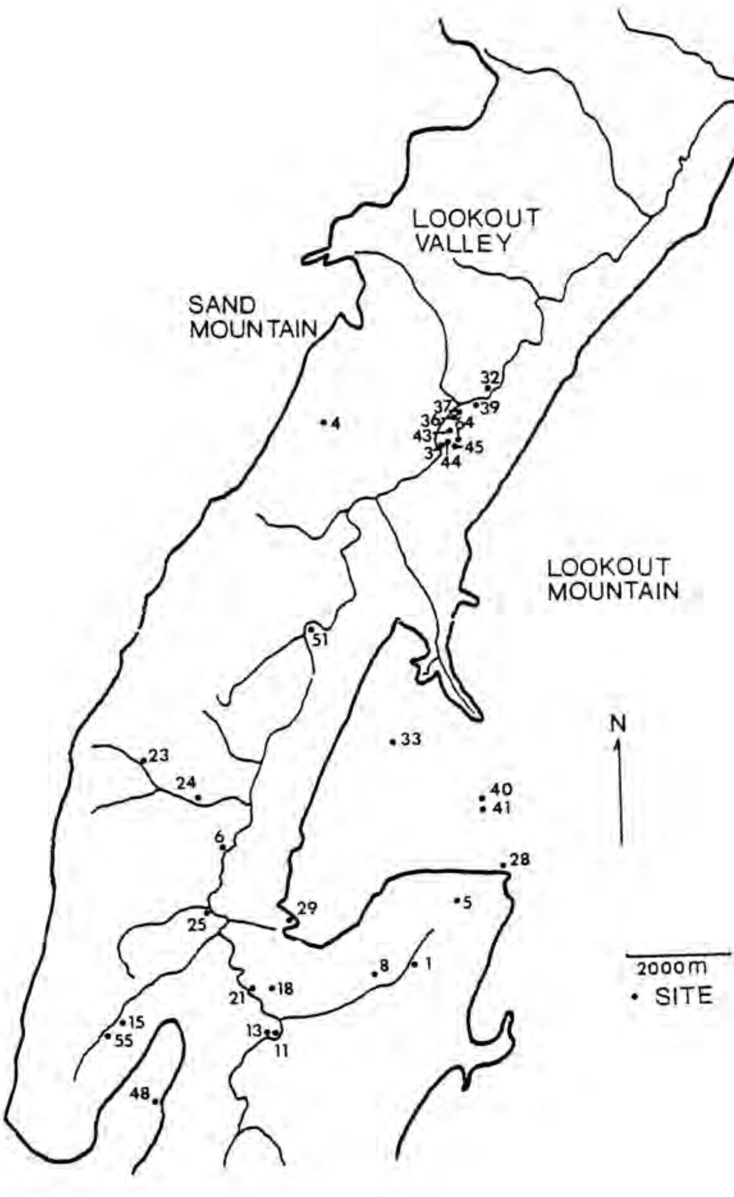


Figure 6. Distribution of Woodland Sites in the Lookout Valley Research Area.

# CHAPTER V

# THEORETICAL FRAMEWORK

## Use of the Regional Research Approach

It is currently difficult to obtain a clear picture of prehistoric man's articulation with his contemporary physical and social environment in the Southeastern United States during the Woodland Period. Archaeological research in this region has largely been directed toward the excavation of a relatively disjointed collection of sites, with particular emphasis placed on the excavation of mounds and large habitation areas. Seldom have archaeologists looked beyond the site to the more complex intersite relationships. Past emphasis on large sites has led researchers to ignore less "spectacular" and less "impressive" sites. Such sites have usually been viewed as being unimportant or insignificant, or were entirely overlooked because of their small size, the absence of any systematic sampling scheme or a failure to utilize a regional research design. As a consequence of these aforementioned practices, most of the data presently available concerning past human activity in the Southeast is based on a very small collection of unrelated sites which is inadequate to be used in attempting to explain how Woodland populations adapted to the environment in which they operated.

It would be expected that in addition to habitation and mortuary sites, a wide variety of smaller extractive and maintenance sites existed in which a variety of limited activities occurred. These sites would not be expected to be randomly distributed over the landscape, but to be located in consideration of both physical and social environmental factors. Contemporary sites situated in a well defined region cannot be viewed as being separate entities, but should be considered as components of the overall settlement system.

There have been several recent attempts to apply Binford's (1964) ideas concerning a regional research design (Thomas 1969, 1973; Struever 1968; Roper 1974) to reconstruct extinct settlement systems. Cultural variation in space can be viewed in terms of differing adaptive requirements to specific resources or groups of resources within the physical environment. The specific resources present in the environment which can be exploited by humans require different types of behavior which would be expected to result in the deposition of different kinds of cultural remains associated with specific maintenance and exploitive activities or combinations of activities.

If the research design is regional in scope, the nature of the extinct settlement system would be expected to be reflected by the diversity, distribution and density of sites within the region (after Struever 1968). If the variability of the archaeological assemblages, and more specifically, the lithic material from sites, is the result of different types of human behavior, it will be possible to test hypotheses relating to human cultural activity through the research universe.

Settlement-Subsistence Systems

Most of the research oriented toward analysis of settlement systems (defined as the functional relationships among a contemporary group of sites within a single culture (Winters 1969)) using the regional concept has been carried on in the Southwest (Plog and Hill 1971, Lipe and Matson 1971, Lindsay and Dean 1971), the Basin-Range area (Thomas 1969, 1973) and the Midwest (Struever 1968, Roper 1974). Relatively little research of this nature has been conducted in the Southeastern United States (Sears 1956, 1961; Pearson 1977). It is proposed that many of the hypotheses concerning the distribution of sites over the landscape tested in the above sections of North America are at least generally, if not specifically, applicable to the Southeast. Studies of prehistoric settlement distributions have been an ongoing concern for many archaeologists during the past 40 years. Braidwood (1937) and Willey (1953) represent two of the earliest attempts at analyzing the distribution of archaeological sites over the landscape. The first major synthesis of research utilizing the settlement pattern approach was carried out by Willey (1956) in his publication of Prehistoric Settlement Patterns in the New World (Watson, LeBlanc and Redman 1971:101). Willey stated that man leaves certain modes of his existence on the land which he exploits and that the arrangements of these settlements are associated with the adaptation of man and his culture to the environmental situation and to the organization of society (Willey 1956:1). Chang has stated that the goal of settlement pattern studies should be directed toward an examination and description of the social groups of archaeological cultures, the spatial and temporal associations of the groups and an analysis of other relationships among these social groups. Chang defines "settlement pattern" as the manner in which human settlements are distributed over the landscape relative to the physical environment (Chang 1958:299-324).

In more recent years, the term "settlement system" has replaced "settlement pattern" in the archaeological literature. Winters (1969) defines "settlement pattern" as the geographic and physiographic relationships of a contemporaneous group of sites contained within a single culture whereas "settlement system" is defined as referring to the functional relationships among the sites contained within the settlement pattern...the functional relationships among a contemporaneous group of sites within a single culture (Winters 1969:110). A system can be generally defined as a set of objects or components and the relationships among those components. The components in a settlement system are the sites. The relationships between components in the system hold the system together. The relationships in a settlement system are those hypothetical kinds of interaction among members of the social units operating at those sites based on the function or functions of the components with respect to other components in the system.

Settlement system is defined for the purposes of this analysis as the functional relationships among sites contained in the same settlement pattern. It is recognized that the problem of identifying contemporary sites is a limiting factor. It is therefore stated that the settlement system will contain sites of the same time period (Woodland), however, these sites will not necessarily be considered to have been operating contemporaneously.

The subsistence system of a society consists of all those activities broadly relating to the procurement, processing and distribution or utilization of food resource. Man and the available food resources which can be exploited by members of a society utilizing that portion of the environment are components of the subsistence system and are connected by specifically subsistence oriented activities (Renfrew 1972:22).

It is assumed that sites associated with the exploitation and utilization of the available resources in the environment will be located near those resources and that different types of behavior will be required in order to successfully procure, process, and consume those resources. If this is true, then archaeological material deposited as a consequence of the performance of a specific subsistence activity or set of activities will be unlike that left by the performance of behavior associated with another set of activities. Through the examination and analysis of archaeological material, and specifically the lithic material, recovered from sites in a settlement system, those sites reflecting similar sets of activities or similar levels of activity diversity may be discerned. The level of discrimination of activity variability among sites in the settlement system will be closely tied to the degree of behavioral variability associated with the performance of the various activities carried out at sites.

Several studies have been carried out in recent years concerning the nature of the cultural adaptation of various Woodland populations in several parts of the Eastern United States. One of the first of these was Struever's analysis of the Woodland subsistence-settlement system in the Lower Illinois River Valley. Struever attempted to interpret the "structure of segmentation" of two prehistoric cultural systems, the Early Woodland and Middle Woodland, by discerning the morphology of the two subsistence-settlement systems. An attempt was made to determine the kinds, number and spatial configurations of material items that represent the framework of the extinct systems for exploiting, processing and storing food and other exploited resources (1968:285). Struever examines the nature of the changes in the settlement and subsistence strategies from the Early Woodland to the Middle Woodland Periods and provides insights into possible explanations for the shifts.

Faulkner has formulated two hypothetical settlement system models for the Middle Woodland Period in the upper Elk and Duck River Valleys in Tennessee (Faulkner and McCollough 1973:425; Faulkner 1973). The first of these hypotheses is formed on the concept of a "nucleated" type in which a large site would function as a permanent settlement from which groups of gatherers would leave for short durations to exploit certain resource areas on a seasonal basis. The second hypothesis is based on a "dispersed" type settlement model which would operate on the basis of a large site being occupied by the entire group, but for a shorter time than in the nucleated model. The population unit would disperse into smaller groups during other seasons of the year and occupy sites in other resource acquisition areas (Faulkner and McCollough 1973: 425).

Roper's analysis of the distribution of Middle Woodland sites in the Lower Sangamon River Valley in Illinois utilizes several environmental attributes to discern patterns of settlement variability in the research area. Roper attempts to determine the relationships between the location of sites and the combinations of resources which were available to population units occupying the sites. Hypotheses concerning three locational strategies based on the correlation of site location with environmental structuring are presented which may have been employed by the Middle Woodland inhabitants of the Sangamon River system (1974:19).

## General Model of Settlement in the Lookout Valley Research Area

The general model of settlement variability in the Lookout Valley research area during the Woodland Period is based on a combination of physiographic and environmental data. The available data base pertaining to these factors is generally very restricted as far as previous investigation in the research area is concerned. Nevertheless, general patterns and trends of environmental variability can be discerned from the limited amount of available reference material and from first hand observation in the field. Many of the concepts and ideas incorporated in this model are based on research conducted by Faulkner and McCollough (1973:41-51) in the Upper Duck River. While the general model of settlement variability formulated for the Normandy Reservoir may not be identical to that present in Lookout Valley, it would be expected that the general trends would be similar.

The availability of the widest range of plant and animal resources, the most easily cultivated and generally most favorable land for prehistoric agriculture, the resource areas of chert used in the manufacturing of stone tools, the most reliable area of water supply and the closest area to probable lines of communication and transportation (trails and waterways) would be expected to occur in the floodplain stratum on the valley floor. It would be expected that the more permanent settlements in the region would be located in the floodplain stratum. It would also be expected that sites having the widest range of artifacts reflecting a wide range of cultural activities would be associated with these permanent sites in the floodplain stratum. Sites located in the floodplain would have ease of access to the other parts of the floodplain as well as more difficult access to the other physiographic zones in the research area. These sites would have the easiest access to communication lines leading to other regions in the Southeast. Supporting data for the above hypothesis was found at the Tunacunnhee site (9Dd25) located on the floodplain with the disclosure of large quantities of exotic Hopewellian material. It would also be expected that a wide variety of smaller sites having a more restricted number and range of artifact types representing a narrower range of activities would be found in the floodplain. These sites would represent a lower level of maintenance or exploitive sites. Artifacts recovered from sites of this nature would tend to reflect more restricted sets of activities carried out at these sites.

It would generally be expected that the material recovered from sites on the floodplain would reflect the full range of subsistence activities which occurred in the research area, with the exception of those exploited resources which were not present in that stratum. The floodplain stratum was probably occupied throughout the year during the Woodland Period. Some sites were permanent settlements or base camps, while other sites represent seasonally occupied camps, special activity sites or exploitive and procurement sites.

A relatively small number of Woodland sites (n=2) were located in the valley upland stratum. A much higher number of sites was located in that stratum during the survey, however, most of the sites contained no culturally or temporally diagnostic artifacts. The valley uplands had ease of access to the resources found on the floodplain, but did not have the advantage of being located immediately adjacent to water resources, good agricultural soil or sources of good chert. It would be expected that sites in the valley uplands would have a lower range of cultural activities than found at some of the more diverse floodplain sites, but because of the relative ease of access to most resources in the floodplain, occupants could perform most of the activities found at floodplain sites. Access to the upland plateau from the valley upland area would still be a difficult task. It is possible that sites in the valley uplands were occupied year around, but not as likely as for sites found on the floodplain.

The upland plateau stratum represents the area of the research universe which is most removed from the resources of the floodplain and the least accessible area from the valley floor. The upland plateau area has very little land suitable for aboriginal agriculture, no chert for manufacturing flaked stone tools, a lack of potable water during the dry seasons and a general absence of efficient lines of communication and transportation with other parts of the research area because of the steep and rocky mountain sides and bluffs. It would be expected that occupation and utilization of the upland plateau would be of relatively short duration and for the exploitation of specific resources. It has been noted that in the Lookout Valley area and other nearby areas, the mountain tops were the source of a wide variety of nuts and acorns. These food resources were greatly exploited by the aboriginal population in the Southeastern United States. A large number of wild animals including the white tailed deer, the wild turkey and the bear also exploit these same food resources. Faulkner and McCollough (1973:49) have noted that the white tailed deer may have been more abundant in the upland zones in the fall because of the migration into the oak-chestnut forests at that time of the year. It would be expected that at least part of the occupation of the upland plateau would be associated with the collection of the wild plant foods and the hunting of animals attracted to the zone by the presence of such resources during the fall of the year. It is also likely that other currently unidentified resources were available in the upland plateau physiographic stratum during all or part of the year and that these resources had an important role in determining the schedule of the yearly cycle. Some of the sites on the upland plateau may be associated with transit from the lower portion of the research area, over the mountains, to other parts of the Southeast. This would be particularly true for sites located near the several gaps in the bluff line where passage would be less difficult. These sites would be expected to be very short term occupations. In general, the nature of the sites in the upland plateau would be expected to reflect a transitory occupation of relatively short duration. Activities at these sites would tend to be reflected in the restricted nature of the diversity of artifacts found at these sites. A model of settlement similar to the one presented above was formulated for the Upper Duck River area of Tennessee by Faulkner and McCollough (1973:41-51).

The generalized settlement system which operated in the Lookout Valley research area during the Woodland Period would be expected to be largely reflected by the nature of the sites located during the surface reconnaissance of the research universe. It is possible that some special purpose sites were overlooked because of the environmental conditions previously described in the research area, but it is likely that the sample of Woodland sites located during the survey reflect the general characteristics of sites in the designated strata in the research area.

## Hypotheses

Numerous hypotheses have been formulated by researchers in geography and anthropology concerning the distribution of settlements over the landscape (Gumerman 1971; Haggett 1965). It has been proposed that archaeological sites are distributed over the landscape with respect to selected critical factors or environmental variables. The term "environmental variable" is defined to include both physical and social attributes. It has been proposed by others that these variables can be employed to explain or predict the distribution of sites over the landscape (SARG 1974). If the variability of archaeological remains and the spatial distribution of sites is a reflection of different types of human behavior, it may be possible to relate the patterned variability of lithic remains to certain kinds of behavior.

The hypotheses to be tested concern intersite lithic variability in the Lookout Valley research area during the Woodland Period (1000 B.C. - A.D. 1000). The general hypothesis to be tested is:

The structure of the Woodland settlement system in Lookout Valley will be reflected by the lithic variability of settlement types in the research universe.

Definitions: (a) Settlement Types are to be defined from those sites which demonstrate particular configurations of exploitive or maintenance activities. These sites will contain a similar inventory of lithic artifacts (Struever 1968).

(b) Site is defined as any location characterized by the deposition of the remains of human activity (SARG 1974).

Assumptions: (a) a specific activity or set of activities will produce similar archaeological remains over space.

(b) archaeological remains will be detectable through archaeological surface reconnaissance.

Specific hypotheses to be tested are as follows:

$H_1$: Sites in the research universe will not contain the same variety or quantity of lithic material. If, as the assumption states, a specific type of human behavior or activity will produce similar remains over space, and if numerous types of activities occurred in the research universe, there should be a certain amount of intersite lithic variability.

$H_2$: Sites that reflect similar types of human behavior will be clustered together on the basis of qualitative similarities of lithic material from those sites. If various types of maintenance and exploitive activities were performed in the research universe, they should be reflected in the archaeological record by variation in the lithic remains recovered from these sites. If it can be demonstrated that sites in the research area sharing similar lithic assemblages can be clustered into groups having low within group variability, the various clusters created may represent types of activities associated with exploiting specific resources or groups of resources in the research universe. Sites having lithic assemblages containing similar patterns of lithic material will represent a similar activity or set of activities.

$H_3$: Sites which contain a similar range of lithic material will be linked together by the presence of similar environmental attributes such as soil type and the type of landform on which the site is located. Different soil types support different kinds of vegetation. Sites located on certain soil types may be associated with the exploitation of certain plant species or communities which predominantly grow on that soil. Certain types of animals which were utilized by the prehistoric inhabitants of the research area may be associated with specific plant communities. Some soil types are more likely to be utilized by populations practicing horticulture. Landform is also considered to be a critical factor which influences human settlement. The great variation in relief and elevation in the Lookout Valley research area is perhaps the most critical factor as far as access to the available resources is concerned. The non-uniform distribution of resources in the research area has already been discussed. The differential ease of access to these resources by the prehistoric population depends on the specific physiographic location of the site.

The formulation and testing of these hypotheses is designed to evaluate the usefulness of the analysis of lithic artifact variability in discerning patterns of intersite activity variability in the research area during the Woodland Period. If the hypotheses derived from the model of settlement-subsistence variability can be supported using the data under consideration, the model can be utilized to analyze the articulation between human behavior and the physical environment in other research areas.

Limitations of Research

There are several limiting factors associated with the analysis of data recovered during the surface reconnaissance of the Lookout Valley research area. The primary limiting condition involves the lack of lithic material from archaeological units having good chronological controls. Most of the material used in the analysis was recovered from surface artifact scatters or from test excavations. Consequently, as is usually the case with archaeological material of this nature, there is a limited amount of chronological control over the data. In order to utilize the material from these sites, the assumption was made that if the diagnostic material in a collection from a site consists of exclusively or largely of Woodland material according to traditional lithic or ceramic classification schemes, the associated material from the sites was also considered to be of Woodland origin. Of the 56 sites located during the survey of the research area, 30 have been classified as being of primarily Woodland occupation. It is possible that some of the material recovered from these sites is the product of previous or later occupation. It is also possible that artifacts and debitage produced during the Woodland Period is present at sites classified as being Archaic or undiagnostic because of the absence of any diagnostic Woodland Period artifacts. A problem of this nature is inherent in any analysis using surface artifact data. If any meaningful analysis of surface artifact material is to be conducted, this assumption must be made.

A second limitation was created by the sampling procedure used in collecting the data. As previously discussed, the initial sampling strategy, transect sampling, proved to be both inefficient and ineffective in locating archaeological sites. A modified version of this approach to sampling was adopted as a consequence of this problem. It is possible that material from sites located in areas of the research universe which did not permit thorough surface reconnaissance may reflect activities not present in the surveyed areas. Such a condition would result in the absence of lithic material associated with these activities from the analysis. It is unlikely, however, that this situation exists for the Lookout Valley area due to the conscientious attempt to thoroughly investigate representative areas of all the delineated physiographic strata used in the analysis.

A third limitation was created by the relatively small sample size of lithic material recovered from the sites. Replication experiments have demonstrated that the manufacturing of one bifacially flaked hand axe can result in the production of thousands of flakes (Newcomer 1971). It is obvious that only a very small percentage of the artifacts are recovered from most archaeological sites. While a relatively small sample of artifacts (compared to the total present at the site) may not fully reflect the complete range of artifact variability at a site, it would be expected that it would be indicative of the general type and intensity of the activities which occurred at the site.

The final limitation to research to be considered is the nature of the type of material left behind, and consequently found by the archaeologist, at a site. It has recently been pointed out that the type of material recovered from archaeological sites may largely represent lost or discarded items which may not fully equate with the actual activities performed at that locus. (Jelinek 1976). Unfortunately, there is no way to completely ascertain the nature of these activities using only artifacts. Analysis of debitage has proven to be useful in gaining insight into activities associated with the range of lithic manufacturing activities which occurred at a site. Geochronological, palynological, dendrochronological, pedological and other scientific techniques provide data relating to the nature of these activities. In most cases, however, the assumption is made that the lithic material recovered from a site does tend to reflect at least the general nature, if not the specific nature, of the activities which took place on the site.

CHAPTER VI

# ANALYSIS OF DEBITAGE

## Introduction

Archaeologists have long recognized the value of utilizing lithic material as a means of analyzing and ultimately explaining past human behavior. The analysis of lithic artifacts has primarily utilized flaked stone tools, with debitage taking a secondary role or being entirely ignored. The goals of such research have been to identify the function of a specific tool type, the analysis of inter or intra site functional variability or simply the creation of artifact classification schemes to be used as a means of data organization and description.

Stone tools recovered from an archaeological context may largely represent unwanted discards which have undergone the process of manufacturing, use, modification and disposal. These tools may no longer reflect the initial form of the artifact. Jelinek (1976:22) has stated that except under unusual circumstances, it may be quite rare to recover a completely functioning tool kit. In view of these factors, the importance of the analysis of debitage which represents the by-product of many past activities may ultimately more accurately reflect human behavior than the tools found at the same site. The differential access to lithic resource areas may also be reflected by the variability of various debitage attributes of material collected from sites in a research area.

The potential importance of lithic debitage in discerning prehistoric activity variability has been recognized by a growing number of archaeologists in both the Old World and the New World. Frison's (1968) work with debitage from the Piney Creek site in Wyoming provides insight into some of the potential possibilities of debitage analysis. Frison found that flakes removed during the sharpening of stone tools provided important data reflecting the range of activities which occurred at the site and could be utilized in the formulation of hypotheses concerning tool use and maintenance (1968:149). He also demonstrated that desirable materials were often removed from a site and that the remaining tools may represent unwanted discards. Research by Leach (1969), Collins (1976), Fish (1976a) and Young and Sheets (1975) have further supported the necessity of considering debitage as a valuable data source in discerning prehistoric activity variability.

These studies have found that the analysis of lithic debris from an archaeological context may contribute data which can be used to formulate and test hypotheses that may ultimately help explain the activities which occurred at a site in the past. In many cases, debitage may be a more accurate indicator of these activities than the tools recovered from the same site.

## Data Set

The data used in the following analysis was obtained from material collected from Woodland sites in the Lookout Valley research area. Only those sites having more than 75 flakes were included in the analysis. These limiting factors reduced the number of usable sites to 26, representing approximately 50 percent of the sites located in the initial survey. Eighteen of the sites were located in the floodplain stratum, two were found in the valley upland stratum, while six were in the upland plateau stratum.

## Chert Resources in the Research Area

More than 99 percent of all tools collected during the survey were manufactured from local chert material. Most of the chert utilized in tool manufacturing came from the Fort Payne chert or St. Louis limestone formations. These two formations are closely associated in the valley and have a linear distribution along both sides of the longitudinal axis of the valley floor. The Fort Payne chert crops out as a wide band capping the low ridges that flank Lookout Valley. In the Dade County area, chert outcroppings consist of thick bedded, gray cherty limestone. This material is highly fractured and occurs as nodules and stringers often more than 1.0 foot thick. Fort Payne chert forms the greater part of the geologic unit in the lower part of the formation. The upper part of the Fort Payne formation is deeply weathered and forms a reddish soil which contains blocky, fossiliferous fragments of chert (Croft 1964:9).

St. Louis limestone is a dark-gray, cherty, fine-grained limestone which overlies the thicker bedded cherty limestone of the Fort Payne chert. St. Louis limestone is best exposed in creek beds and gullies on the lower portion of Sand Mountain. The limestone is generally thick-bedded and contains many large nodules and stringers of chert (Croft 1964:9-10). Lookout Creek, the major drainage system of the valley, flows along the eastern side of the low ridges, largely along and near the base of the Fort Payne chert formation (Sullivan 1942:6).

Due to the geological processes which formed the Lookout Valley area, no chert deposits are found on the plateau tops or on the upper portions of the plateau slopes. For all practical purposes, chert resources exploited by the prehistoric inhabitants of the research area are located on or near the valley floor. Fort Payne chert bearing formations are largely concentrated in two narrow bands which extend through the research area. These formations are oriented roughly parallel to the longitudinal axis of Lookout Valley. Most of this material would be expected to occur in gullies and creek beds along the valley floor, but some low quality and highly weathered chert may be available on the ridges which rise from the valley bottom. In contrast, sites containing chert artifacts and debitage are distributed through all three of the physiographic strata in the research universe. Examination of aboriginal lithic material strongly suggests that nodular chert was the most commonly exploited form of the raw material used by the prehistoric population. Chert nodules can be procured most easily from stream gravel or from soil which has formed through the weathering processes acting on chert bearing deposits.

## Goals of Debitage Analysis

The goals of the analysis of debitage are directed toward the examination of the relationship between site location and the kind of debitage found at a site. The determination of the location of each site was simplified by employing the three physiographic strata (Figure 3) used in the initial stratification of the research area prior to commencement of the surface survey. This procedure enabled the location of all sites to be described in terms of one of the three strata.

The elevation of a site above the valley floor generally reflects the accessibility the inhabitants of a site would have to chert resources. Sites located on the valley floor would have the easiest access to chert. Sites situated in the valley upland zone, having a mean elevation of 35 meters above the valley floor, would have less access, while sites on the upland plateau, having a mean elevation of 325 meters above the valley floor, would have the least access to chert. All sites in any one stratum can be viewed as a class for which general statements concerning the expected nature of debitage within the stratum can be derived by analyzing the debitage from member sites.

## The Model

Newcomer (1971) has distinguished three general stages of flakes produced during the manufacturing of bifaces. While it is recognized that these stages may not be directly applicable to all types of manufacturing processes, the study can be utilized for analogy. The first stage of production is called "roughing out". Flakes are removed from a nodule using direct percussion and are consistently thick with cortex on the outer surface. Bulbs of percussion and undulations on the inner surface are prominent. The second stage of flake production, termed "thinning and sharpening", produces thinner flakes with some cortex. The third stage, called "finishing" is characterized by smaller flakes with no cortex, which are similar to those flakes produced in the second stage of production (1971:86-90). Newcomer concludes that flakes removed during the first stage are much larger than those in subsequent stages and that there is an incremental decrease in the size of flakes removed during the three stages of manufacturing (1971:93).

On the basis of Newcomer's experiments and research conducted by Collins (1976), Lavine-Lischka (1977) and others, debitage has been analyzed in terms of three activities designed to represent the various stages of flaked stone tool manufacturing. These definitions are quite simplistic, but are sufficient for this level of analysis. Primary reduction activity refers to the shaping of a nodule or block of chert into a core (after White 1963:5). Debitage produced by this activity would include large flakes, a high percentage of cortical material, angular fragments and large cores. <u>Secondary reduction activity</u> refers to the process of removing flakes from a core and the manufacturing of preforms from cores. Debitage produced by this activity would include smaller flakes and debris, less cortical material and fewer angular fragments. Some cores would be expected to be present. <u>Tool production/modification</u> refers to the process of manufacturing finished tools from preforms and modifying or resharpening existing tools. Debitage produced by this activity would include small flakes and associated debris, a low percentage of cortical material and numerous bifacial thinning flakes. Few cores would be expected to be associated with this activity.

The following model has been formulated in view of the previously discussed distribution of chert and archaeological sites in the Lookout Valley research area. The acquisition of chert nodules would be expected to largely occur at various locations along the valley floodplain. Nodules would be reduced and modified for use throughout the research area. The transport of chert from the floodplain to the higher areas of the valley and the mountain top would require increasingly greater expenditure of energy by the prehistoric inhabitants. Chert nodules are relatively large and heavy, consequently it would be more economical to reduce unmodified nodules to lighter cores or preforms prior to the removal of the chert from the resource areas.

It would be expected that a wide variety of debitage reflecting a full range of lithic manufacturing activities would be present in the valley floodplain stratum. These processes would include primary reduction, secondary reduction, tool use, modification and discard. It would also be expected that primary reduction of chert nodules to a more convenient and economical form for transport and use in the higher elevations of the research area would occur on the floodplain.

A limited amount of primary reduction activities would be expected to occur in the valley upland stratum. Secondary reduction, tool use, modification and discard would be more common activities in this area. Primary reduction would be expected to be an infrequently occurring activity on the upland plateau because of the distance to the chert resource area. Lithic activities in the upland plateau zone would also include some secondary reduction, but the majority of activities would, however, concentrate on tool use, tool modification/resharpening and discard.

## Selection of Attributes

In order to test hypotheses derived from the model, a number of attributes which have proven to be useful in discerning patterns of debitage variability were selected for use in the project:

a) Mean weight of debitage - The mean weight of debitage was determined for each site by dividing the total weight of debitage by the number of pieces of debitage recovered. Since only one type of raw material was utilized, this value is a good overall descriptor of flake size at a site.

b) Percent of cortical material - The percent of cortical material recovered from a site was derived by dividing the number of pieces of debitage with cortex on the outer surface by the total number of pieces of debitage recovered from a site.

c) Percentage of cores - The percentage of cores present in the debitage collection was determined by dividing the number of cores recovered by the total amount of debitage from a site.

The mean weight of cores at each site was also determined. The values of each of these attributes were determined for each site used in the analysis and were the criteria utilized in discerning patterns of *inter* and *intra* stratum debitage variability.

## Hypothesis Formulation

If the model presented is applicable to the pattern of prehistoric chert resource exploitation, evidence of primary reduction activity would be expected to be associated with sites located in the floodplain stratum. There should be incremental decrease in the presence of attributes associated with primary reduction as the distance to the chert resource area increases. Under the general model presented, the following predictions can be made concerning the type of debitage recovered from sites where primary reduction activities occurred:

a) Waste flakes and fragments will be larger than at sites where there was little primary reduction. A large mean flake weight will reflect this tendency.

b) Debitage collections will contain a higher percentage of cortical material than found at sites where other types of lithic reduction activities occurred.

c) A high or higher percentage of cores will be found at sites where primary reduction occurred. Cores will be larger at these sites because they will not be as fully utilized as in areas where chert is not readily available.

The results of the analysis of the Lookout Valley debitage will be examined from two perspectives: the inter stratum analysis, which will examine site debitage variability with respect to the distance from sites to the chert acquisition areas; and intra stratum analysis, which will examinge debitage variability within each of the strata.

Inter Stratum Debitage Variability

Values for the attributes used in the first stage of the analysis were first calculated for each of the 26 sites. Upon completion of this step, the mean, range and standard deviation of the attributes were calculated for all sites in each of the three strata. Figure 7 is a chart demonstrating the variation of the mean, range and standard deviation of the mean flake weight of sites in each of the strata. The relative difference in the elevation of sites in each of the strata is also shown.

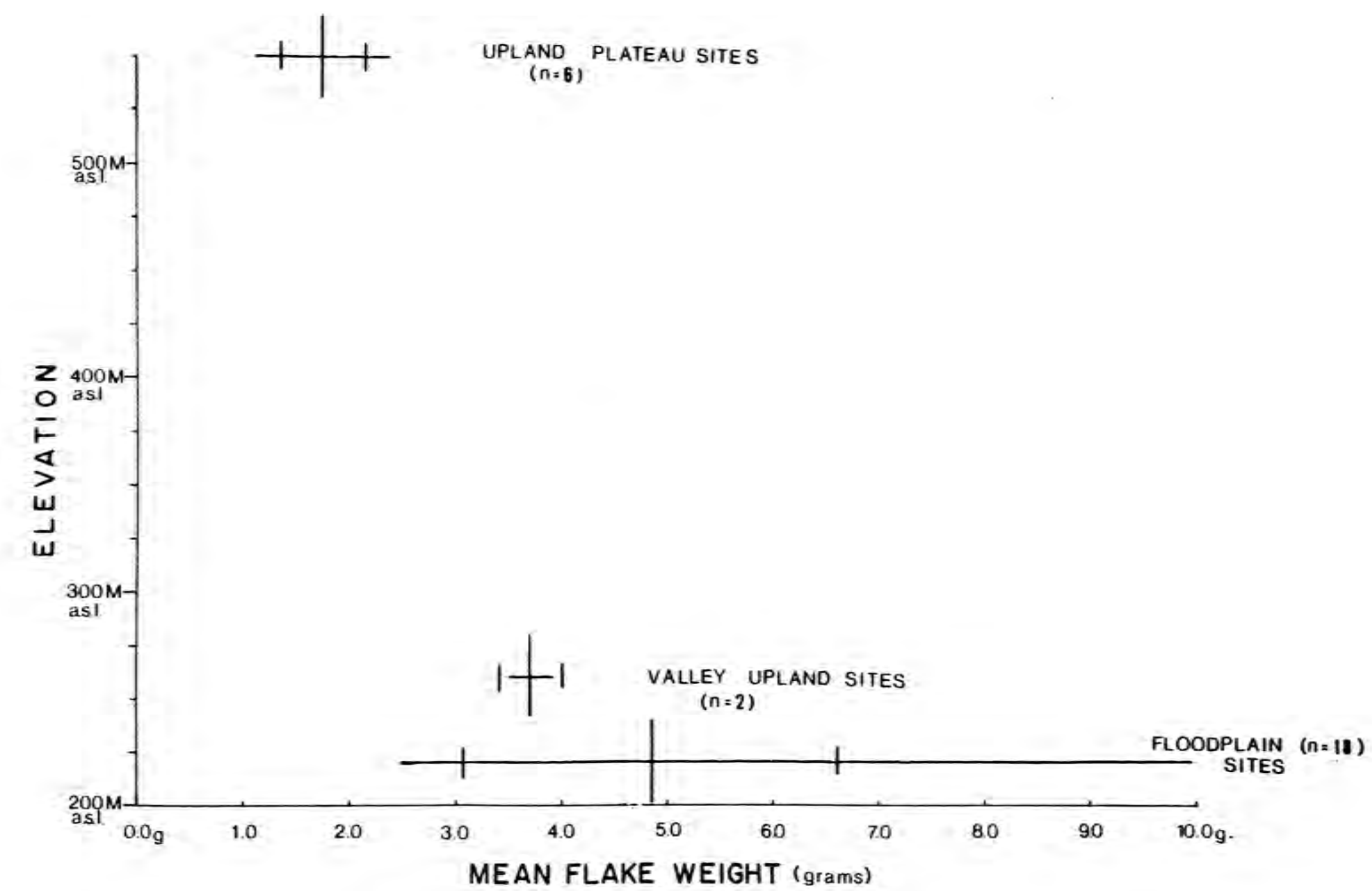


Figure 7. Mean, Range and Standard Deviation of the Mean Flake Weight of Debitage From Sites in Each Stratum.

Calculations of statistics for valley upland stratum sites are included, but the small sample size (n=2) of sites from that stratum may not fully reflect the range of variability present in that category of sites.

Sites in the floodplain have a mean flake weight of 4.8 grams, a standard deviation of 1.8 grams and a range of 2.5 to 10.0 grams. The great range and standard deviation reflect the degree of debitage variability among sites located in this stratum (Figure 8).

Sites located in the valley upland stratum which hypothetically had less access to chert resources were found to have a smaller mean flake weight of 3.7 grams, a standard deviation of .3 grams and a range of 3.5 to 3.9 grams. Sites in the upland plateau stratum have a mean flake weight of only 1.7 grams, a range of 1.1 to 2.3 grams and a standard deviation of .4 grams indicating a narrower range of flaked stone tool manufacturing or modification activities producing consistently smaller flakes.

The second attribute to be analyzed was the percentage of cortical material present at a site. Figure 9 is a chart showing the variation of the mean, range and standard deviation of the percentage of cortical material at sites in each of the three strata. The presence of a high percentage of cortical material would be expected to be associated with primary reduction activities. Sites on the floodplain have a mean percentage of cortical material of 38 percent, a range of 32 to 58 percent and a standard deviation of eight percent. Table 4 presents a comparison

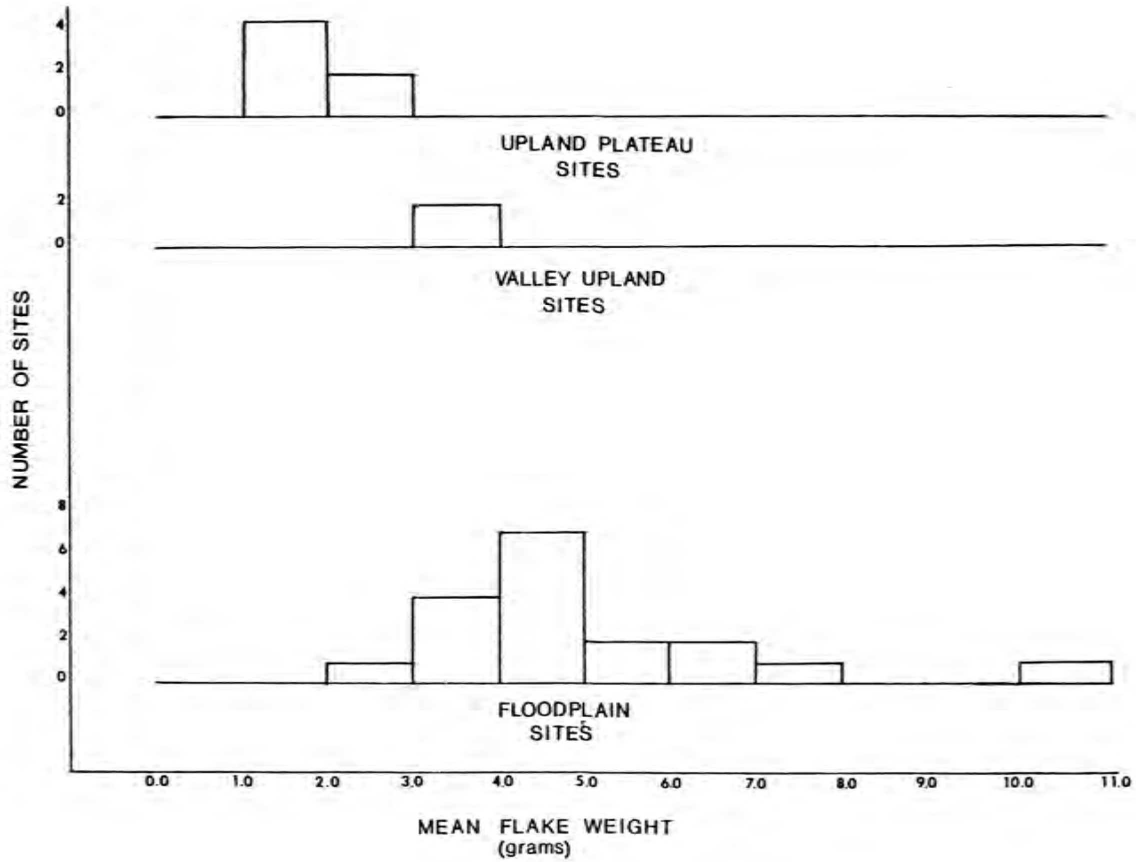


Figure 8. Distribution of Mean Flake Weight Values.

of debitage characteristics of those sites identified as being primarily Woodland with all sites located during the survey.

Table 4. Comparison of Woodland Sites With All Sites in the Lookout Valley Research Area.

| Sites | Mean Flake Weight | Mean Percentage of Cortical Material | Mean Percentage of Cores |
|---|---|---|---|
| Woodland Floodplain Sites | 4.8 | .38 | .013 |
| All Floodplain Sites | 4.6 | .39 | .012 |
| Woodland Valley Upland Sites | 3.7 | .47 | .020 |
| All Valley Upland Sites | 3.1 | .40 | .016 |
| Woodland Upland Plateau Sites | 1.7 | .21 | .003 |
| All Upland Plateau Sites | 1.6 | .20 | .002 |

The figures presented in Table 4 indicate that there is relatively little difference in the debitage attributes between Woodland sites and all sites in the research area. The great similarity of all the statistics presented in the table would tend to support the hypothesis that the variability of lithic processing activities as revealed through debitage found at sites in the various physiographic strata in the research area has not varied greatly through time.

An examination of the distribution of the values of the percentage of cortical material at floodplain sites disclosed that 78 percent (n=14)

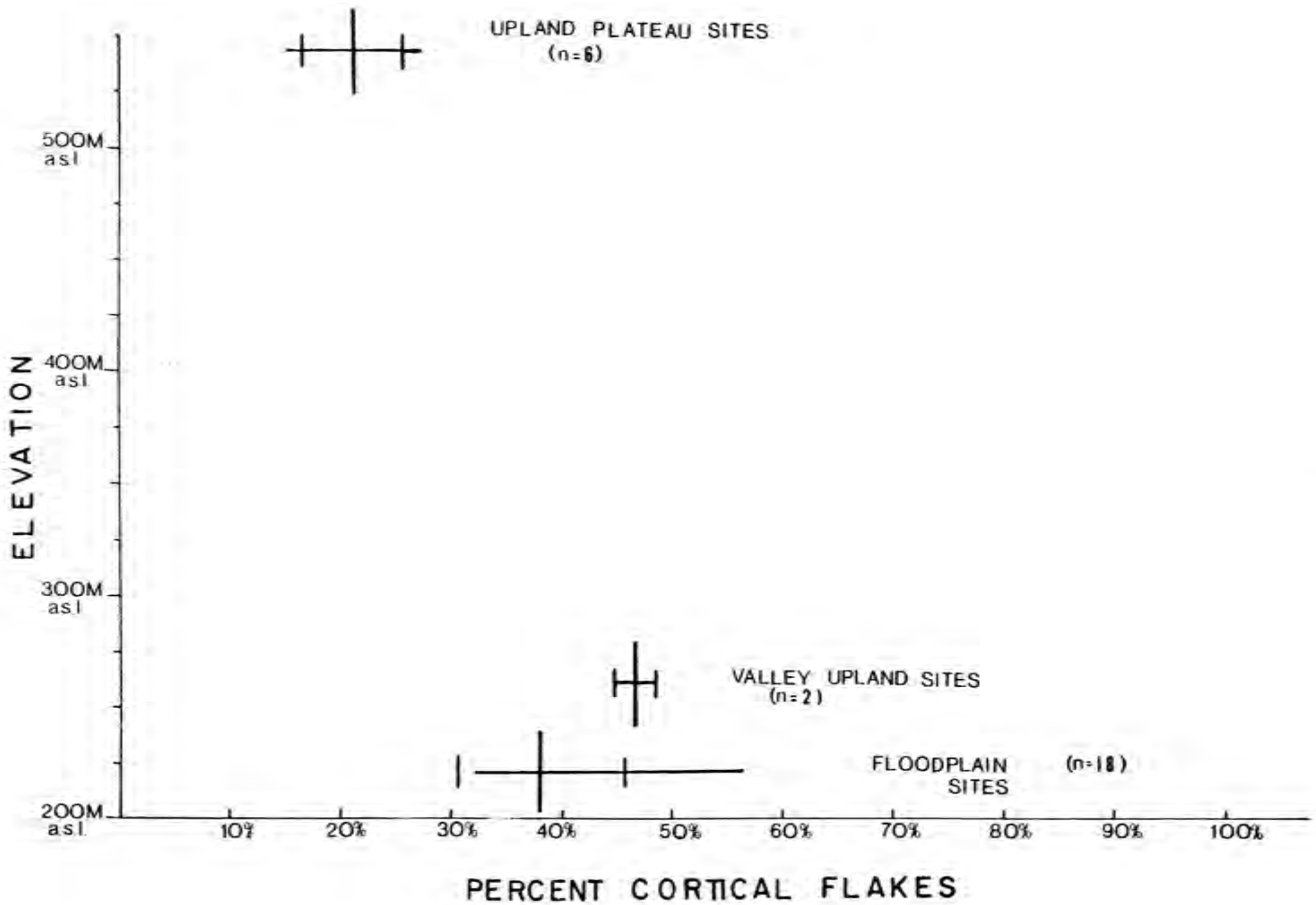


Figure 9. Mean, Range and Standard Deviation of the Percentage of Cortical Material at Sites in Each Stratum.

of the sites had percentages ranging between 30 to 40 percent, of which 56 percent of the sites (n=10) ranged between 30 to 35 percent cortical flakes. A comparison of floodplain sites with sites from the other two strata (illustrated in Figure 10) reveals that no sites outside of the floodplain have a percentage of cortical material in the 30 to 40 percent range.

Sites in the valley upland stratum have a mean percentage of cortical material of 47 percent, a range of 45 to 48 percent and a standard deviation of two percent. The relatively high mean of 47 percent falls within the upper end of the range of the floodplain sites which is incongruous with the proposed model. The high mean value of the debitage from sites in this stratum may reflect the small sample size of valley upland sites. When all valley upland sites which were located during the survey were analyzed (n=6), the mean percentage of cortical material was 40 percent. This percentage is more consistent with the expectations of the proposed model. The high percentage of cortical material at valley upland sites may also reflect the presence of scattered occurrences of low quality chert found on some of the valley ridge tops which may have been utilized by the prehistoric population to some extent.

The range and variability of the upland plateau sites is much more restricted than at sites on the floodplain. Sites on the upland plateau had a mean percentage of cortical material of only 21 percent, a range

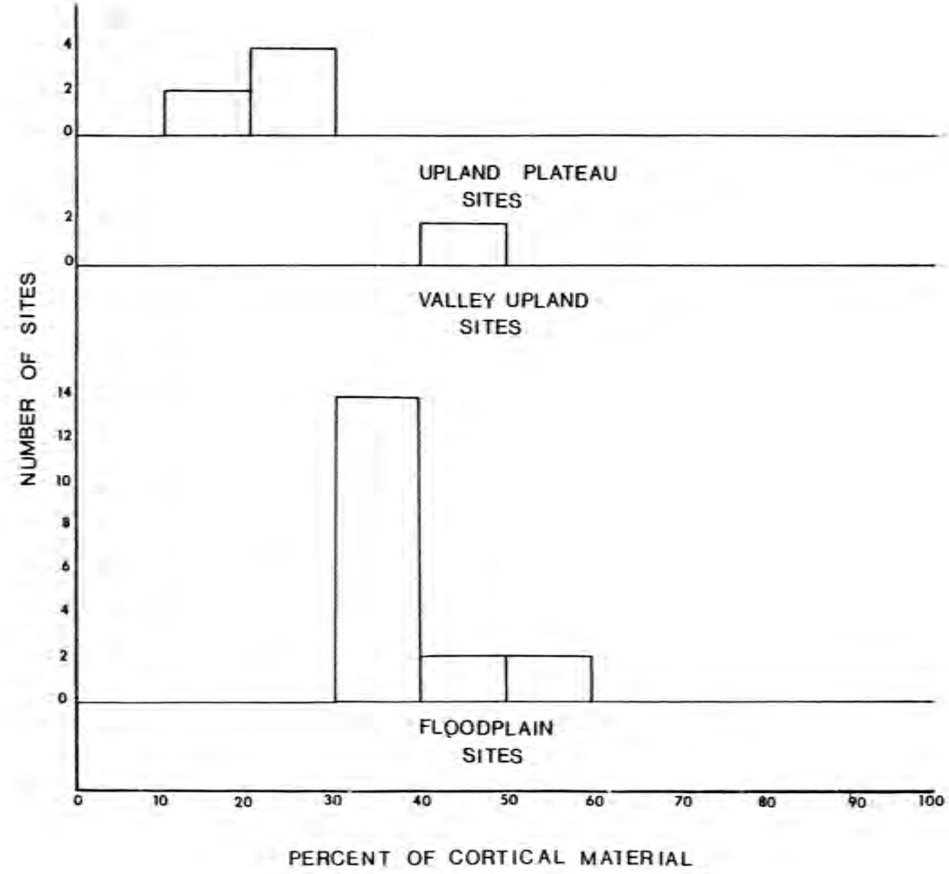


Figure 10. Distribution of the Mean Percentage of Cortical Material.

of 15 to 27 percent and a standard deviation of five percent. The mean and range of the upland plateau sites are well below the corresponding values of sites in the lower two strata.

Figure 11 is a scatter diagram of the two variables mean flake weight and percentage of cortical material for all Woodland sites used in the analysis. A multivariate statistical technique known as cluster analysis was utilized to delineate the three groups of sites shown in the diagram using the two aforementioned attributes as variables. The method used to analyze the site debitage is known as the minimum variance or Ward's method. This type of polythetic agglomerative clustering is based on within group variance. A cluster is defined as a group of entities in which the sum of squares among members of each cluster is minimal (Anderberg 1973). The computer program used in the cluster analysis is from M. Anderberg (1973). The analyses used the average squared Euclidean distance coefficient as a measure of item difference. A more detailed description of the clustering technique will be presented later.

The results of the clustering disclosed that there were three highly discrete clusters present (Figure 11). Cluster I contains six sites, all of which are located in the floodplain zone. These sites are characterized as having large flakes and a high percentage of cortical material. Cluster II contains 12 sites of which 10 are included in the floodplain zone and two are in the valley upland zone. Sites characteristically

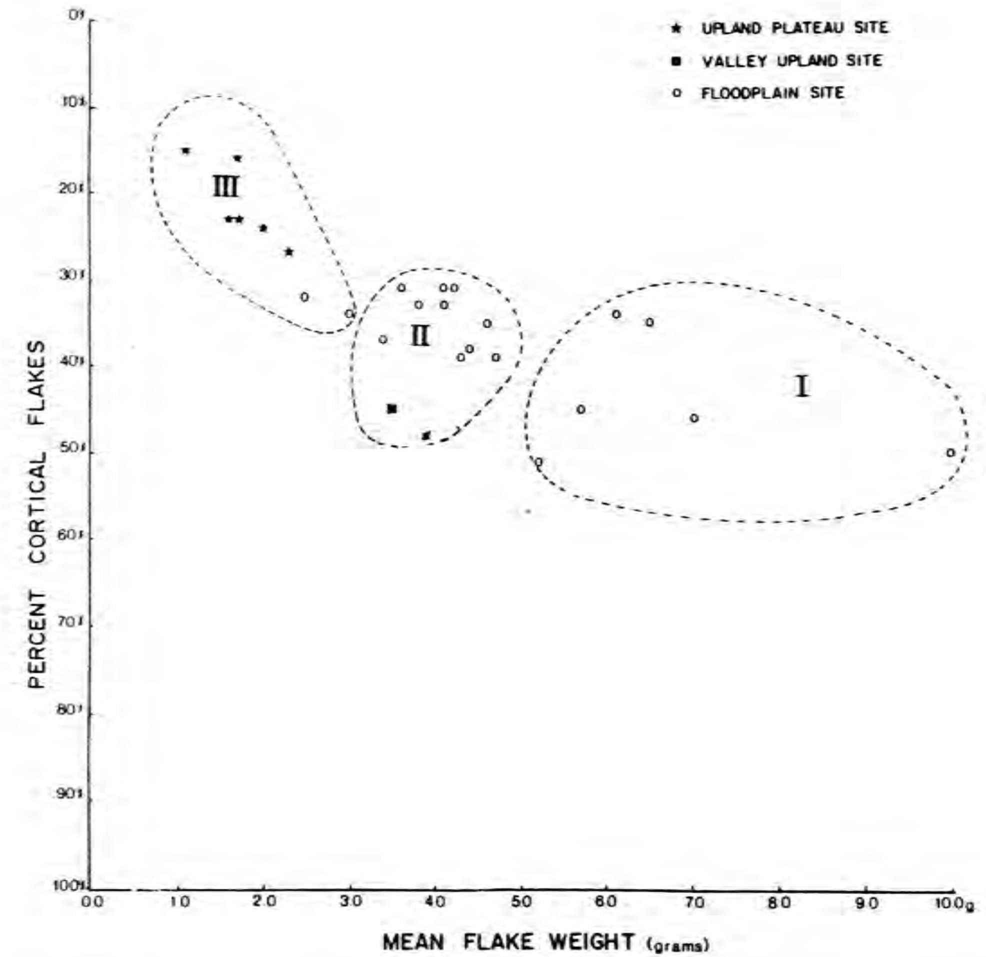


Figure 11. Scatter Diagram of Mean Flake Weight and Percentage of Cortical Material.

have a smaller mean flake weight and a lower percentage of cortical material than sites included in Cluster I. Cluster III contains eight sites. Seventy-five percent of the sites (n=6) are upland plateau sites, while 25 percent of the sites (n=2) are located in the floodplain. Cluster III sites are characterized as having a low mean flake weight and a low percentage of cortical material. Sites included in Figure 11 were first plotted using the values of the two debitage attributes, then site clusters were delineated on the basis of the results of the cluster analysis.

The correlation coefficients (r) were calculated to summarize the relationship between the two variables for the sites in each of the strata. Correlation coefficients indicate the degree to which variation in one variable is related to change in another variable and provide a means for comparing the strength of the relationship between one pair of variables and another (Nie, et. al. 1975:276-277). The coefficient of determination ($r^2$) was also calculated for each stratum. The coefficient of determination indicates that percentage of the total sample variation of "y" which is explained by "x". The following table summarizes the results of the analysis:

Table 5. Correlation of Mean Flake Weight and Percentage of Cortical Material.

| Strata | Correlation Coefficient (r) | Coefficient of Determination ($r^2$) |
|---|---|---|
| Floodplain | .763 | .582 |
| Valley Upland* | -- | -- |
| Upland Plateau | .816 | .665 |
| All Woodland Sites | .800 | .640 |

*not calculated because of small sample size

The correlation coefficient (r) for the two variables among all sites is .800. The coefficient of determination ($r^2$) is .640 meaning that 64 percent of the variability of the mean flake weight is explained by the percent of cortical material present at a site. Floodplain sites had a lower correlation of .763 explaining 58 percent of the variability, while upland plateau sites had a correlation coefficient of .816 explaining 67 percent of the variability. The difference in the values of the correlation coefficients suggests a wider range of activity among floodplain sites than indicated by debitage at sites in the upland plateau. The correlation coefficient for valley upland sites was not calculated because of the small sample size of sites in the stratum.

The third attribute analyzed was the percentage of cores present in the debitage collections from each site. Cores on sites in the floodplain formed .013 percent of the debitage or 13 cores per 1000 flakes and had a mean weight of 46.7 grams. Sites in the valley upland stratum had a slightly higher percentage of cores of .020 or 20 cores per 1000 flakes, but had a lower mean weight of 43.3 grams. Cores in the upland plateau stratum formed only .003 percent of the debitage or three cores per 1000 flakes, and had a mean weight of only 31.0 grams. Cores were found at only two of the six upland plateau sites which were analyzed.

In view of the results of this stage of the analysis, several trends in the patterning of debitage are evident:

a) As access to chert resource areas decrease, the mean size of flakes at sites tend to decrease.

b) There is a tendency for less cortical material to be present at sites as access to chert decreases.

c) Cores tend to decrease in percentage and size (weight) as access to chert decreases.

Collectively, these trends support the hypothesis that primary reduction activity is closely associated with the floodplain stratum.

If the model is correct, evidence of the final stage of tool manufacturing would be expected to form a higher percentage of debitage in the upland plateau stratum than at sites located at lower elevations. A 33 percent random sample of sites from the floodplain and upland plateau strata and both sites from the valley upland stratum were selected for further analysis. Debitage collections from these sites were divided into three categories: complete flakes, broken flakes and angular fragments. Complete flakes were subdivided into flakes of normal percussion and bifacial thinning flakes. Normal percussion flakes tend to be associated with primary and secondary reduction activities, while bifacial thinning flakes tend to be associated with the final phase of core preparation, preform manufacturing and tool modification/resharpening. The analysis disclosed that there is a decrease in the percentage of percussion flakes and a complimentary increase in thinning flakes as the distance to the chert resource areas increase. Table 6 presents the data used in calculating the percussion flake/bifacial thinning flake ratios. The ratio of percussion to thinning flakes in the floodplain stratum is nine to one, with bifacial thinning flakes representing approximately 10 percent of the complete flakes at these sites. The ratio decreases to three to one at sites in the valley upland strata and to less than two to one at upland plateau sites where bifacial thinning flakes represent 37 percent of the complete flakes. The percentage of angular fragments has a corresponding but less dramatic decrease as the distance to the chert resource areas increase. Angular fragments formed 23.7 percent of the debitage at floodplain sites. The value decreased to 16.9 percent at valley upland sites and to 17.7 percent at upland plateau sites. It would be expected that the production of angular fragments would be positively correlated with lithic modification activities utilizing normal percussion flaking.

Table 6. Quantitative and Percentage Composition of Debitage.

| Site Number | Percussion Flakes | Thinning Flakes | Angular Fragments | Broken Flakes | Total |
|---|---|---|---|---|---|
| Floodplain | | | | | |
| LV-1 | 110(20%) | 15(3%) | 144(27%) | 269(50%) | 538 |
| LV-3 | 76(13%) | 9(2%) | 217(36%) | 301(50%) | 603 |
| LV-15 | 88(17%) | 10(2%) | 76(15%) | 332(66%) | 506 |
| LV-36 | 97(19%) | 1(0%) | 107(21%) | 314(61%) | 519 |
| LV-51 | 25(16%) | 6(4%) | 51(33%) | 72(47%) | 154 |
| LV-64 | 192(36%) | 22(4%) | 81(15%) | 238(45%) | 533 |
| Total | 588(21%) | 63(2%) | 676(24%) | 1526(54%) | 2853 |
| Valley Upland | | | | | |
| LV-8 | 23(17%) | 8(6%) | 30(22%) | 75(55%) | 136 |
| LV-18 | 23( 8%) | 7(2%) | 43(15%) | 222(75%) | 295 |
| Total | 46(11%) | 15(4%) | 73(17%) | 297(69%) | 431 |
| Upland Plateau | | | | | |
| LV-28 | 110(23%) | 56(12%) | 83(18%) | 223(47%) | 472 |
| LV-29 | 138(25%) | 88(16%) | 98(18%) | 229(41%) | 553 |
| Total | 248(24%) | 144(14%) | 181(18%) | 452(44%) | 1025 |

Intra Stratum Debitage Analysis

The results of the first stage of analysis have demonstrated a high degree of inter stratum debitage variability. Analysis of the data also indicates that there is considerable debitage variability within each of the three strata. It was first necessary to assign sites in the research area to groups which shared common patterns of debitage. The Anderberg-Ward cluster analysis program was utilized for the initial classification of the sites.

The results of the clustering of the 26 sites shows that there are three clusters. These clusters (Figure 12) contain sites which have a high degree of between group variability and a low within group variability of debitage. The three variables, mean flake weight, percentage of cortical material and percentage of cores which were utilized for the inter stratum analysis, were used as variables in the cluster analysis. Cluster I consists of six sites which share attributes associated with a high frequency of primary reduction activity. The mean flake weight of Cluster I sites range between 5.2 and 10.0 grams and have a mean of 6.75 grams. The mean percentage of cortical material is 45 percent, ranging between 34 and 58 percent (Table 7). Cluster I sites have a mean percentage of cores ranging between .006 and .026 and have a mean of .019 or 19 cores per 1000 pieces of debitage.

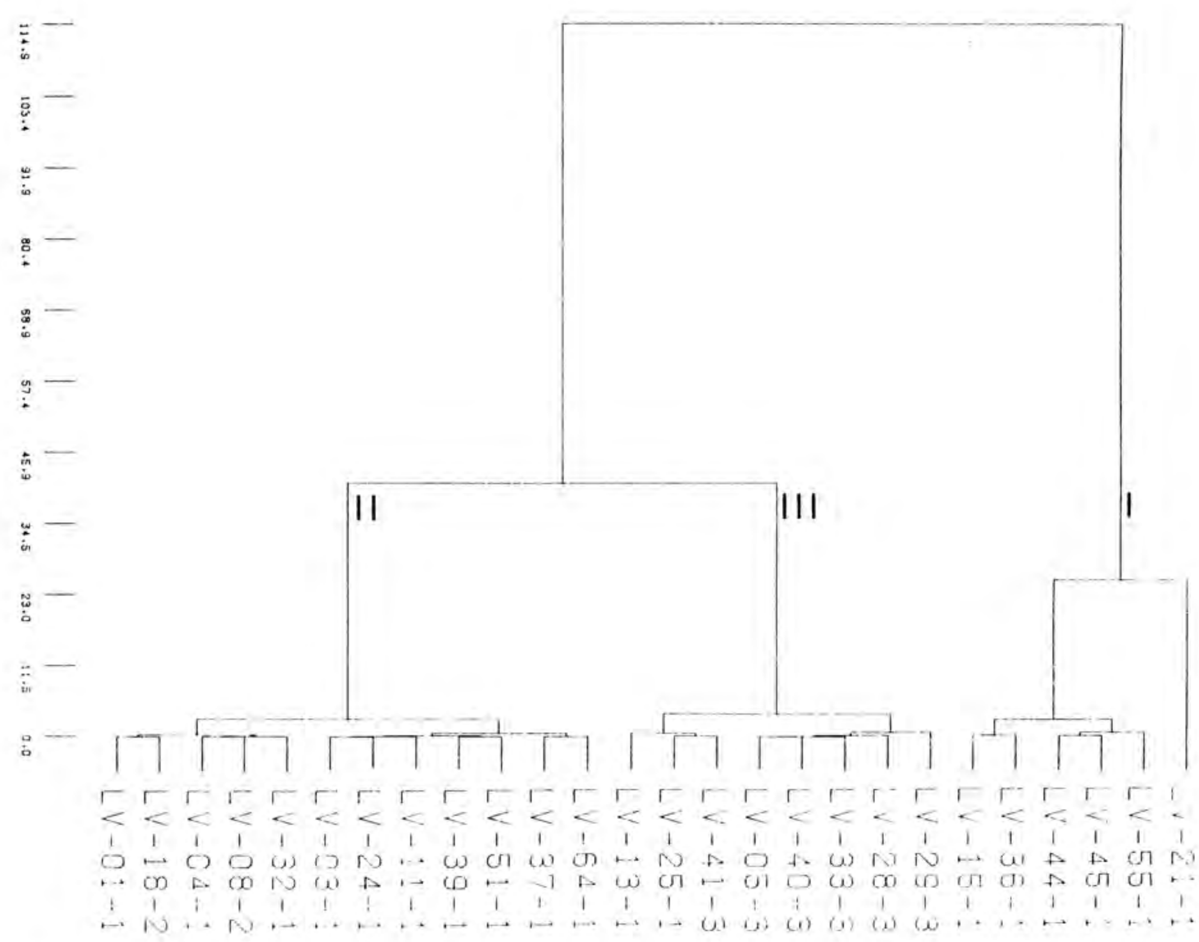


Figure 12. Dendrogram Showing Results of Cluster Analysis Using Ward's Method.

Table 7. Summary of Debitage Data for Sites Included in Clusters I-III.

| Cluster | Number of Sites | Mean Flake Weight | Mean Percentage of Cortical Material | Mean Percentage of Cores |
|---|---|---|---|---|
| I | 6 | 6.75 | .448 | .019 |
| II | 12 | 4.05 | .366 | .013 |
| III | 8 | 1.99 | .243 | .003 |

Cluster II contains 12 sites which tend to reflect that type of debitage expected from sites where there is less primary reduction, but considerable secondary reduction activity. These sites have a lower mean flake weight of 4.05 grams ranging between 3.4 and 4.7 grams, a lower mean percentage of cortical material of 37 percent which ranges between 31 and 48 percent and a lower percentage of cores of .013 ranging between .000 and .029.

Cluster III consists of eight sites which share debitage attributes which would be expected to be associated with a low frequency of occurrence of primary and secondary reduction activities. The mean flake weight of Cluster III is 1.99 ranging between 1.1 and 3.0 grams. The mean percentage of cortical material ranges between 15 and 34 percent with a mean of 24 percent. Cores infrequently occur at Cluster III sites as indicated by the low mean percentage of .003 or three cores per 1000 pieces of debitage. Cores were only found at three Cluster III sites.

The most commonly occurring lithic processing activity at Cluster III sites would be expected to be associated with the final stages of tool production and modification of existing tools.

According to the model of lithic resource utilization presented, sites located in the floodplain would display the widest range of debitage variability. Sites in the valley upland zone would reflect a narrower range of activities, while sites on the upland plateau would have the most restricted range of activities. Examination of the location of sites assigned to each of the three clusters reveals that sites in the floodplain were included in all three of the clusters indicating a wide range of debitage variability among sites located in this stratum. Valley upland sites were present only in Cluster II which is characterized by middle range attribute values that are not as high as Cluster I attributes or as low as attribute values in Cluster III. Upland plateau sites were present only in Cluster III which is characterized by a very low mean flake weight, a low percentage of cortical material and a very low percentage of cores.

The results of the intra stratum analysis demonstrate that floodplain sites are distributed through all three clusters, while upland plateau sites are restricted to one cluster. Inter stratum analysis showed that floodplain sites have the widest ranges and the highest standard deviations of the attributes which were analyzed. Upland plateau sites had much smaller ranges and much lower standard deviations. Both of these analyses demonstrate that as the distance to the chert resource areas increases, there tends to be a decrease in the range of lithic manufacturing activities.

CHAPTER VII

# ANALYSIS OF PROJECTILE POINTS

## Problem

Archaeological investigation in the Southeastern United States has resulted in the accumulation of large collections of lithic material from a wide variety of archaeological sites. Projectile points usually form the largest single category of lithic tools recovered from archaeological research units. Consequently, projectile points have been the subject of numerous and varied classification schemes. Projectile points have been of special interest to prehistorians for several reasons. Projectile points, unlike most other flaked stone tools, conform to a relatively narrow range of morphological variability. Certain combinations of attributes have been recognized to co-occur on projectile points during certain periods of time enabling analysts to group points which share these attributes into projectile point "types". It has also been observed that projectile point attributes tend to change through time and over space enabling archaeologists to use projectile points as an indicator of temporal, spatial or cultural variability. These characteristics are not commonly found among other categories of flaked stone tools.

In the past, the classification of projectile points has been a rather subjective or arbitrary operation based largely on intuitively discerned morphological attributes. Projectile point types have traditionally been based on detailed descriptions of these attributes which co-occur on the artifacts. The intuitive properties of the traditional projectile point classification schemes result in a wide range of variability of artifacts included in a defined type. Most intuition based typologies include items which share a few of the recognized attributes such as notching, base shape or blade shape. Typologies designed solely on intuitive sorting procedure do not take into account the subtle variation that occurs in the attributes designated for analysis. The number of attributes used in grouping items in the intuitive based typologies are, because of the limits of the human mind, limited to a relatively small number when compared to the number that can be simultaneously analyzed by more objective criteria (Sackett 1968:73). When an archaeologist places a collection of projectile points into groups, he is apt to select, either consciously or unknowingly, a small subset of attributes and to classify the items using these attributes alone (Christenson and Read 1977: 164). It is also likely that the attributes selected for the analysis will not be measured consistently on all points under investigation. While all projectile point classification schemes are based on types containing a continuum of attribute variability, it may be possible to greatly reduce the within group variability by utilizing more meaningful attributes derived through multivariate analysis.

Previous Research

The development of an objective clustering technique for lithic material in archaeology is not a new one. Research by Spaulding (1953), Sackett (1966), Montet-White (1973, 1974), Gunn and Prewitt (1975), Christenson and Read (1977), Thomas (1970) and others has been oriented toward the goal of developing means of grouping artifacts for analysis. These techniques are based on quantitative attributes of the artifact that can be consistently and objectively measured, recorded and analyzed. Various multivariate statistical techniques are capable of analyzing large numbers of cases with numerous attributes in a very short time.

One problem associated with using a set of measurements to describe an artifact exists in the form of transforming the continuous line forming the outline of the tool into a series of discrete measurements (Montet-White 1973). Many different measuring techniques have been employed by the various analysts working with projectile point classification schemes. Many researchers have used linear and angular measurements of projectile points as attributes (Christenson and Read 1977, Thomas 1970). Others have used polar coordinate measurements (Montet-White 1974). The polar coordinate technique produces a series of continuous measurements taken from regularly spaced locations on the projectile point, while the linear-angular technique produces a set of measurements taken from various selected locations on each point (length, width, notch angle, etc.).

One of the first applications of the polar coordinate measuring technique in lithic analysis was carried out by Montet-White during her analysis of lithic material from the Le Malpas rockshelter in France. It was discovered that the linear-angular measurements were not particularly useful in some types of analysis since there was no means to reconstruct the complete tool outline from the selected measurements. The polar measurements proved to be valuable in the grouping of tools since the technique minimizes the loss of information encountered in transforming irregular geometric shapes into a number of discrete measurements. The technique produces measurements which are compatible with a variety of multivariate statistical analytic techniques and allows the artifact to be reconstructed from the original data set (Montet-White 1973:61).

Montet-White later used the polar coordinate technique with Archaic projectile points from Missouri. Eighteen measurements were made on each projectile point of which 12 were taken at 30° intervals around the margins of the point and six were taken from the centroid of the point to specific landmarks on the point. The analysis of the data set using Principal Components analysis was successful in discerning a number of properties which were characteristic of the technological structure of the projectile points. Experiments have shown that the use of the polar coordinate grid was an effective technique of measuring when the analysis was concerned with the functional and formal properties of an industry (Montet-White 1974:21-22).

Montet-White observed that the principal components analysis of the variables did not result in the definition of traditional projectile point types. The results of the analysis indicated that the polar coordinate system of measurements was not able to discern or record the variability in the basal or hafting portion of the projectile points which may partially explain the lack of definition of traditional types where basal or haft morphology is usually an important criteria for classification (Montet-White 1974:21-22). In view of the aforementioned factors, the polar coordinate measuring technique was selected in preference of the other possible techniques for use in the analysis of the Lookout Valley projectile points.

## Data Set

The projectile points used in the analysis were selected from lithic material collected during the surface reconnaissance of sites in the Lookout Valley research area and points excavated from the Tunnacunnhee site (9Dd25). Projectile points and ceramics served as the primary means of classifying a site as being Woodland. In order to determine the temporal association of the primary occupation of a site, it was necessary to compare the points recovered during the survey with traditional projectile point types established through time by regional archaeologists. Much difficulty was encountered during the operation of "dating" the projectile points because of the high degree of morphological variability among projectile points in the collection. Many of the traditional classification schemes depict the "typical" point through a picture or series of pictures which do not represent the full range of variability present in the "type", if in fact, the "type" exists. The operation of matching many of the projectile points collected during the survey with the type photographs was at best, a subjective procedure of which the disadvantages have already been discussed.

Analytical Procedure

In view of the aforementioned problems and limitations, the decision was made to devise a technique of grouping projectile points which would be efficient, replicable and result in the creation of comparable groups of projectile points having a minimum amount of within group variability and a maximum amount of between group variability. The polar coordinate measuring technique was determined to be the most efficient means of measuring projectile point morphological variability. Several problems were initially encountered while measuring the projectile points, the primary one being that of the accurate measurement of a three dimensional form. The error in measuring caused by this problem was greatly reduced by placing the point on a sheet of photographic printing paper in the darkroom, exposing the points to light from a photographic enlarger and developing the print, producing a two dimensional image of each point. A minimal amount of distortion of the point shape was caused by this procedure and the resulting measurements were more accurate and more consistently replicable than those made using the actual projectile point. Once the photograph of the point was prepared, the centroid of the point was located and served as a reference point for the measurements. The locus of the centroid of a point is defined as the midpoint of the line connecting the tip of the point and the midpoint of the base.

A plastic transparency of the polar coordinate grid was placed over the point image with the center of the grid over the centroid of the projectile point image (Figure 13). The polar axes radiate from the central point of the polar grid at five degree intervals. The 0/360 degree line served as the axis of the origin of the polar coordinate grid, extending from the centroid of the point to the midpoint of the base. Angle vectors were measured from the axis of origin in a counterclockwise direction. Distance was measured from the centroid of the point to the intersection of the polar axes with the edge of the artifact (after Montet-White 1973).

A random sample of points was selected from the unbroken projectile points recovered during the survey for preliminary testing of the usefulness of the polar coordinate measuring technique. The data matrix used in the initial analysis consisted of 59 cases and 37 variables. The first

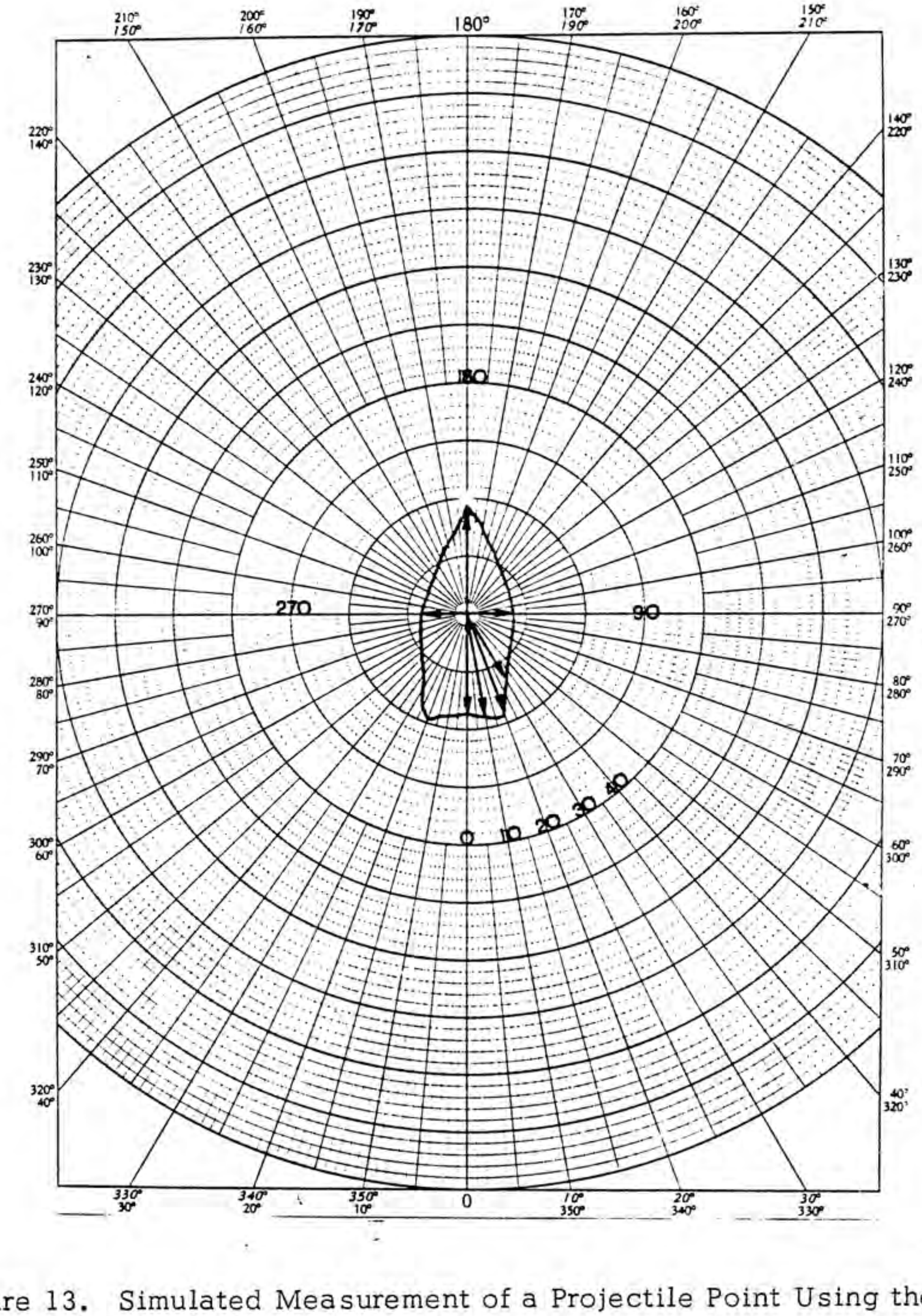


Figure 13. Simulated Measurement of a Projectile Point Using the Polar Coordinate Grid.

36 variables measured were the lengths of the vectors formed by the polar axes. These vectors are defined by certain lengths, with the point of origin at the centroid of the point and measured in ten degree increments. The 36 variables contribute data that defines two dimensions of the point, length and width, while variable 37, thickness of the projectile point taken at the midpoint of the 0/360°-180° line was obtained by measuring the actual projectile point and contributes data concerning a third dimension.

Metric data from 59 projectile points was analyzed using a principal components analysis from the Statistical Package for the Social Sciences (SPSS) computer program (Nie, et. al. 1975). A correlation matrix based on the correlation between variables (or attributes) served as the basic input to the analysis. The principal factoring without iteration option was selected for the analysis. This option does not alter the main diagonal of the correlation matrix and the principal components formed by the analysis are exact mathematical transformations of the original variables (Nie, et. al. 1975:479). No rotation of the factors was done in the initial experiment with the data set.

Principal components analysis involves finding a new and often smaller set of variables or components linearly related to the old set. The components or new variables are uncorrelated, making it possible to regard the analysis as exploiting any correlation between the original variables, replacing them with fewer and uncorrelated variables. Many of the original variables may be correlated because of some unobserved effect that is not directly measured by the original variables (Doran and Hodson 1975:191).

Two types of principal components analysis can be conducted with a data set: a Q mode analysis (based on the correlation between units) examines the cases across variables; and R mode analysis (based on correlation between variables) examines variables across cases. R mode analysis was selected for use in these experiments. The purpose of the R-mode analysis is to create components from original variables that summarize the variability in the sample of projectile points. Analysis of the data set (59 cases, 37 variables) disclosed that the first three components created by the principal components analysis accounted for 80.3 percent of the total variability in the sample of points. Component I had high correlations with those variables which describe the shape of the blade of the projectile point (40°-170°, 190°-320° vector lengths) and account for 56.5 percent of the total variability measured by the attributes. Component II had high correlations with those variables which measure point length (0°-20°, 180°, 340°-350° vector lengths) and account for 17.2 percent of the total variability. The third component represents those variables defining the area of the projectile point where the various treatments for hafting (notching, stems, etc.) are located (30°, 330° vector lengths). Component III accounts for 6.6 percent of the total variability as measured by the designated attributes. Examination of the sources of variability in each of the three components indicates that Component I consisted of 27 variables having high correlations (.50 of higher) with that component. The large number of variables having high correlation coefficients indicates that the information contributed by the variables may be redundant and the number of variables being measured may be reduced without a great loss of information. Components II and III each contain a much smaller number of variables having high correlation coefficients. The decision was made to revise the attribute list used in measuring the points so as to reduce the number of vectors measured in the area represented by Component I and increase the number of vectors in the areas represented by Components II and III. The modification of the choice of attributes to be measured would ideally result in a more detailed measure of the morphological variability in the selected areas of the projectile point. The new list of attributes to be measured is presented in Table 8.

The second data set to be analyzed consisted of 167 projectile points which included most of the 59 points used in the first analysis previously described. Thirty-six polar coordinate vector measurements were made on each projectile point using the revised list of attributes presented in Table 8. Attribute 37 was the thickness of the projectile point at the centroid. The first analytic technique selected for use was an R-mode factor analysis of principal components analysis. The

Table 8. List of Polar Coordinate Vectors Used as Attributes in Projectile Point Analysis.

| Vector Number | Vector Angle |
|---|---|
| 1 | 0° |
| 2 | 10° |
| 3 | 15° |
| 4 | 20° |
| 5 | 25° |
| 6 | 30° |
| 7 | 35° |
| 8 | 40° |
| 9 | 45° |
| 10 | 60° |
| 11 | 70° |
| 12 | 90° |
| 13 | 100° |
| 14 | 120° |
| 15 | 130° |
| 16 | 150° |
| 17 | 160° |
| 18 | 170° |
| 19 | 180° |
| 20 | 190° |
| 21 | 200° |
| 22 | 210° |
| 23 | 230° |
| 24 | 240° |
| 25 | 260° |
| 26 | 270° |
| 27 | 290° |
| 28 | 300° |
| 29 | 315° |
| 30 | 320° |
| 31 | 325° |
| 32 | 330° |
| 33 | 335° |
| 34 | 340° |
| 35 | 345° |
| 36 | 350° |
| 37 | Thickness at midpoint |

program selected was a modified version of the BMD 8M program with varimax rotation from the Biomedical package of computer programs (Dixon 1973). The principal components analysis was conducted using a covariance matrix as the basic input. Only those factors with eigenvalues greater than 1.0 were rotated using Kaiser's criterion.

A total of 14 components was created from the data set during the principal components analysis. Examination of the total variance contributed by each of the components demonstrated that 86.4 percent of the total variability could be accounted for by the first three components. Component I accounted for 66.8 percent of the total variance. Variables which had high correlations with Component I are those generally associated with measuring the length of the projectile point (0°-25°, 150°-210°, 335°-350° vector lengths). Component II accounted for 13.4 percent of the total variance and expressed the shape of the blade of the projectile point. Attributes which measured variation in blade shape are highly correlated with Component II (45°-160°, 210°-315° vector length). Component III contributed 6.2 percent of the total variability and expressed the variation in the area of the projectile point which would be expected to be affected by the variation of hafting techniques (stems, notches, etc.). Attributes which express this characteristic are represented by vectors between 30°-45° and 315°-330°.

The wide range of morphological variability present among projectile points included in the analysis made it possible that the results of the principal components analysis could be biased by extreme cases. Extreme cases or outliers are represented by those items which fall beyond the normal range of variability of sample members (Christenson and Read 1977:170). Each of the projectile points included in the analysis can be measured by three new variables (Components I, II, and III) which accounted for 86.4 percent of the total morphological variability of the points. The 167 cases, each with three new variables, were analyzed using an Identification of Outliers program (BMD 10M) from the Biomedical computer program (Dixon 1973). The program screens multivariate data for outliers by computing the Mahalanobis distance of each case from the center of the distribution of the remaining cases. The case is removed if the probability of the F-statistic corresponding to the greatest distance is smaller than a specified value. This process continues until all probabilities are sufficiently large (Dixon 1973:227). The value of the probability of the F-statistic was set at .05 for the purposes of this analysis. Thirty-eight of the 167 cases (22.8 percent) were determined to be outliers with the probability set at .05. Projectile points which are removed by the outlier program are not lost from the analysis, but may represent unrecognized classes of data or unique items (Christenson and Read 1977:170-171). Examination of those projectile points removed by the outlier program disclosed that the group included points which were extremely long, short, wide or asymetrical in shape.

The completion of the removal of the outliers left 129 cases for further processing and analysis. The new data set was analyzed using the BMD 8 R-mode factor analysis having the same program options that were used in the first analysis, except that the number of components to be formed was set at three. Results of the analysis revealed that three components accounted for 83.8 percent of the total morphological variability measured by the selected attributes. Component I, as with the first stage of analysis, represented the overall length of the points with those variables between 0°-25°, 150°-210° and 335°-350° having the highest correlations with the component (Table 9). Component I contributed 61.6 percent of the total variance of the sample of projectile points. Component II expressed the shape of the blade and formed 14.0 percent of the total variance. Component II has high correlations with those variables between 35°-160° and 210°-320°. Component III expressed variability in the hafting area of the projectile point (25°-35° and 320°-335°) and formed 8.2 percent of the total variance. It is interesting to note that while the number of vectors passing through the area hypothetically affected by hafting was doubled after analysis of the first sample of 59 projectile points, the individual proportion of the total variance formed by Component III increased only slightly from 6.6 percent to 8.2 percent in the second analysis. Traditional projectile point typologies rely greatly on hafting characteristics to discriminate among projectile points types, yet in the results of this analysis, the

Table 9. Correlation Coefficients of Variables and Components Using 129 Cases and 37 Variables.

| Variable Number | Vector Angle | Component I | Component II | Component III |
|---|---|---|---|---|
| 1 | 0 | .96021 | .14074 | .08515 |
| 2 | 10 | .95324 | .14587 | .14129 |
| 3 | 15 | .92873 | .13081 | .24804 |
| 4 | 20 | .85660 | .08242 | .37912 |
| 5 | 25 | .63062 | .08262 | .58237 |
| 6 | 30 | .23091 | .29048 | .76704 |
| 7 | 35 | .03556 | .53043 | .62719 |
| 8 | 40 | .10234 | .65415 | .49179 |
| 9 | 45 | .19449 | .70519 | .37159 |
| 10 | 60 | .16381 | .77043 | .25441 |
| 11 | 70 | .07636 | .79954 | .22776 |
| 12 | 90 | .09868 | .82215 | .08690 |
| 13 | 100 | .20852 | .82760 | .08060 |
| 14 | 120 | .28457 | .79784 | .10150 |
| 15 | 130 | .34316 | .78118 | .04759 |
| 16 | 150 | .54383 | .64516 | -.02471 |
| 17 | 160 | .70796 | .59078 | .01124 |
| 18 | 170 | .82338 | .40773 | -.01785 |
| 19 | 180 | .95198 | .14234 | .08950 |
| 20 | 190 | .84798 | .34654 | .02178 |
| 21 | 200 | .77700 | .49743 | -.00860 |
| 22 | 210 | .69214 | .57658 | .02672 |
| 23 | 230 | .44488 | .72585 | .16421 |
| 24 | 240 | .34348 | .78094 | .12152 |
| 25 | 260 | .15256 | .86393 | .20979 |
| 26 | 270 | .11578 | .78425 | .20974 |
| 27 | 290 | .04942 | .75590 | .34341 |
| 28 | 300 | .13406 | .75012 | .31470 |
| 29 | 315 | .14385 | .66925 | .41799 |
| 30 | 320 | .12663 | .59482 | .53291 |
| 31 | 325 | .05889 | .44065 | .68174 |
| 32 | 330 | .22047 | .27335 | .76303 |
| 33 | 335 | .66547 | .09684 | .60627 |
| 34 | 340 | .83593 | .05945 | .40139 |
| 35 | 345 | .94062 | .10348 | .22064 |
| 36 | 350 | .95871 | .11610 | .12741 |
| 37 | Thickness | .42660 | .33024 | -.04534 |
| Cumulative Proportion of Total Variance | | 61.6 | 75.6 | 83.8 |

variation in the morphology of that portion of the projectile point affected by hafting accounted for only 8.2 percent of the total variance of the point.

A two dimensional plot of the 129 projectile points (Figure 14) based on factor scores of Components I and II was prepared to visually examine the distribution of points with respect to the traditional point types in which the projectile points were placed at the beginning of the analysis. If discrete projectile point types are present among members of the sample, it would be expected that those points which are members of one type would tend to be clustered. Examination of the distribution of points on the plot reveals that this is not the situation among members of the sample. Points in some of the traditional types (Types 1, 3 and 6) tend to be concentrated in certain areas of the plot, but generally there is a great overlap of all point types. The results of the analysis tend to suggest that the traditional projectile point typologies currently used by many archaeologists in the Southeastern United States are not particularly useful mechanisms for grouping points into homogeneous classes.

A principal components analysis using the correlation matrix as the basic input unit was also performed on the data set of 129 cases and 37 variables. Several investigators who have done research in the area of projectile point analysis have used the correlation matrix as input for principal components analysis. There was no substantative difference

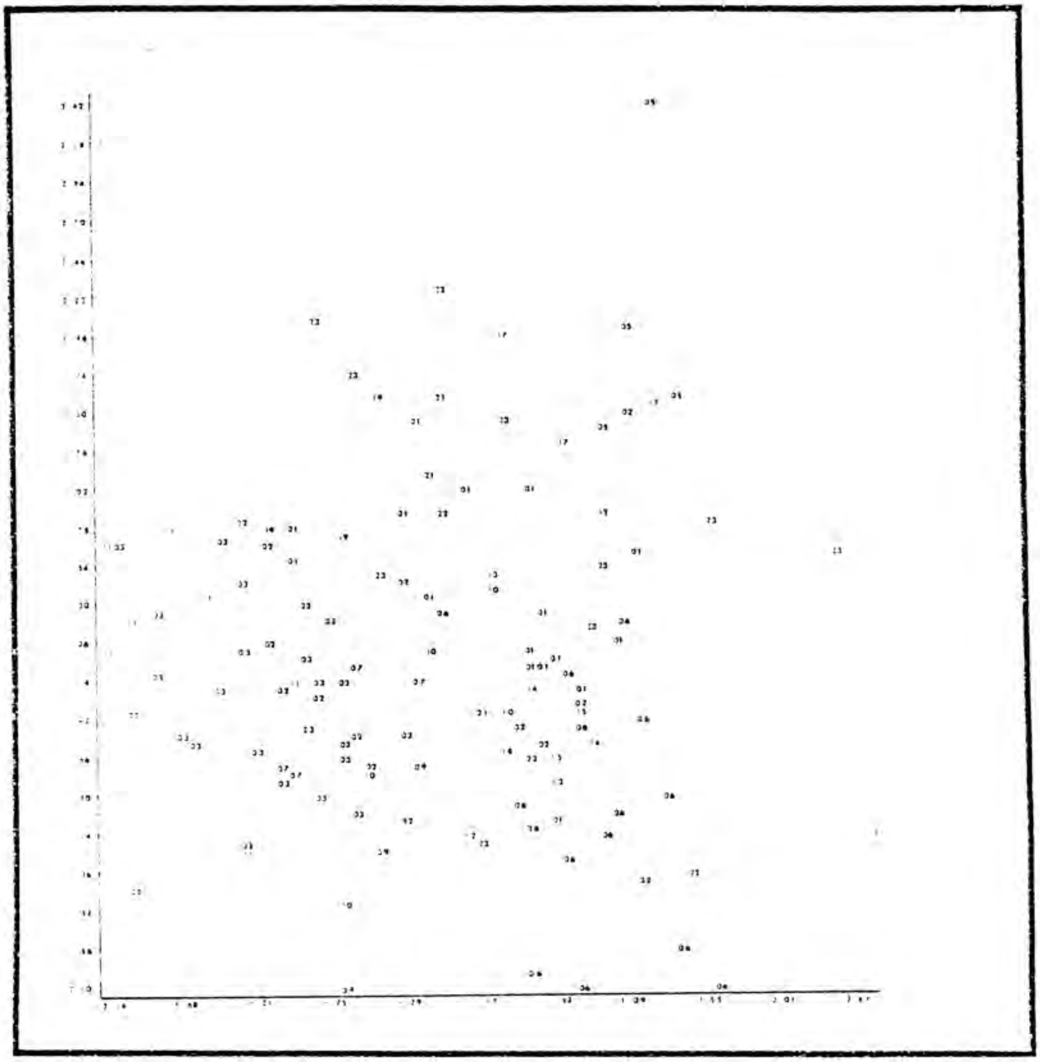

Figure 14. Plot of Projectile Points Based on Factor Scores of Components I vs II.

in the result of the analysis using the correlation matrix than from that using the covariance matrix derived from the aforementioned data set.

The use of the two dimensional plot as a means of discerning patterns of similarity among projectile points is restricted in that it can only take into account the variability contributed by two variables or components at one time. Several types of multivariate analytical techniques are available which can be utilized to analyze a large number of variables simultaneously. The technique of cluster analysis was selected for the purpose of further analyzing the data set under investigation. Cluster analysis has been utilized as an effective tool with which to form hypotheses about category structure. Cluster analysis can assemble observations into groups which prior misconceptions or ignorance would prevent. It can apply a system of grouping more consistently in a large data set than can the human brain (Anderberg 1973:4).

Recent discussions have centered on the merits of using cluster analysis as a grouping technique in archaeology. Christenson and Read have criticized the use of cluster analysis as a technique of numerical taxonomy for the initial classification of raw data because of the problem of irrelevant variables. The removal of these variables and the classification of the remaining variables by the R-mode factor analysis (or principal components analysis) make the utilization of cluster analysis appropriate in the definition of artifact types (Christenson and Read 1977:174).

The method of cluster analysis used to analyze the sample of projectile points is known as the minimum variance of Ward's method. Ward's method is a polythetic agglomerative clustering technique based on within group variance. Ward's method is designed to find at each stage those clusters whose merger gives the minimum increase in the total within group error sum of squares (Anderberg 1973:141-142). A cluster is defined as a group of entities in which the sum of squares among the members of each cluster is minimal. Most clustering procedures start with a matrix of similarities or distances and measure relationships between each pair of units. The process is repeated during the procedure until all units "similar" to existing clusters have fused into one (Doran and Hodson 1975:175). The computer program used in the cluster analysis was from Anderberg (1973). The analyses here used the average squared Euclidean distance coefficient as a measure of item differences. The data set used in the cluster analysis consisted of 129 cases (projectile points) and three variables (factor scores from Factors I, II and III). The first three factor scores cumulatively formed 84 percent of the total variance measured by the original attributes.

The dendrogram (Figure 15) based on the results of the clustering of 129 projectile points shows that there are four major clusters and numerous subclusters present in the data set. The clusters are discrete, which suggests a relatively high between group variance and a

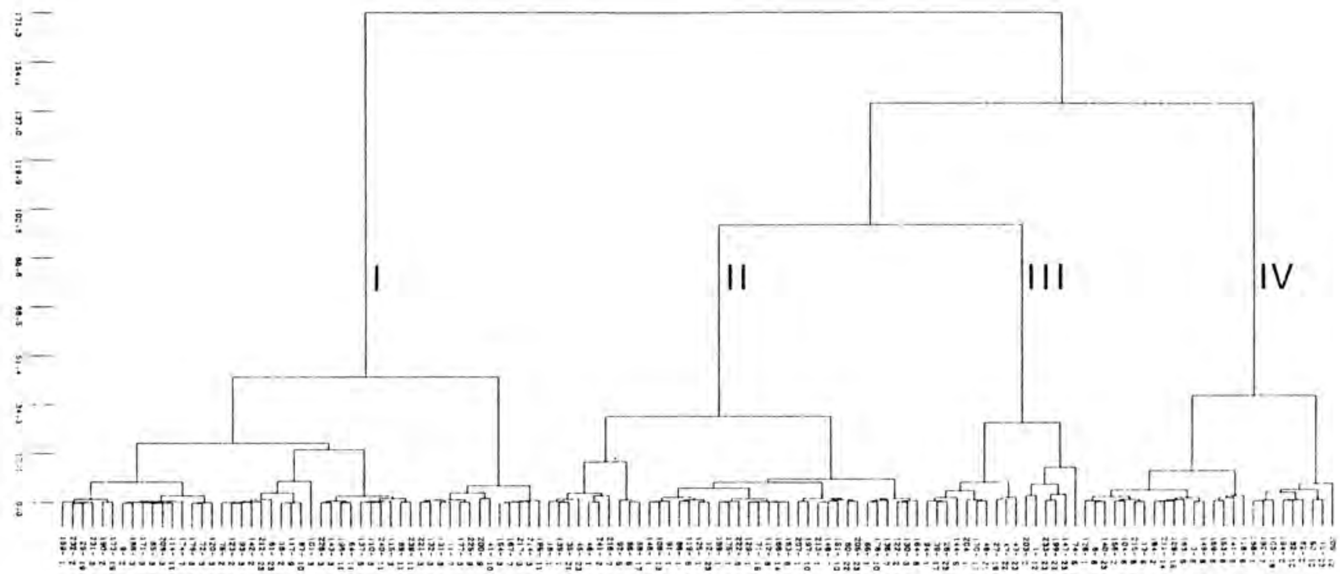


Figure 15. Dendrogram Showing Results of Cluster Analysis Using Ward's Method.

low within group variance. Examination of the projectile points contained in each cluster reveals that the points shared attributes associated with projectile point length and blade shape, but there was a lack of discrimination among points having different hafting characteristics. Some subclusters contain projectile points which tend to reflect traditional point typologies, but the poor discrimination among points having different hafting features negated this tendency in most cases.

Figures 16-19 are diagrams showing the mean and range of each of the 36 variables of the point included in the four clusters. The minimum and maximum values of each variable have been illustrated to demonstrate the range of variability exhibited by members of each of the four clusters. The mean values of each variable have been joined together to produce a generalized outline of the points in each cluster. Cluster I (Figure 16) contains 49 projectile points which are characterized as being short, having a mean length of 31.8 millimeters, a low length/width ratio of 1.8 to 1.0 and having either straight parallel sides or side notches at the hafting area. Cluster II (Figure 17) consists of 38 projectile points. These points are generally longer than those included in Cluster I having a mean length of 42.2 millimeters and a length/width ratio of 2.1 to 1.0. The blade margins of Cluster II points tend to converge toward the proximal (base) end of the points as consequence of notching or less extreme forms of marginal indentation. Cluster III (Figure 18) contains 16 projectile points which can be characterized as

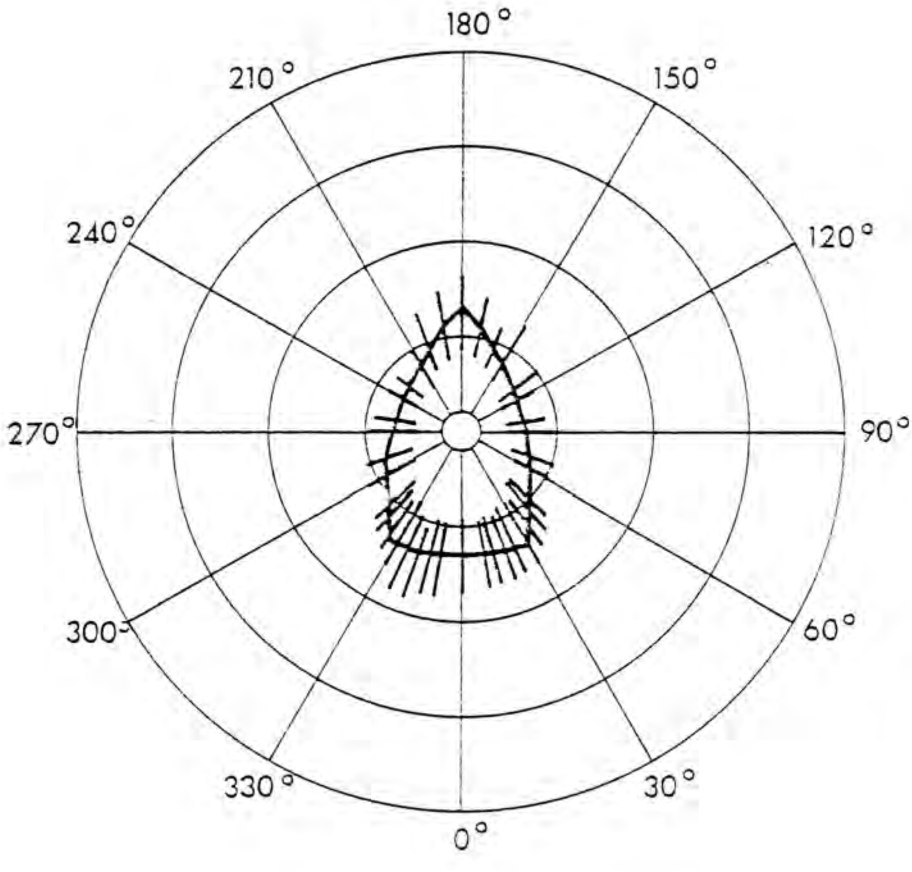


Figure 16. Generalized Visual Display of Projectile Points in Cluster I.

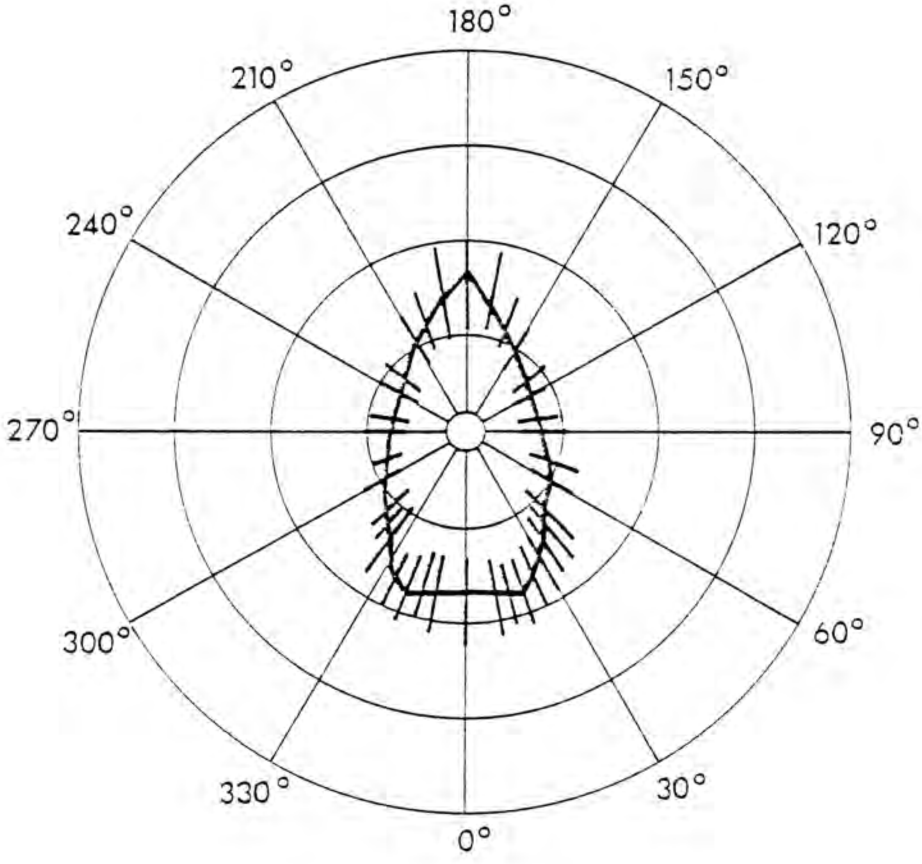


Figure 17. Generalized Visual Display of Projectile Points in Cluster II.

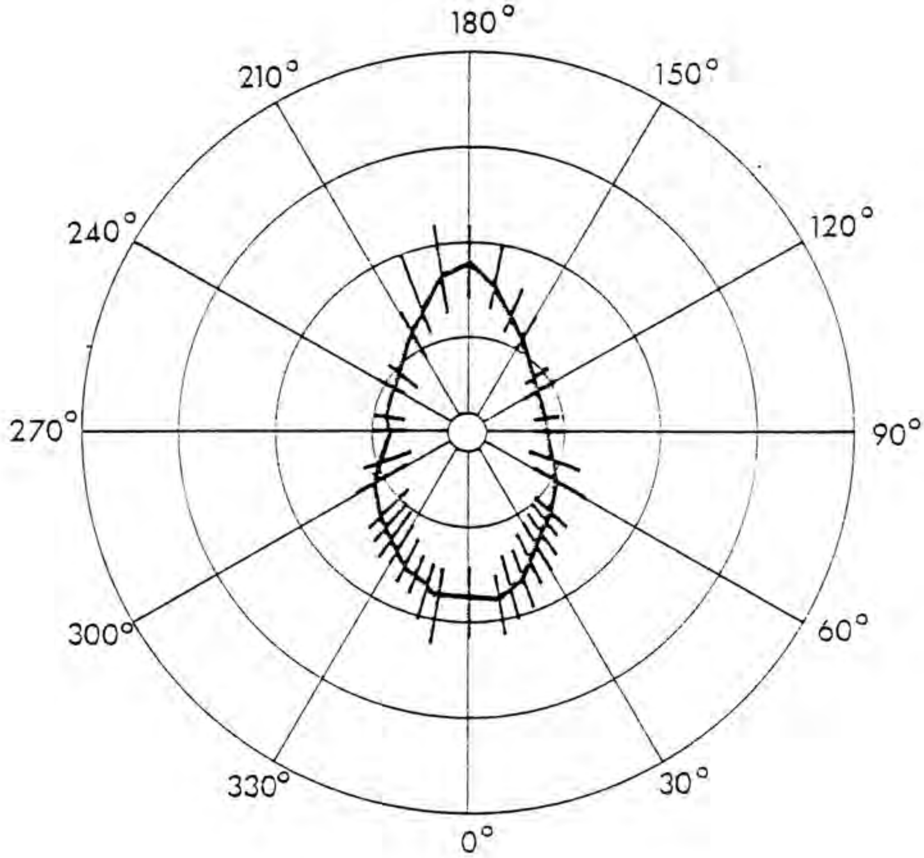


Figure 18. Generalized Visual Display of Projectile Points in Cluster III.

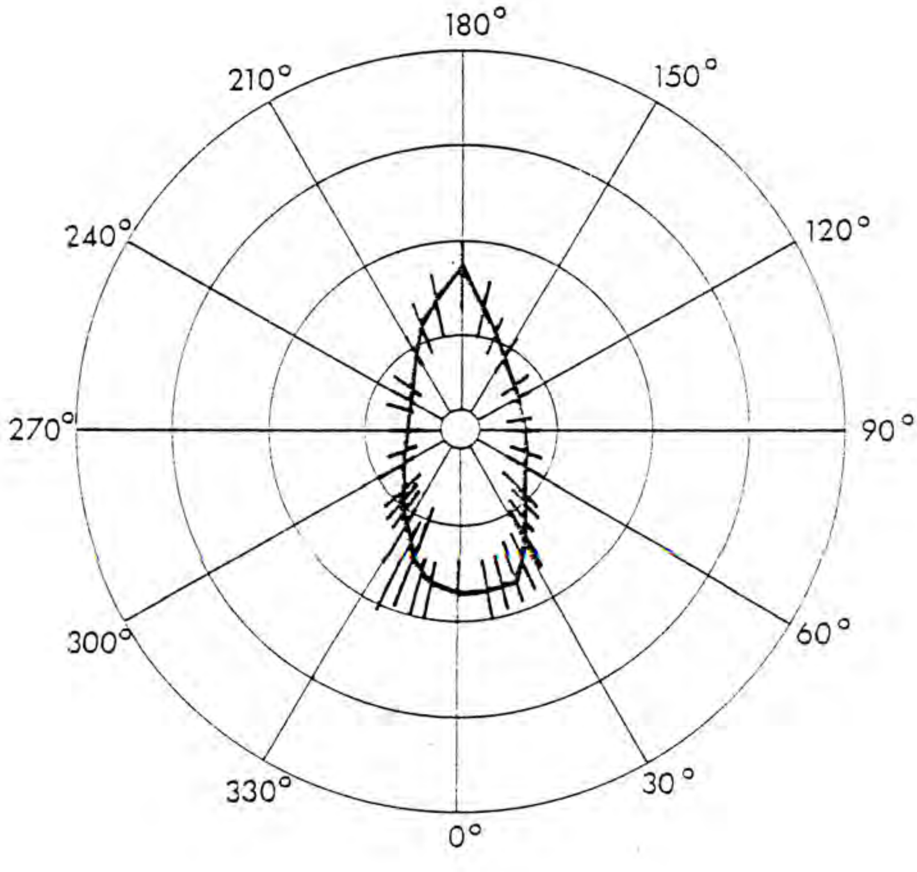


Figure 19. Generalized Visual Display of Projectile Points in Cluster IV.

having a slightly longer mean length than Cluster II points (44.7 millimeters), but the same length/width ratio of 2.1 to 1.0. The proximal portion of the margin of Cluster III points converges more sharply toward the base of the points reflecting the presence of numerous stemmed points within the group. Cluster IV (Figure 19) consists of 26 projectile points. These points have a mean length of 42.9 millimeters and a high length/width ratio of 2.7 to 1.0 reflecting the tendency of Cluster IV points to be long and narrow. Points included in Cluster IV tend to have a much straighter blade edge outline than found among members of the other three clusters.

## Summary

While the analytic procedure discussed in this chapter did not produce an "automatic" technique for classifying projectile points which would replace the more traditional subjective techniques, it did provide significant information toward gaining insight into the nature of morphological variability of projectile points. The experiments have demonstrated that while a very limited number of the total sample of projectile points used in the analysis conform to one of the preconceived traditional projectile point types, the vast majority do not. Most of the members of the sample fall along the continuum between the traditionally recognized types. The weakness of the traditional practice of forcing or "pigeon holing" a projectile point into a type on the basis of one or two arbitrary or intuitive attributes has been demonstrated. The analytic techniques used in these experiments have emphasized the usefulness of discerning information relating to the overall morphological characteristics of the sample. While clusters created by these procedures do not necessarily conform to the traditional concept of projectile point types, they can serve as a means of reducing the variability of group members prior to a subsequent stage of analysis and contribute valuable information toward the identification of the sources of morphological variability among members of the sample. The measuring techniques utilized in obtaining the data used in the analysis of the material are easily replicated and can serve as a means of accurately and objectively communicating the nature of projectile point variability collected from various research areas. The types created by these analytic techniques share morphological and structural characteristics which, while not necessarily being good indicators of temporal differences or similarities, may reflect underlying functional similarities or other unrecognized similarities.

# CHAPTER VIII

# DISTRIBUTIONAL VARIABILITY OF TOOL TYPES IN THE LOOKOUT VALLEY RESEARCH AREA

## Introduction

Archaeological research in the Southeastern United States has resulted in the accumulation of large collections of lithic material from a multitude of sites which greatly vary in their spatial, temporal and functional dimensions. These collections include numerous categories of tools as well as large quantities of associated debitage. In the past, it has been customary to group lithic material into broad categories such as projectile points, endscrapers, sidescrapers, gravers, etc. The research unit (component, site, etc.) could then be described utilizing recognized categories of artifacts allowing one research unit to be subjectively compared with analogous research units based on the presence-absence, percentage or quantity of a specific artifact type or set of artifact types present at those units.

The technique of assigning a specific artifact to a group traditionally involved the comparison of the artifact at hand with an "ideal type" or "diagnostic type". The analysis of nonprojectile point lithic artifacts largely consisted of grouping items into a few easily recognized, general categories such as "endscrapers", "sidescrapers" or the ubiguitous "other". These broad tool categories have a high degree of within group variability because of the nature of the grouping technique employed. Broad categories of tools are useful in analyzing site artifact diversity to some extent, however, it is possible to subdivide some of the categories into more homogeneous units on the basis of morphological and technological attributes. Lithic research in the Old World has long taken this approach. One of the most extensive attempts to define formal tool types has been the classification of lithic material from the Lower and Middle Paleolithic in Europe by Francois Bordes (1961). Other classification schemes have been formulated by Tixier (1974) and Sonneville-Bordes and Perrot (1955, 1956 and others). Typologies developed by these and other prehistorians in the Old World have gone far beyond the simplistic approach taken by many Southeastern archaeologists in the classification of nonprojectile point lithic material. Recent research in lithic analysis has been directed toward the selection and measurement of artifact attributes which can be utilized as uniform, objective means of describing artifact morphology. Studies by Leach (1969), Fish (1976a), Sackett (1966), Wilmsen (1970) and Montet-White (1973, 1974) have attempted to more explicitly differentiate within categories of artifacts to discern a wider range of morphological variability. The further refinement of a category of tools into more discrete subcategories creates a larger number of attributes which can be utilized in discerning patterns of artifact variability or diversity that may reflect patterns of human behavior.

The explanation for the apparent lack of interest in lithic material by many Southeastern archaeologists ranges from having to deal with small unsystematically collected samples of material which were unsuitable for detailed analysis to the general lack of interest in lithic artifact data because of the apparent restricted application to the reconstruction of chronology and culture history. A growing number of Southeastern prehistorians have become more aware of the value of lithic artifact data as the archaeological paradigm has slowly shifted from one emphasizing culture history to one stressing the merits of the explanation of past human behavior.

One of the most extensive and elaborate examples of lithic analysis carried out in the Southeast to date is the lithic typology formulated for the Normandy Reservoir in Tennessee (Faulkner and McCollough 1973). The analysts attempt to discern patterns of variability based on lithic resource utilization and artifact variability at sites located in the research area. Ongoing research at the Yellow Creek power plant site in Tishomingo County, Mississippi by Thorne, Broyles and Johnson (1977) has as its goal the development of an economical approach to the problem of describing a large volume of debitage and the isolation and description of the by-product of specific stages of production of bifacial stone tools (1977:50). Research by Paul R. Fish at the

University of Georgia has been directed toward developing various techniques designed to quantify, measure and compare artifact diversity as a measure of activity variability for sites in several research areas in Georgia (Fish 1976b).

A major limiting factor concerning the analysis of nonprojectile point artifacts, and specifically in the Lookout Valley research area, is the absence of replicative morphological patterning among members of various artifact types. Projectile point analysis is not as restricted by this factor since the projectile point morphology conforms to a relatively narrow range of morphological attribute values when compared to non-projectile point artifacts. Unlike projectile points, the grouping of non-projectile point artifacts on the criteria of overall shape or gross morphology is usually not a very productive clustering procedure.

Non-projectile point artifacts recovered from Woodland sites in the Lookout Valley area were first grouped into broad categories on the basis of general retouch attributes. These categories included bifaces, endscrapers, sidescrapers, gravers, etc. An attempt was made to further discriminate among members of these artifact categorieson the basis of various technological attributes such as the type of retouch present (bifacial or unifacial), the number of retouched edges and the shape of the area of retouch. This procedure was quite successful among several of the artifact types including bifaces, endscrapers, sidescrapers and nibbled edge pieces. These tool categories generally had large sample sizes (more than 75 items) which would be expected to be more representative of the wide range of morphological variability present in each type.

Discrimination was much more difficult and less successful among other tool types because of the small sample size and the extremely high degree of variability of overall tool morphology. It is unlikely that the overall morphological variability of a tool type is represented in a small sample and seemingly distinctive groupings within a tool category may merge into the total range of morphological variability upon increasing the sample size.

The distribution of the various artifact types identified in the lithic material collected from sites under investigation in the Lookout Valley area was analyzed to discern any patterns of inter or intra stratum distributional variability. The following is an outline of the tool types utilized in the distributional analysis:

I. Thick Bifaces

II. Thinned Bifaces

III. Endscrapers

  A. Unifacially flaked

    1. Straight edge

    2. Convex edge

  B. Bifacially flaked

    1. Straight edge

2. Convex edge

C. Nosed Scrapers

IV. Sidescrapers

A. Unifacially Flaked

1. Single edge

a. Convex

b. Straight

c. Concave

2. Double edge biconvex

B. Bifacially Flaked

1. Single edge

a. Convex

b. Straight

2. Double edge-biconvex

3. Convergent-straight/convex

V. Perforators

VI. Pedunculates

VII. Beaked Implements

VIII. Gravers

IX. Nibbled Edge Pieces

A. Straight edge

B. Convex edge

C. Concave edge

X. Projectile Points*

XI. Denticulates

XII. Notched Pieces

*Projectile point fragments were not used in the calculation of the percentage of occurrence of tool types unless noted.

The following is a discussion of the technological and morphological attributes of the above tool categories. Analysis has been directed toward discerning patterns of distributional variability of these tool types among the sites in the research area and the association of specific tool types with various physical and cultural environmental attributes present in the Lookout Valley area. The definitions presented in this chapter were derived through examining the material under investigation and synthesizing definition used by other researchers in the field (Bordes 1961; MacDonald 1968; Graybill and Seckinger 1976; Faulkner and McCollough 1973 and others).

Thick Bifaces

The thick biface tool category includes crudely flaked complete and broken bifaces which may represent the initial stage of reducing an unmodified piece of chert to a finished bifacially flaked tool. Very few complete examples of this tool category (less than 2 percent) are represented in the artifact assemblages collected from sites in the research area which may indicate that they are broken discards that were eliminated from the tool manufacturing process. The absence of many complete forms of this artifact type may be explained since these would continue to the next stage of tool manufacturing. Many of the specimens recovered from the Lookout Valley area are broken along the longitudinal or transverse axis of the biface.

Thick bifaces would be expected to be found at two different stages of the technological sequence of the stone tool manufacturing process: a) thick bifaces would be found at sites where unmodified chert was being processed into these thick bifacially flaked preforms (primary reduction areas) or b) at sites where thick bifaces would be transported for further modification after being initially shaped at sites located closer to the chert resource areas (secondary reduction areas). Presumably, an examination of lithic debitage from these sites would provide insight into the specific lithic reduction activities at sites where thick bifaces occur.

Thick bifaces form 16 percent or more of the assemblages at nine sites in the research area of which 89 percent (n=8) were located in the floodplain stratum and 11 percent (n=1) was located in the valley upland stratum. No sites from the upland plateau stratum were included in this group. The figure of 16 percent represents an arbitrary break in the distribution of the percentage of occurrences of thick bifaces at sites under investigation. The percentage of occurrence of thick bifaces in assemblages from all sites ranged from 0.0 to 28.9 percent. Based on the above data, it is apparent that the presence of a high percentage of thick bifaces is associated with floodplain sites. This result would be expected since these sites have the easiest access to chert resources. Further analysis of the distribution of thick bifaces disclosed that they were present at a total of 18 sites including 76 percent (n=16) of the floodplain sites, 100 percent (n=2) of the valley upland sites. Thick bifaces did not occur at any of the upland plateau stratum sites.

Analysis of debitage attributes of the nine sites having a higher percentage of thick bifaces (greater than 16 percent) reveals that 44 percent of the sites were grouped in debitage Cluster I by the cluster analysis of site debitage attributes. Cluster I is characterized as having attributes associated with a high frequency of occurrence of primary reduction. Forty-four percent of the sites (n=4) were grouped in debitage Cluster II which has attributes associated with a lower frequency of occurrence of primary reduction activities, while 11 percent (n=1) of the sites were placed in debitage Cluster III which contains sites sharing debitage attributes associated with tool modification and maintenance. The hypothesis of thick bifaces being associated with the early stages of the lithic reduction sequence tends to be supported by the results of the analysis presented above. Faulkner and McCollough conclude that morphologically similar artifacts from the Normandy Reservoir may also represent bifaces in the earlier stages of thinning (1973:83).

Thinned Bifaces

The category of thinned bifaces consists of complete and broken bifaces which have been thinned and have been retouched along the lateral and transverse edges. Members of this artifact category generally have a lanceolate or ovoid shape and a rounded base. Flake scars are normally shallower and broader than those found on thick bifaces. Bifacial thinning flaking techniques were apparently more extensively used in the preparation of thinned bifaces than in the production of thick bifaces. Breakage patterns of thinned bifaces are similar to those found on thick bifaces with many of the examples having been broken along the transverse axis. Very few examples of unbroken thinned bifaces were recovered during the survey. Specimens collected during the surface reconnaissance may represent discards which were broken during production and eliminated from the stone tool manufacturing sequence. Bifaces which completed this stage of tool production without being broken were further modified in the subsequential stage of the tool production sequence.

Faulkner and McCollough (1973:83) referred to object sharing similar attributes with artifacts included in the "thinned biface" category as knives and preforms. Thinned bifaces probably represent a more advanced stage in the bifacial tool manufacturing process than that of the thick biface. Faulkner and McCollough noted that thinned bifaces could easily be converted into projectile points or knives by stemming or notching (1973:83). It is probable that some of the items classified as thinned bifaces are parts of other types of bifacially flaked tools such as projectile points.

Thinned bifaces would be expected to be present at most sites in the research area. Analysis of the data reveals that thinned bifaces were found at 70 percent of the sites having predominantly or exclusively Woodland cultural material. Thinned bifaces were present at 81 percent (n=17) of the floodplain sites, 100 percent (n=2) of the valley upland sites and 29 percent (n=2) of the upland plateau sites. Sites where thinned bifaces formed 20 percent or more of the total assemblage of tools included 57 percent (n=12) of the floodplain sites, 50 percent (n=1) of the valley upland sites and 14 percent (n=1) of the upland plateau sites. Thirteen of these sites had debitage collections of sufficient size to be considered for analysis. Analysis of debitage attributes of the 13 sites where thinned bifaces represent 20 percent or more of the artifacts revealed that 23 percent (n=3) of the sites were grouped in debitage Cluster I, 62 percent (n=8) of the sites were placed in debitage Cluster II, while only 15 percent (n=2) of the sites were included in Cluster III. All sites in debitage Cluster I (n=6) had a mean percentage of thinned bifaces of 22 percent. Sites in Cluster II (n=12) had a mean percentage of 24.6 percent, while Cluster III sites (n=8) had a lower mean of 16.4 percent.

Based on the above analysis, it seems that a high percentage (greater than 20 percent) of thinned bifaces are most closely associated with floodplain and valley upland sites where debitage attributes indicate that occurrence of primary and secondary reduction, with emphasis on sites having debitage attributes associated with secondary reduction activities (debitage Cluster II sites).

Endscrapers

Endscrapers are defined as unifacially or bifacially flaked tools having a line of marginal retouch located along the distal transverse edge of the flake and perpendicular to the longitudinal axis of the flake (MacDonald 1968; Faulkner and McCollough 1973; and others). Endscrapers were one of the most commonly occurring and widely distributed tool types in the research area. Endscrapers were found at 70 percent (n=21) of the Woodland sites. Endscrapers occurred at 76 percent (n=16) of the floodplain stratum sites, while they were present at 50 percent (n=1) of the valley upland sites and 57 percent (n=4) of the upland plateau sites.

Two sets of attributes were utilized to further discriminate among endscrapers: a) the type of flaking present on the working edge of the tool and b) the shape of the working edge. The following categories, based on the above attributes, were used to subdivide the endscraper tool category:

a) bifacially flaked, straight edge endscrapers

b) bifacially flaked, convex edge endscrapers

c) unifacially flaked, straight edge endscrapers

d) unifacially flaked, convex edge endscrapers

A fifth category of endscraper was observed which may be considered as a unifacially flaked, convex edge endscraper, but because of its other distinctive attributes, was considered as a separate category.

e) nosed endscrapers

Table 10 demonstrates the occurrence of the types of endscrapers with respect to the physiographic location of the sites under investigation.

Table 10. Frequency of Occurrence of Endscraper Types by Stratum.

| Type of Endscraper | Number of Sites Where Type Occurs | | | |
|---|---|---|---|---|
| | Floodplain | Valley Upland | Upland Plateau | Total Sites |
| Unifacial-straight | 4 | 1 | 0 | 5 |
| Unifacial-convex | 13 | 1 | 1 | 15 |
| Bifacial-straight | 1 | 0 | 3 | 4 |
| Bifacial-convex | 8 | 0 | 0 | 8 |
| Nosed | 5 | 1 | 0 | 6 |

Unifacial endscrapers formed 78.6 percent (n=77) of the total collection of endscrapers, while bifacial endscrapers contributed 21.4 percent (n=21). Unifacial endscrapers occurred at 67 percent (n=14) of the floodplain stratum sites, 50 percent (n=1) of the valley upland sites and 14 percent (n=1) of the upland plateau stratum sites. Bifacial endscrapers were found at 38 percent (n=8) of the floodplain sites and 43 percent (n=3) of the upland plateau sites. No bifacial endscrapers were recovered from valley upland sites.

A. Unifacial-straight edge endscrapers

Ten examples of unifacial-straight endscrapers were recovered from five sites in the research area. Unifacial-straight endscrapers represented 10.2 percent of the total collection of endscrapers. Unifacial-straight edge endscrapers were present at 19 percent (n=4) of the sites located in the floodplain strata, 50 percent (n=1) of valley upland sites. None were recovered from upland plateau sites.

Unifacial straight endscrapers were manufactured from unmodified flakes which exhibited few indications of having been shaped to any common form. Sixty percent (n=6) of the endscrapers had cortex on their outer surfaces. Cortex was an unusual occurrence on bifacial endscrapers. Marginal retouch flakes on unifacial-straight endscrapers were generally smaller than those observed on bifacial endscrapers.

B. Unifacial-convex edge endscrapers

Unifacial-convex edge endscrapers formed the largest category of endscrapers collected in the research area. A total of 55 unifacial-convex endscrapers was recovered from 15 sites which represent 56.1 percent of all endscrapers. The distribution of this category of end-scraper was largely restricted to the floodplain stratum with 62 percent (n=13) of the floodplain sites containing 95 percent (n=52) of the uni-facial-convex endscrapers. Unifacial-convex edge endscrapers oc-curred at 50 percent (n=1) of the valley upland sites containing four per-cent (n=2) of the total number of this type of scraper, while they oc-curred at 14 percent (n=1) of the upland plateau sites which contained two percent (n=1) of the sample.

Most examples included in this tool category exhibited steep retouch along the working edge of the tool. Retouch was generally lo-cated on the outer surface of the flake when flake surfaces could be identified. The lateral margins of the majority of these tools diverged toward the working edge, however several examples were found which had converging lateral margins. Twenty-seven percent (n=15) of the unifacial-convex endscrapers were manufactured utilizing cortical flakes.

C. Nosed endscrapers

Nosed endscrapers formed a specialized subcategory of uni-facial convex endscrapers which were considered as a separate tool type in the analysis. Nosed endscrapers have steeply converging lateral edges which converge toward the retouched edge. The inner surface of the flake is generally flat while the outer surface is steeply beveled toward the working edge.

Nosed endscrapers were recovered from six sites in the research area which formed 12.3 percent (n=12) of the total collection of endscrapers. Nosed endscrapers occurred at 24 percent (n=5) of the floodplain stratum sites. These sites contained 92 percent (n=11) of all nosed scrapers found at Woodland sites in the research area. Nosed endscrapers occurred at 50 percent (n=1) of the valley upland sites, while no nosed endscrapers were recovered from upland plateau sites.

D. Bifacial-straight edge endscrapers

Four examples of bifacially flaked, straight edge endscrapers representing 4.1 percent of all endscrapers were recovered from Woodland sites in the research area. All of the items in this tool type had steep retouch along the working edge which was located on the distal end of the flake. Retouch was also present along portions of the lateral margins of the scrapers. The lateral margins diverge sharply from the proximal end toward the working edge of the tool. The additional marginal retouch on these tools may indicate that items included in this tool type share attributes reflecting secondary functions which have been overshadowed by the more obvious attributes associated with the endscraper function.

The four examples of bifacial-straight endscrapers were recovered from four sites. Seventy-five percent (n=3) of these sites were located on the upland plateau, while 25 percent (n=1) were located on the floodplain. These tools may reflect some type of activity which was more commonly practiced in the upland plateau area, but a statement of this nature is quite hypothetical based on such a small sample size.

E. Bifacial-convex endscrapers

A total of 17 bifacial-convex edge endscrapers was recovered from eight sites in the research area. Bifacial convex endscrapers formed 17.4 percent of the total collection of endscrapers found at Woodland sites. All sites at which this type of endscraper occurred were located in the floodplain stratum. No examples were recovered from the valley upland or the upland plateau strata.

Two examples of bifacial-convex endscrapers were stemmed indicating that they had once been hafted or were manufactured using discarded or broken projectile points. The majority of the remainder of the specimens of this tool type exhibited lateral edges which diverge toward the working edge of the tool.

## Diversity of Endscrapers at Woodland Sites in the Lookout Valley Research Area

The following table demonstrates the diversity of endscrapers with respect to the location of sites in the research area.

Table 11. Diversity of Endscrapers.

| Types of Endscrapers Present (n) | Diversity Score (n/5) | Floodplain Sites | Valley Upland Sites | Upland Plateau Sites | Total |
|---|---|---|---|---|---|
| 0 | .00 | 5 | 1 | 3 | 9 |
| 1 | .20 | 10 | 0 | 4 | 14 |
| 2 | .40 | 1 | 0 | 0 | 1 |
| 3 | .60 | 2 | 1 | 0 | 3 |
| 4 | .80 | 2 | 0 | 0 | 2 |
| 5 | 1.00 | 1 | 0 | 0 | 1 |

A total of 23 sites representing 77 percent of all sites under investigation was found to have less than two types of endscrapers present. This category of sites included 71 percent (n=15) of floodplain sites, 50 percent (n=1) of the valley upland sites and 100 percent (n=7) of the upland plateau sites. Sites which have two or more types of endscrapers were found only in the floodplain stratum (86 percent, n=6) and the valley upland stratum (14 percent, n=1). The results of the above analysis indicate that floodplain sites contain the widest range of endscraper diversity (.00-1.00) as well as a high level of endscraper diversity (.40-1.00). Upland plateau sites have the lowest range of endscraper diversity (.00-.20).

Sidescrapers

Sidescrapers are defined as those flaked stone tools having a line of bifacial or unifacial retouch located along one or more edges of a flake where those edges are oriented parallel to the longitudinal axis of the flake (Faulkner and McCollough 1973; MacDonald 1968; and others). Items included in the sidescraper category shared a wide range of morphological attributes making tool shape a generally poor criterion for discriminating subcategories of sidescrapers. Three attributes were ultimately utilized to differentiate among sidescrapers: a) the type of flaking present on the working edge, b) the number of edges having retouch and c) the shape of the retouched edge. The following is a listing of subcategories of sidescrapers present at Woodland sites in the Lookout Valley research area. The number of scrapers in each category, the percent of all sidescrapers formed by each category, the number of sites where each type occurred and the percent of sites where each type was found are included in Table 12.

A total of 80 examples of sidescrapers was recovered from Woodland sites in the research area. Ninety-six percent (n=77) of these were recovered from sites located in the floodplain stratum, one percent (n=1) was found at valley upland sites, while three percent (n=2) were found at upland plateau sites. Sidescrapers were found at 57 percent (n=12) of floodplain sites, 50 percent (n=1) of valley upland sites and 29 percent (n=2) of the upland plateau sites. Bifacial-single edge-convex

Table 12. Percentage of Occurrence of Sidescraper Types in the Research Area.

| Type of Sidescraper | Number of Specimens | Percent of Total | Number of Sites where Present | Percent of all Sites |
|---|---|---|---|---|
| Unifacial-single edge-convex | 12 | .15 | 4 | .13 |
| Unifacial-single edge-straight | 13 | .16 | 7 | .23 |
| Unifacial-single edge-concave | 9 | .11 | 4 | .13 |
| Unifacial-double edge-biconvex | 4 | .05 | 2 | .07 |
| Bifacial-single edge-convex | 22 | .28 | 13 | .43 |
| Bifacial-single edge-straight | 3 | .04 | 1 | .03 |
| Bifacial-double edge-biconvex | 6 | .08 | 3 | .10 |
| Bifacial-convergent-straight-convex | 11 | .14 | 6 | .20 |
| | 80 | | | |

sidescrapers were the most commonly occurring type of sidescraper representing 28 percent (n=22) of all sidescrapers. This type of sidescraper was also the most widely distributed type, occurring at 43 percent (n=13) of the Woodland sites in the research universe. Bifacial-single edge convex sidescrapers were the only type of sidescraper found at sites located outside of the floodplain stratum. One example was found at a site in the valley upland stratum and two examples were recovered from sites in the upland plateau stratum. All other types of sidescrapers listed in Table 12 were recovered from sites located in the floodplain stratum. Bifacial-single edge-straight sidescrapers had the most restricted distribution with all three specimens occurring at one site in the floodplain.

Examination of the sidescraper diversity index discloses that 83 percent (n=25) of all sites have diversity scores ranging from .00 to .25 (0 to 2 types of sidescrapers present), with 60 percent (n=15) of those sites having no sidescrapers (Table 13). Three sites had high diversity index scores with two sites having index values of .75 (six types of sidescrapers present) and one site with an index score value of .88 (seven types of sidescrapers present). The high sidescraper diversity indices of these three sites generally reflect their high overall index of diversity scores when all tool types (n=25) are considered in the analysis (.68, .92 and .92 respectively). All three of these sites were located in the floodplain stratum.

Table 13. Diversity Index of Sidescrapers Based on Types Presented in Table 12.

| Number of Types of Sidescrapers Present (n) | Diversity Index Score (n/8) | Number of Sites with D.I. Score | Percent of all Sites |
|---|---|---|---|
| 0 | .00 | 15 | .50 |
| 1 | .13 | 5 | .17 |
| 2 | .25 | 5 | .17 |
| 3 | .38 | 2 | .07 |
| 4 | .50 | 0 | .00 |
| 5 | .63 | 0 | .00 |
| 6 | .75 | 2 | .07 |
| 7 | .88 | 1 | .03 |
| 8 | 1.00 | 0 | .00 |

## Perforators

This class of tool is distinctive in that members have sharp projections which extend from the distal end of the flake. These projections often exhibit retouch along the edges of the facets which converge to form the point. The length and diameter of the projections are quite variable as is the overall morphology of the tool. Some of the projections appear to have been intentionally manufactured for the purpose of forming the point, while other perforators were apparently fabricated utilizing natural projections. Retouch along the margins and at the tip of the point indicate that these tools were used for piercing or boring activities (see Faulkner and McCollough 1973; MacDonald 1968; Bordes 1961 and others).

A total of 62 perforators was recovered from 16 sites in the research area. Fifty-seven percent (n=12) of the sites in the floodplain contained perforators, while they occurred at 100 percent (n=2) of the valley upland sites and 29 percent (n=2) of the upland plateau sites. Ninety percent (n=56) of the perforators were recovered from floodplain sites in the Lookout Valley research area.

## Beaked Implements

Beaked implements have not been widely recognized or discussed in the archaeological literature in the Southeastern United States. The artifact form has been recognized and initially described by Graybill and Seckinger while analyzing lithic material from northeast Georgia (1976:43).

Most of the items included in the "beaked implement" tool category were manufactured using thick chert flakes or angular chert fragments. Retouch consisted of several large flakes removed from the distal end of the flake creating a large projection at one end of the tool. Marginal retouch was evident at the tips and along the margins of the retouched areas on several examples of the beaks. The shape of the area of retouch varied from straight to concave. Many of the specimens appeared to have been formed utilizing natural fissures or facets in conjunction with intentional retouch. The attributes of beaks from the Lookout Valley area generally conform to those described by Graybill and Seckinger from northeast Georgia (1976:43-47).

A total of 17 examples of beaked implements was recovered from eight sites (27 percent) in the Lookout Valley research area. Seven (88 percent) of these sites were located in the floodplain stratum, while one (13 percent) was recovered from a valley upland site. No beaked implements were recovered from sites in the upland plateau stratum. Eighty-eight percent (n=15) of the beaked implements occurred at floodplain sites. Beaked implements had one of the more restricted distributions of any tool category used in the analysis.

Gravers

The graver tool category includes amorphously shaped flakes which have one or more small sharp projections or spurs extending from the flake margins. Graver spurs are formed by the removal of small flakes from the flake margins adjacent to the spur. Alternate retouch was utilized to form some spurs, while simple unifacial or bifacial flaking techniques were employed in the manufacturing of the remainder of the tool (Faulkner and McCollough 1973:87). Marginal retouch in areas other than the graver spur was present on several members of this tool type, however the majority of the gravers examined exhibited no marginal retouch other than that necessary to form the spur.

A total of 25 gravers was recovered from 12 sites in the Lookout Valley area. Ninety-two percent (n=11) of the sites containing 96 percent (n=24) of the gravers were located in the floodplain stratum. Gravers occurred at 52 percent of all floodplain stratum sites. No gravers were recovered from valley upland stratum sites, while one example occurred at an upland plateau stratum site.

Nibbled Edge Pieces

Nibbled edge pieces were defined as thin flat flakes exhibiting regular intentional retouch along one or more of the edges of the flake. Flake scars in the areas of retouch were very small on these tools. A total of 57 examples of nibbled edge pieces was recovered from sites in the research area. Nibbled edge pieces were divided into three categories based on the shape of the retouched edge:

a) Straight

b) Convex

c) Concave

Nibbled edge pieces were uniformily distributed among the three categories presented above. Straight nibbled edge pieces formed 37 percent (n=21) of the sample, convex edge pieces formed 32 percent (n=18), and concave edge pieces contributed 32 percent (n=18) of the variability. The occurrence of nibbled edge pieces in the research area was restricted to seven (23 percent) of the sites, all of which were located in the floodplain stratum.

Projectile Points

Projectile points were the most commonly occurring and widely distributed artifact type in the research area. Both complete and broken projectile points were included in determining the number of artifacts in this part of the analysis. A total of 197 complete and 233 broken projectile points were recovered from sites under investigation. While projectile points are ubiquitous at sites in the Lookout Valley research area, there is variation in the percent of the assemblage variability accounted for by projectile points.

Projectile points and projectile point fragments account for a mean of 36.1 percent of the artifacts at floodplain stratum sites. The percentage increases to 38.5 percent for sites in the valley upland stratum, while projectile points account for 69.3 percent of the artifacts at upland plateau stratum sites. This trend is reflected in the diversity index scores of upland plateau stratum sites by the fact that upland plateau sites tend to have low diversity index score values which is a consequence of one artifact type (projectile points) accounting for a large percentage of the artifacts at these sites (see Chapter IX). The data presented above tends to support the hypotheses that upland plateau sites represent specialized activities (hunting) associated with the exploitation of certain animal resources in the upland areas of the research universe.

Denticulates

Items included in the denticulate tool category exhibited unifacial or bifacial retouch along one or more convex edges of the flake. Flake scars created by the removal of several adjacent marginal retouch flakes form a serrated edge along these convex edges (Faulkner and McCollough 1973:86).

A total of 62 examples of denticulates was recovered from sites in the research area. Denticulates were one of the more widely distributed tool types in the research area being present at 53 percent of the Woodland sites. Ninety-five percent (n=60) of the denticulates were recovered from 14 floodplain stratum sites, while two percent (n=1) were found at one valley upland stratum site and two percent (n=1) of the total collection of denticulates was recovered from an upland plateau stratum site. Denticulates were found at 67 percent (n=14) of the floodplain stratum sites, 50 percent (n=1) of the valley upland stratum sites and 14 percent (n=1) of the upland plateau stratum sites.

Notched Pieces

Specimens included in the notched tool category have one or more semicircular concavities on one or more of the flake edges. Retouch along the working edge may be either unifacial or bifacial (Faulkner and McCollough 1973:86). Flakes utilized for notches range from thick crudely retouched flakes to well thinned flakes. Notch morphology ranges from narrow deep concavities to wide shallow concavities. Notches also occur on other categories of broken tools.

A total of 64 notched pieces were recovered from 14 (47 percent) of the sites under investigation in the Lookout Valley research area. Notched pieces were recovered from sites in all three of the physiographic strata. Ninety-two percent (n=59) of the notches occurred at floodplain stratum sites, five percent (n=3) were found at sites in the valley upland stratum, while three percent (n=2) were from sites in the upland plateau stratum. Notches occurred at 53 percent (n=11) of the floodplain stratum sites, 50 percent (n=1) of the valley upland stratum sites and 29 percent (n=2) of the upland plateau sites.

Pedunculates

Pedunculates are defined as amorphously shaped artifacts of varying dimensions having small spatulate shaped projections protruding from one margin of the flake. The projections have parallel or converging lateral margins and are rounded on the end, forming a convex working edge. Retouch along the working edge is normally unifacial (70 percent, n=7) and occurs on the outer surface of the flake when flake surface can be identified. Retouch along the working edge is steep, resembling the retouch that occurs on the working edge of unifacial convex edge end-scrapers. The projection forming the pedunculate on unifacially flaked specimen occurs on the distal end of the flake in 86 percent (n=6) of the examples. Bifacially flaked pedunculates form 30 percent (n=3) of the total sample. Bifacially flaked pedunculates seem to occur on other types of bifacially flaked artifacts which have been broken. All examples of pedunculates collected from the research area had concave shaped areas of marginal retouch along the flake edge adjacent to the pedunculate projection. A total of ten examples of pedunculates were recovered from sites in the research area of which 100 percent (n=6) were located in the floodplain stratum.

# CHAPTER IX

# INTER-SITE ACTIVITY DIVERSITY IN THE LOOKOUT VALLEY RESEARCH AREA

A fundamental hypothesis of the Lookout Valley research project has been that the intensity and diversity of human activity is not uniform throughout the research area and that through utilizing appropriate analytical research techniques, it may be possible to discern the nature of the variability. The first phase of the analysis has been directed toward discerning distributional patterns of specific artifact types among Woodland sites in the research area. It is apparent, based on the results of the analysis of the distribution of tool types through the research area, that tools do not occur uniformily in the three designated physiographic strata. The second stage of analysis is directed toward discerning patterns of activity among Woodland sites on the basis of the variability of artifacts recovered from these sites. Two distinct analytical approaches were employed to group sites which share similar artifact attributes.

The first technique utilized was an index of diversity. The index of diversity is based on the diversity of artifact types present on a site rather than on the differing frequencies or percentages of specific artifacts among sites. Essentially, the index of diversity can be used to distinguish those sites having a wide variety of tool types present from those sites where only a few tool categories were represented (Fish 1976b:30). The diversity index has been used in ecology to analyze and compare species diversity. These indices have been utilized to compare and contrast one group or community of populations with other groups of populations. Ecologists have found that of the total number of species in a community, a small percentage are abundant, while a large percentage are much less common. The large number of rare species tend to be responsible for the species diversity of the community (Odum 1971:148-149).

The second technique used was based on a combination of principal components analysis and cluster analysis. The results of this level of analysis grouped sites together which share similar percentages of specific artifact types.

Index of Diversity

An index of diversity was calculated for all Woodland sites located during the archaeological surface reconnaissance of the Lookout Valley research area. The index of diversity is based on the diversity of artifact types which are recovered from sites rather than on differing frequencies of specific artifact types. The measure of diversity deals with observed artifact categories within an assemblage (Fish 1976b:30). The value of the diversity index score for a site is calculated utilizing the following formula:

$$\text{Diversity Index} = \frac{\text{number of artifact categories at a site}}{\text{number of artifact categories used in analysis}}$$

The index of diversity has been successfully utilized in measuring artifact variability among sites located in the Big Slough Watershed, Grady and Mitchell Counties, Georgia (Fish and Mitchell 1976) and the Ebenezer Creek Watershed, Effingham and Screven Counties, Georgia (Fish 1976b). Fish was able to define classes of sites based on natural breaks in the distribution of the values of the index of diversity. Site classes created in this manner could then be utilized as a basis of hypothesis formulation concerning activity variability in the research area. The successful utilization of the index of diversity is based on the assumption that the diversity of artifacts present is a close approximation of the nature of the site as a whole. In cases where artifacts on a presence - absence basis are widely distributed among artifact categories, the result is a high diversity index value reflecting a wide range of activities. In cases where the artifacts represent only a few categories, the index of diversity is low and the assumption is made that a restricted number of activities is reflected (Fish 1976b:30).

Two values of the index of diversity were calculated for each site. The first index of diversity was calculated using 12 artifact categories which represent gross artifact variability. The categories utilized were as follows:

1) Thick Bifaces
2) Thinned Bifaces
3) Endscrapers
4) Sidescrapers
5) Perforators
6) Pedunculates
7) Beaked Implements
8) Gravers
9) Nibbled Edge Pieces
10) Projectile Points
11) Denticulates
12) Notched Pieces

Figure 20 is a chart showing the results of calculating the index of diversity for 30 Woodland sites using the above attributes. Three classes of sites were defined based on the distribution of the diversity index scores. Class I contained 11 sites which had diversity index scores ranging from .08 to .33. Scores in this range indicate that assemblages from Class I sites had from 1-4 tool types represented. All Class I sites contained projectile points. Of the remaining tool types found at Class I sites, 73 percent were represented by the endscraper, sidescraper, thinned biface or denticulate tool categories. Class I contained six sites (55 percent) located in the floodplain stratum and five sites (45 percent) located in the upland plateau stratum. Seventy-one percent (n=5) of all upland plateau sites were included in the Class I category of sites. Class II included 11 sites which had diversity index scores ranging from .42 to .67, with 55 percent (n=6) of the scores in the .50-.58 range. Assemblages from Class II sites contained from five to eight tool types which represent a wider range of activities than reflected by Class I site diversity index scores. Sixty-four percent (n=7) of the

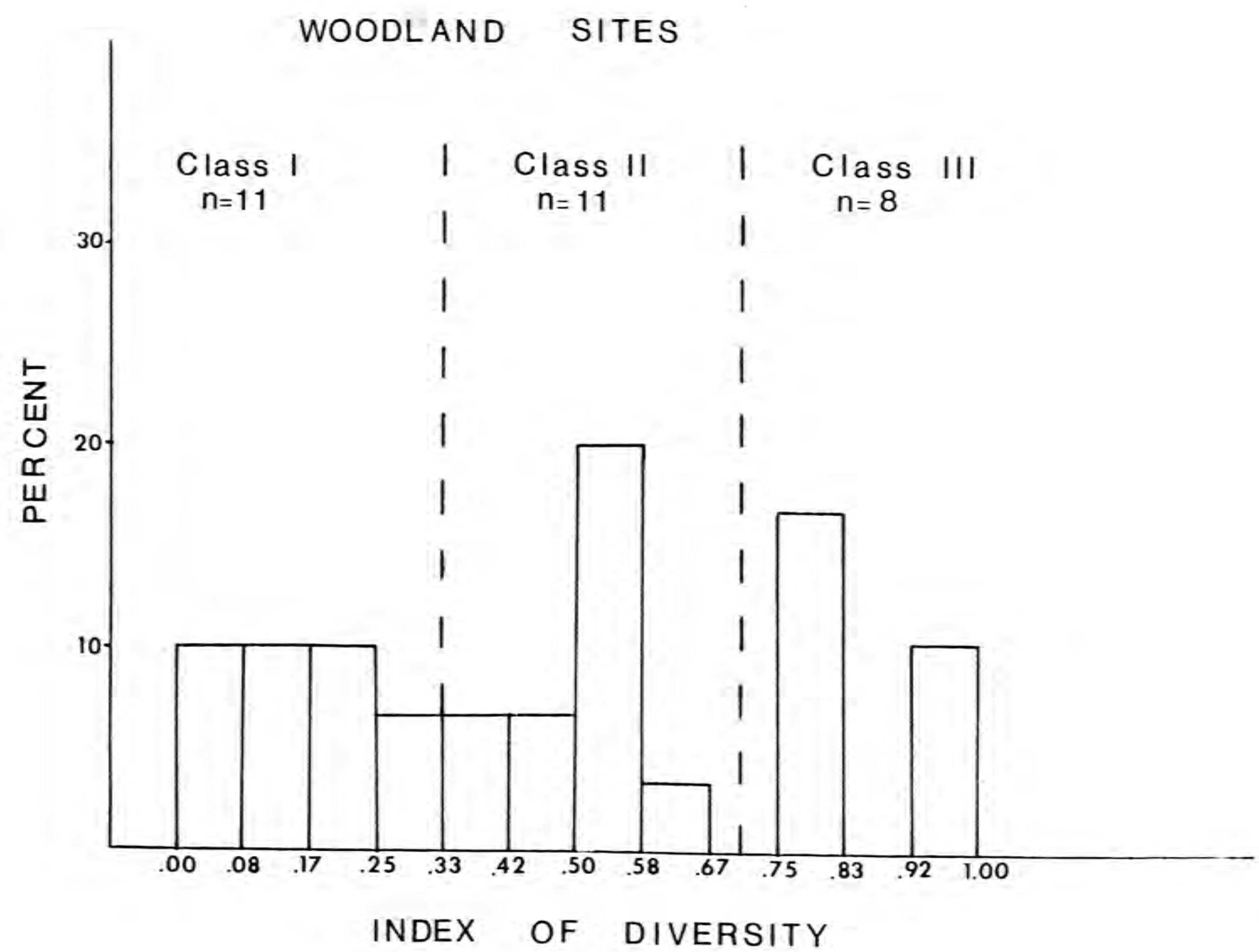


Figure 20. Index of Diversity Using 12 Tool Types.

Class II sites were located in the floodplain stratum, 18 percent (n=2) in the valley upland stratum and 18 percent (n=2) of the sites were in the upland plateau stratum. Class III contained eight sites with diversity index values ranging between .83 and 1.00 indicating the presence of 10 to 12 tool types. Class III sites would hypothetically be the location of the widest range of cultural activities as reflected by flaked stone tools. All sites included in the Class III site category were located in the floodplain stratum.

Examination of site activity variability as reflected by the index of diversity provides insight into site activity variability through the research area. Floodplain sites had a mean diversity index score of .59, a range of .08 to 1.00 and a standard deviation of .29. Floodplain sites exhibited an extremely wide range of diversity index scores supporting the hypothesis formed during the analysis of debitage of a high degree of activity variability among floodplain sites. There is a tendency for the percentage of floodplain sites to increase in the site classes as the mean diversity index score of the class increases. Floodplain sites were found to be present among all three of the site classes forming 55 percent of Class I sites, 64 percent of Class II sites and 100 percent of Class III sites.

Valley upland sites were found to be present only in site Class II. None were included in Class I or Class III. Valley upland sites had a mean diversity index score of .54, a range of .50 to .58 and a standard deviation of .06. Valley upland sites had a very restricted range of diversity index scores which may reflect the small number of sites located in the stratum (n=2).

Upland plateau sites had a mean diversity index score of .25, a range of .08 to .58 and a standard deviation of .19. Upland plateau sites had a lower mean diversity index score than found among floodplain or valley upland sites which tends to suggest a more limited number of activities at sites in the less accessible portions of the Lookout Valley research area. The more restricted range of index scores indicates a lower level of activities among upland plateau sites than found among sites in the floodplain.

Examination of debitage attributes from sites used in the diversity index analysis yielded the following results (Table 14).

Table 14. Debitage Attributes of Diversity Index Site Classes.

| Diversity Index Site Class | Mean Flake Weight | Mean Percentage of Cortical Material |
|---|---|---|
| *Class I (n=7) | 2.9 grams | .28 |
| Class II (n=11) | 3.8 grams | .36 |
| Class III (n=8) | 5.3 grams | .39 |

*Four sites included in Class I of the diversity index analysis had debitage collections of insufficient size to be included in the analysis.

Sites in Class III had the highest mean flake weight and the highest mean percentage of cortical material of the three site classes derived by the diversity index scores. Based on the hypotheses presented in the discussion of debitage attribute variability among sites in the research area, the sites in Class III (Table 14) reflect attributes associated with the initial phase of tool manufacturing (large flakes and a high percentage of cortical material). There is an incremental decrease in the mean flake weight and the mean percentage of cortical material at sites in diversity Classes II and I.

A similar pattern of cortical flakes was noted by Fish (1976b) in the Ebenezer Creek watershed in Effingham and Screven Counties, Georgia. Fish has hypothesized that Class III sites in the Ebenezer Creek Watershed would be the likely location of initial tool manufacturing, with finished tools being carried out to sites of specialized activities (Fish 1976:33). The results of the analysis of the Lookout Valley debitage tend to support a similar hypothesis for Class III sites in research area.

The analysis of the site diversity index scores indicates several trends. Floodplain sites tend to have the widest range of intersite activity diversity. Floodplain sites which have low diversity index scores may represent specialized activity areas. These sites would be included in site Class I (see Figure 20). Other floodplain sites with higher diversity index scores reflect a wider range of activities and would be included in site Class II or III. Floodplain sites form 100 percent of Class

III sites. Valley upland sites have a lower mean diversity index score than found among floodplain sites which supports the hypothesis of a more restricted range of activities at sites in that stratum. Upland plateau sites have the lowest range of diversity index scores reflecting a more restricted range of cultural activities as reflected by the diversity of flaked stone tools. The majority of upland plateau sites are included in site Class I. Site Class III, which contains the most diverse sites, has no upland plateau sites among its membership.

A second index of diversity was calculated using a more refined list of tool types as attributes. Categories used in the analysis are presented in Table 15.

Figure 21 shows the results of calculating the index of diversity for 30 sites using the attributes listed in Table 15. The results of the analysis are generally similar to those obtained using the 12 attributes, except that the diversity index score values tend to be reduced for most sites. Three broad classes of sites can be discerned on the basis of the distribution of the diversity index scores. Class I included 18 sites which had scores ranging between .04 and .32. Class I consisted of 56 percent (n=10) floodplain sites, six percent (n=1) valley upland sites and 39 percent (n=7) upland plateau sites. Class I contained 48 percent of all floodplain sites, 50 percent of the valley upland sites and 100 percent of the upland plateau sites. Class II contained ten sites which had diversity index scores ranging between .36 and .64. Class II

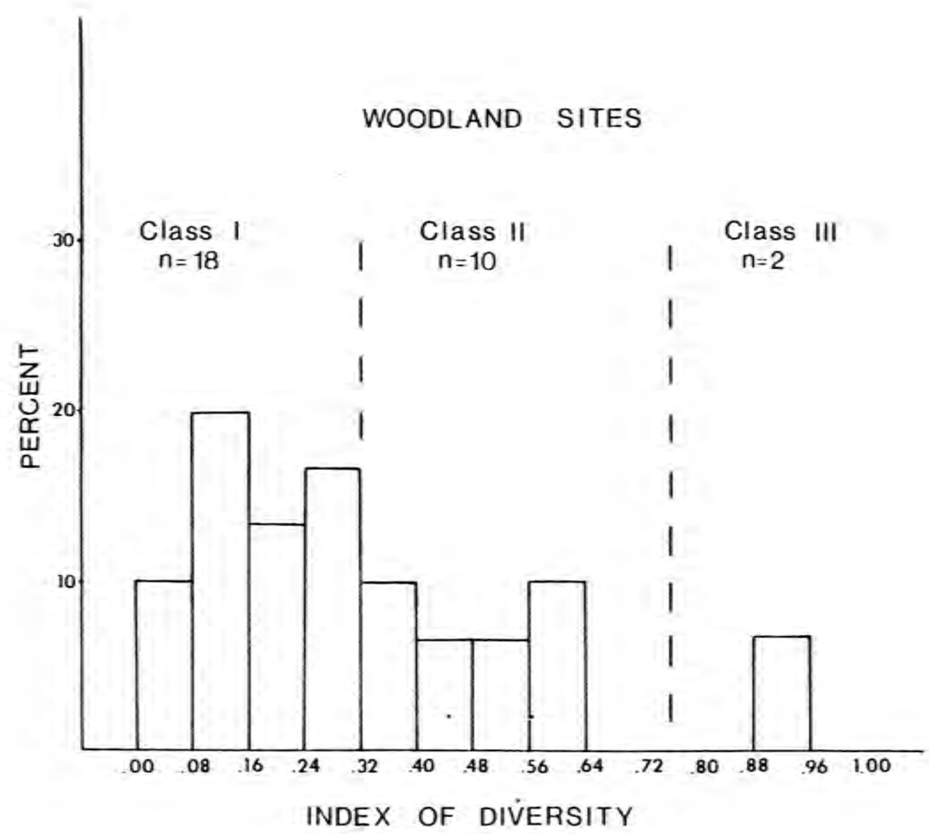


Figure 21. Index of Diversity Using 25 Tool Types.

Table 15. List of Tool Types Used as Attributes in the Calculation of Second Site Diversity Index Scores.

1. Thick Biface
2. Thinned Biface
3. Endscrapers, Unifacially Flaked, Straight Edge
4. Endscrapers, Unifacially Flaked, Convex Edge
5. Endscrapers, Bifacially Flaked, Straight Edge
6. Endscrapers, Bifacially Flaked, Convex Edge
7. Endscrapers, Nosed
8. Sidescrapers, Unifacially Flaked, Single Edge, Convex
9. Sidescrapers, Unifacially Flaked, Single Edge, Straight
10. Sidescrapers, Unifacially Flaked, Single Edge, Concave
11. Sidescrapers, Unifacially Flaked, Double Edge, Biconvex
12. Sidescrapers, Bifacially Flaked, Single Edge, Convex
13. Sidescrapers, Bifacially Flaked, Single Edge, Straight
14. Sidescrapers, Bifacially Flaked, Double Edge, Biconvex
15. Sidescrapers, Bifacially Flaked, Convergent, Straight-Convex
16. Perforator
17. Pedunculate
18. Beaked Implement
19. Graver
20. Nibbled Edge Piece, Straight Edge
21. Nibbled Edge Piece, Convex Edge
22. Nibbled Edge Piece, Concave Edge
23. Projectile Point
24. Denticulate
25. Notched Piece

contained 90 percent (n=9) floodplain sites and ten percent (n=1) valley upland sites. No upland plateau stratum sites were included in Class II. Class III included two sites which had diversity index scores ranging between .88 and .96. Both of these sites were located in the floodplain stratum. No valley upland or upland plateau stratum sites were present in Class III.

The results of the calculation of the diversity index scores using 25 variables parallels the results of the first calculating using 12 variables. The distribution of sites tended to be shifted to the lower end of the scale reflecting a general reduction of the value of the diversity index score for most sites. The relative position of sites in the distribution was not greatly altered. Generally, the use of a larger number of tool types or attributes tended to reduce the apparent diversity among sites. Floodplain sites were present in all three of the site classes in both of the analyses; valley upland sites occupied a position between floodplain sites with high diversity scores and less diverse floodplain sites, while upland plateau sites were confined to the lower end of the scale.

The second stage of intersite analysis was designed to discern patterning among sites which have similar artifact assemblages. The results of the analysis produced groups of sites which share similar percentages of specific artifact categories. When sites share similar percentages of specific tool types, the assumption is that similar activities or sets of activities were performed at those locations. Groups of sites created during this stage of the analysis have a low level of within group artifact variability and a high level of between group artifact variability.

A multistage analytical procedure employing several multivariate statistical techniques was utilized for this phase of the analysis. The data base consisted of 30 sites and 12 artifact types used as attributes. Attributes used in the analysis are the same as those used in the computation of the first index of diversity (Figure 20). Raw data counts for each site were recorded on computer cards, then processed to convert the raw counts to percentages. Conversion to percentages is a necessary step to normalize or equalize the artifact counts since the assemblages represent samples from a population of unknown size and distribution (Dumond 1974:255).

The first phase of analysis was a Principal Components analysis of the new data set created by the conversion of raw artifact counts to percentage data. The program used for this task was BMD08M with varimax rotation from the Biomedical package of computer programs (Dixon 1973). The principal components analysis was conducted using a covariance matrix. Squared multiple correlations were used for computing communality estimates. Only those factors with eigenvalues greater than 1.0 were rotated using Kaiser's criterion.

The first data set submitted for principal components analysis consisted of 30 cases and 12 variables. Results of the analysis disclosed that one case was anamolous. The case was removed from the data set and a new data set consisting of 29 cases and 12 variables was analyzed. A list of correlation coefficients of variables with rotated factor scores resulting from the principal components analysis is presented in Table 16.

Table 16. Correlations of Variables with Rotated Factor Scores. (High correlation coefficients are underlined)

| | Factor | | | | |
|---|---|---|---|---|---|
| Artifact Type | I | II | III | IV | V |
| Thick Bifaces | .07737 | .12372 | -.09448 | .08345 | .97303 |
| Thinned Bifaces | .19792 | .94188 | -.08854 | .09300 | .01347 |
| Endscrapers | -.95328 | -.16581 | -.12671 | .20834 | -.02439 |
| Sidescrapers | -.05367 | -.05648 | -.01558 | .22118 | .11848 |
| Perforators | .10008 | .01103 | .97474 | .11651 | -.09573 |
| Pedunculates | .07050 | -.14213 | -.02011 | -.59552 | -.09878 |
| Beaked Implements | .25878 | -.09496 | .20208 | .11821 | .12295 |
| Gravers | -.01706 | -.07000 | -.07068 | -.06749 | -.05448 |
| Nibbled Edge Pieces | .07225 | .03425 | .69133 | .01950 | -.00313 |
| Projectile Points | .14270 | -.73711 | -.34005 | .24239 | -.37592 |
| Denticulates | .04465 | .23731 | -.13409 | -.94165 | .05666 |
| Notched Pieces | .06079 | .04436 | .00196 | .00173 | .08784 |
| Cumulative Proportion of Total Variance | 50.7 | 66.9 | 76.9 | 86.2 | 92.0 |

Five components accounting for 92.0 percent of the total variance were considered for further analysis. Component I is a specific component which has a high negative correlation with Variable 3 (End-scrapers). The variation in Component I represents 50.7 percent of the total variance present. Component II has a high positive correlation with Variable 2 (Thinned Bifaces) and a lower negative correlation with Variable 10 (Projectile Points). Component II represents a contrast between two extremes, those sites with a high percentage of thinned bifaces and a low percentage of projectile points and those sites with a high percentage of projectile points and a low percentage of thinned bifaces. The individual proportion of the total variance represented by Component II is 16.2 percent. Component III has a high positive correlation with Variable 5 (Perforators) and a lower positive correlation with Variable 9 (Nibbled Edge Pieces). Component III contributed 10.0 percent of the total variance. Component IV has a high negative correlation coefficient with Variable 11 (Denticulates) and a lower negative correlation with Variable 6 (Pedunculates). The individual proportion of the variance represented by Component IV was 9.3 percent. Component V is a specific component which has a high positive correlation with Variable 1 (Thick Bifaces). The individual proportion of the total variance represented by Component V is 5.8 percent. The use of the principal components analysis reduced the number of variables from 12 to five, with the five new uncorrelated components having a cumulative percentage of the total variance of 92.0 percent.

The formation of groups of sites which share similar artifact attributes requires the use of some type of clustering technique. The method of cluster analysis used to group the sample of sites was Ward's. The analysis presented here used the average squared Euclidean distance coefficient as a measure of item difference. Case factor scores of principal components I-V were used to develop the distance matrix (Table 17). A seven cluster solution was selected for the purpose of data analysis (Figure 22).

The clusters created by the cluster analysis contain sites which share similar percentages of artifact types. Table 18 is a listing of the approximate percentage of variability contributed by each of the five components among the seven clusters of sites. The percentage of variability contributed by each component in a cluster was estimated by calculating the mean percentage of artifacts attributes having high positive or negative correlation coefficients with a component. The mean percentage figures were added together in components having more than one high correlation coefficient (greater than .50). While it is realized that these attributes do not explain all of the variability within a component, they do provide a good indication of the source of that variability.

Sites in Cluster I and II are similar in that a wide variety of artifacts were present at sites in both clusters. Cluster I (n=9) had a

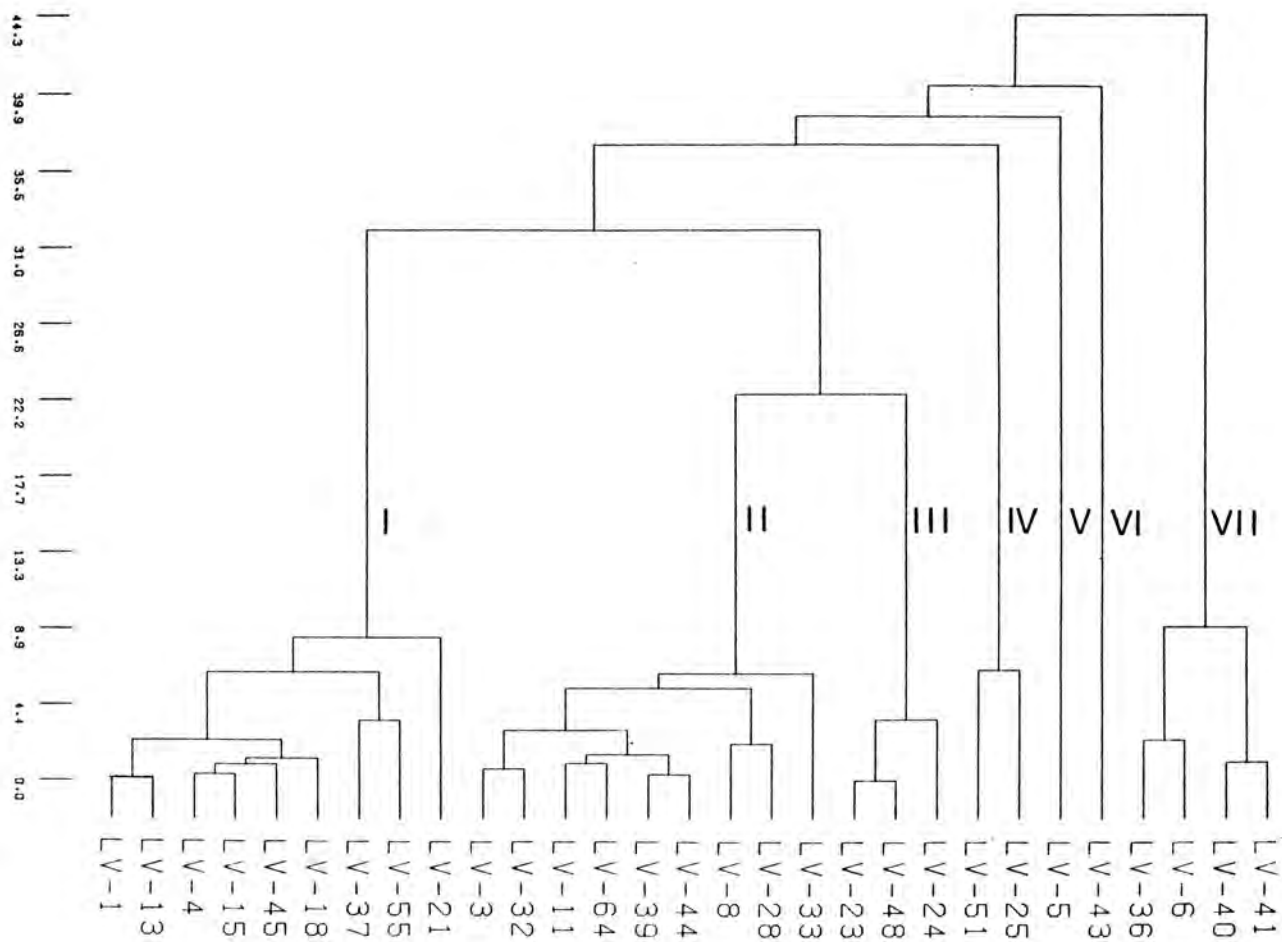


Figure 22. Dendrogram Showing Results of Cluster Analysis of Site Artifact Data.

Table 17. Factor Scores Used as Input to Cluster Analysis of Sites.

| Cluster | Site Number | Factor I | Factor II | Factor III | Factor IV | Factor V |
|---|---|---|---|---|---|---|
| I | LV-1 | .710 | .191 | -.665 | .137 | .884 |
| I | LV-13 | .498 | -.145 | -.594 | .179 | .857 |
| I | LV-4 | -.063 | .321 | -.498 | .080 | 1.234 |
| I | LV-15 | -.001 | .138 | -.042 | -.238 | 1.015 |
| I | LV-45 | .001 | -.531 | .083 | -.046 | .962 |
| I | LV-18 | -.652 | .470 | -.098 | .378 | .886 |
| I | LV-37 | -.612 | -.296 | .392 | -1.107 | 1.588 |
| I | LV-55 | .517 | .400 | -.504 | -1.556 | .725 |
| I | LV-21 | .422 | .195 | .021 | .938 | 2.751 |
| II | LV-03 | .179 | 1.015 | .096 | -.501 | -.086 |
| II | LV-32 | -.136 | .699 | -.068 | .159 | -.201 |
| II | LV-11 | .851 | .178 | .053 | .183 | .314 |
| II | LV-64 | .301 | -.148 | .060 | .258 | -.446 |
| II | LV-39 | -.016 | .307 | .316 | .773 | .136 |
| II | LV-44 | .301 | .349 | .555 | .804 | -.301 |
| II | LV-8 | 1.054 | -.591 | .962 | .519 | .164 |
| II | LV-28 | .118 | -.529 | .948 | .469 | -.947 |
| II | LV-33 | -.495 | -.054 | .580 | -.905 | -1.256 |

Table 17. (continued)

| Cluster | Site Number | Factor I | Factor II | Factor III | Factor IV | Factor V |
|---|---|---|---|---|---|---|
| III | LV-23 | 1.427 | -1.759 | -.909 | .589 | -.961 |
| III | LV-48 | 1.427 | -1.758 | -.909 | .589 | -.961 |
| III | LV-24 | .428 | -.679 | -.779 | .428 | -.298 |
| IV | LV-51 | .153 | 1.546 | -.543 | -2.677 | -1.000 |
| IV | LV-25 | .373 | -.889 | -.140 | -2.992 | -.607 |
| V | LV-5 | .736 | 3.520 | -.966 | 1.520 | -1.656 |
| VI | LV-43 | .286 | .099 | 4.406 | .178 | -.593 |
| VII | LV-36 | -2.700 | .462 | -.109 | .241 | .279 |
| VII | LV-6 | -2.947 | -.718 | -.334 | .437 | -.624 |
| VII | LV-40 | -.665 | -.731 | -.790 | .677 | -1.115 |
| VII | LV-41 | -1.489 | -1.064 | -.525 | .488 | -.736 |

Table 18. Percentage of Variability Contributed to Clusters I-VII by Artifact Types Having High Correlation Coefficients With Each Component.

| | Component | | | | | |
|---|---|---|---|---|---|---|
| Site Cluster | I | II | III | IV | V | Total |
| I | 9.2 | 36.7 | 5.2 | 12.3 | 21.1 | 84.5 |
| II | 8.4 | 38.8 | 15.5 | 6.4 | 7.8 | 76.9 |
| III | 3.7 | 77.8 | 0.0 | 0.0 | 3.7 | 85.2 |
| IV | 0.0 | 41.7 | 0.0 | 58.3 | 0.0 | 100.0 |
| V | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| VI | 0.0 | 20.0 | 80.0 | 0.0 | 0.0 | 100.0 |
| VII | 38.1 | 46.9 | 0.7 | 1.5 | 3.0 | 90.2 |

higher percentage of thick bifaces (Component V), denticulates and pedunculates (Component IV), while Cluster II (n=9) had a higher percentage of perforators and nibbled edge tools (Component III). Cluster III (n=3) sites contained a high percentage of artifacts represented by Component II (Thinned Bifaces or Projectile Points). Projectile points represented 62.5 percent of the artifacts present at Cluster III sites. Cluster IV (n=2) sites had high percentages of projectile points or thinned bifaces (Component II) and denticulates and pedunculates (Component IV). Cluster V (n=1) contained one site at which the only artifact type present was thinned bifaces. Cluster VI (n=1) consisted of one site having a high percentage of perforators and nibbled edge pieces (Component III). Cluster VII (n=4) was represented by sites having a high percentage of endscrapers (Component I) and thinned bifaces or projectile points (Component II).

The results of the cluster analysis disclosed several trends in the distribution of sites in the research area. Cluster I and II consist of sites which have their total artifact variability accounted for by a relatively high number of artifact types. Examination of the pattern of distribution of Cluster I and II sites with respect to the diversity index scores of those sites supports the above statement (Table 19). Eighty-eight percent (n=8) of Cluster I sites and 100 percent (n=9) of Cluster II sites were included in diversity Classes 2 or 3 in the diversity analysis which had moderate to high diversity index scores (Figure 20).

Table 19. Percentage Distribution of Sites Among Site Clusters and Diversity Index Classes

| | Diversity Index Class | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Cluster I | .11 | .44 | .44 |
| Cluster II | .00 | .56 | .44 |
| Cluster III | .67 | .33 | .00 |
| Cluster IV | 1.00 | .00 | .00 |
| Cluster V | 1.00 | .00 | .00 |
| Cluster VI | 1.00 | .00 | .00 |
| Cluster VII | .75 | .25 | .00 |

In contrast, 82 percent (n=9) of the sites included in Clusters III-VII were included in diversity Class I. Class I was characterized by low diversity index scores. Most of the sites in Clusters III-VII have a high percentage of artifact variability explained by a low number of artifact types.

The geographic distribution of sites in the clusters roughly parallels that found among the diversity index site classes. Sixty-seven percent (n=14) of the floodplain stratum sites were included in Cluster I and II. One hundred percent (n=2) of the valley upland stratum sites were contained in these two clusters, while only 29 percent (n=2) of the upland plateau stratum sites used in this analysis were included.

In effect, the diversity index enables the identification of those sites sharing <u>similar levels of activities</u> based on the number of artifact types present at a site, while the principal components analysis and cluster analysis makes it possible to identify the sources of that variability and group together those sites which share <u>similar percentages of artifacts</u>.

In view of the results of the analysis of the distribution of tool types among Woodland sites in the Lookout Valley research area, several trends are evident:

1) The widest range of artifact diversity occurs among floodplain sites.

2) The widest variety of flaked stone tools occurs at floodplain sites.

3) There is an incremental decrease in the level of activities as reflected by flaked stone tools as one moves out of the floodplain toward the upland plateau.

4) Upland plateau sites tend to reflect a much narrower range of activities than found among floodplain sites.

Primary emphasis of the Lookout Valley project has been based on the analysis of activity variability among Woodland sites on the inter and intra stratum level. The use of the physiographic stratum concept provides a good overall descriptor of the general environmental conditions within a specific portion of the research universe. It is also worthwhile to examine the association of archaeological sites with specific environmental characteristics such as soil and water resources, even though the variability of these attributes may be somewhat correlated with a specific physiographic stratum.

Soils

The types of soils on which archaeological sites are located have been utilized as a means of examining settlement variability in various parts of the world (Green 1973, SARG 1974, Fish 1976b). The activities carried out by the prehistoric inhabitants of archaeological sites in the research universe may be related to the type of soil on which a site is located. If permanent base camps or habitation sites were associated with agricultural activity, as is often hypothesized for the

Woodland Period, it would be expected that these sites would be located on or near soils having potential for primitive agricultural activity.

The calculation of the diversity index scores (Figure 20) indicates that three classes of sites could be discerned. Class I sites had low diversity index scores and may represent specialized activity areas. Class III sites had high index of diversity scores which may represent more permanent base camps. It would be expected that the base camps with high diversity index scores would tend to be situated on soil with good agricultural potential.

No data is available concerning the distribution or quality of soils in the research area during the prehistoric or early historic periods. The only available source of data pertaining to the quality of soils in the Lookout Valley area is a Department of Agriculture soil survey report published in 1942 (Taylor, et. al. 1942). Approximately 80 percent of the land in Dade County had never been cleared and cultivated prior to the 1942 soil survey. It is unlikely that culturally induced alterations of the soil in the research area, such as erosion associated with the introduction of plow agriculture by European settlers, seriously altered the basic distribution of soil types (Taylor, et. al. 1942:13).

Four classes of soils are present in the research area. The best soils in the county are classified as second class soils (28 percent of the county) and are considered good to fair for crops based on 1942 standards. Third class soils (8 percent of the total) are considered fair to poor for crop land and generally occur on steeper slopes than second class soils. Fourth class soils (17 percent of the total area) are unsuited for agricultural purposes because of stoniness, steep slopes or impervious subsoil. Fifth class soils (47 percent) consist of rough, stony or mountainous land which is best suited for forests (Taylor, et. al. 1942:58-59).

Woodland sites located in the floodplain stratum (n=21) are found on Class 2 (81 percent of the sites), Class 3 (10 percent of the sites) and Class 4 (10 percent of the sites) soils. Valley upland sites (n=2) are located on Class 2 (50 percent) and Class 4 (50 percent). Upland plateau sites have the most restricted distribution, occurring only on Class 5 soils (100 percent). Examination of the distribution of soils among the three classes of sites in the diversity index (Table 20) discloses that Class III sites (n=8), having the highest diversity scores and the most diverse assemblages of artifacts, are largely found on Class 2 soils (highest quality). Sixty-three percent of the sites in site diversity Class II (n=11) are located on good soil, while only 27 percent of Class I sites are found on soil which is well suited for agricultural purposes.

If the four soil classes are quantified so that Class 2 soils have a value of 2.0, Class 3 soils = 3.0, etc., the trend can be more

Table 20. Site Distribution According to Site Diversity Class and Soil Type.

| | Soil Type | | | | |
|---|---|---|---|---|---|
| Site Diversity Class | 2 | 3 | 4 | 5 | Total |
| I | 3 | 2 | 1 | 5 | 11 |
| II | 7 | 0 | 2 | 2 | 11 |
| III | 8 | 0 | 0 | 0 | 8 |
| Total | 18 | 2 | 3 | 7 | 30 |

clearly discerned. The mean value of soils on which Class I sites (low diversity scores) are found is 3.7, indicating the presence of sites located on soils poorly suited for agricultural purposes. Sites in Class II of the diversity index have a mean of 2.9, while sites in Class III (high diversity scores) have a mean value of only 2.0 which indicates the presence of sites which only occur on Class 2 soils. A tendency can be observed, based on the above analysis, that sites having high artifact diversity index scores are located on the best soils and as the artifact diversity scores decrease, the sites tend to be situated on more inferior agricultural soils. The tendency is best observed among floodplain stratum sites since this is the only stratum having sites distributed through all three site diversity classes in the diversity index.

A similar trend was observed among sites in each cluster of the cluster analysis (Figure 22). Cluster I contains eight sites (89 percent) located on Class 2 soils and 67 percent of the sites in Cluster II were located on Class 2 soils. The remaining clusters of sites contained sites situated primarily on inferior quality agricultural soils.

## Water

Water is a physiological necessity for all living forms. The primary factors which can be measured include rainfall, humidity and available surface water (Odum 1971:119). Water is considered to be a critical resource because: a) the necessity of potable drinking water, b) available aquatic food resources such as shellfish, fish, aquatic mammals and water fowl and c) a means of communication and transportation.

The availability of water in the research area is not a serious problem most of the year. Shortages in the water supply are most likely to occur in the upland areas of the Lookout Valley area. In the nineteenth and early part of the twentieth centuries it was not unusual for mountain people to haul water during dry periods, while the valley would always have an adequate supply of water (Taylor et. al. 1942:3-4).

Water resources in the valley consist of Lookout Creek, the primary drainage feature, a number of smaller secondary streams, as well as numerous springs and sinkholes. In contrast, very few streams are found on the mountain tops. Most of the drainage is toward the interior portion of the mountain tops. Some of the smaller streams leave the rim of the mountain through small inconspicuous gaps (Sullivan 1942:6).

The distance of a site from water was determined using U.S.G.S. topographic maps and observations in the field. Distances were calculated from the center of the site to the nearest source of water. Other sources of water may have been utilized by the prehistoric inhabitants which were not observed in the field, absent from topographic maps or no longer present. Floodplain stratum sites are located on or near the primary and secondary streams which crosscut the valley floor. The distance to the nearest water supply at these sites ranges between 20 meters and 250 meters. The access to and reliability of the water supply was not a critical factor to the inhabitants of these sites. A more serious problem among floodplain inhabitants might have been the possibility of being affected by flooding during periods of high water. The location of floodplain sites would be expected to be based on a compromise between being too close to streams and consequently being inundated during periods of high water and yet being close enough to have easy access to the water supply for general utility purposes. The mean distance of floodplain sites to the nearest source of water is 84.3 meters, with a range of 20 to 250 meters.

Valley upland sites located on the ridges and hills throughout the valley tended to be located farther from the sources of water than other classes of sites. The two Woodland sites in the research area from this stratum had a mean distance to water of 190.0 meters and a range of 160 to 220 meters. Upland plateau sites were situated in the area of the research universe having the lowest level of reliability for a continuous supply of water. Many of the sites on the upland plateau were located near the rim of the mountain where small streams and springs leave the mountain top. The mean distance to the nearest source of water for upland plateau sites was 52.9 meters, considerably below the mean distance of sites in the other physiographic strata. Upland plateau sites range in distance from 10 to 270 meters from the nearest source of water. If the site located 270 meters from water is removed from consideration, the range and mean are reduced to 10 to 25 meters and 16.7 meters respectively. Many of the upland plateau sites (71 percent) were located in or near rockshelters which have immediate access to water (closer than 25 meters). During the survey a large number of rockshelters were tested for prehistoric occupational debris, but generally, only those sites situated near a supply of fresh water were found to be utilized by the prehistoric population. It appears that the access to a supply of water was a more critical factor in determining site location in the upland plateau where the water supply is less reliable, than at the floodplain or valley upland sites where a continuous supply of water exists year around. No sites were located during the surface survey which were situated greater than 270 meters from a source of water. The mean distance to the nearest source of water for all sites under investigation was 84.0 meters.

## CHAPTER X

## SUMMARY AND CONCLUSIONS

This study has been directed toward the analysis of the nature of the lithic artifact variability among Woodland sites in the Lookout Valley research area and the formulation of a general model of settlement variability based on the results of that analysis. An attempt has been made to examine the intersite activity variability as discerned through the analysis of flaked stone tools and debitage with respect to those environmental factors considered to be critical to settlement and subsistence during the Woodland Period.

A second goal of this study has been to test a series of research strategies and analytical techniques which can be utilized to discern patterns of prehistoric behavioral variability using material collected during archaeological surface reconnaissance. The development of techniques which can be applied to this type of data is a worthwhile goal since much of the archaeological data base consists of surface collected artifacts.

The generalized model of settlement variability based on the diversity of lithic material occurring at sites in the research area provides a framework for predicting the nature of activity variability in the research area. A model is a construct used to test the goodness of fit of the data. The model presented in this study is supported by the results of the analysis of data. Additional data collected from new sites in the research area can be used to test further and modify the model presented in this study. The model also lends itself to testing with data from other regions to compare the nature of settlement variability in the Lookout Valley area with that found in other research areas.

One of the goals set forth in Chapter V was to test a number of hypotheses related to the nature of intersite activity variability. The first hypothesis predicted that a certain amount of intersite lithic artifact variability would be expected in the research area. The results of analysis have supported this hypothesis by demonstrating a wide range of artifact variability both within and between the three major physiographic strata.

The second hypothesis predicted that sites could be grouped into categories which reflected the various types of maintenance and exploitive activities performed in the research area. The results of that part of the analysis demonstrated that while broad categories of sites could be derived on the basis of the diversity of activity carried out at a site and the similar composition of assemblages, they are not considered to reflect specific types of activities or combinations of activities. The analysis disclosed the existence of a continuum of site activity ranging from those sites having evidence of little activity variability to those showing a very wide range of activity.

The third hypothesis stated that sites which contained a similar range of lithic material will be linked together by the presence of similar environmental attributes. While sites sharing similar artifact attributes were not always associated with the same environmental characteristics, the study clearly demonstrated that patterns of site artifact variability were associated with the three environmental strata delineated in the research area. General locational characteristics of sites within these strata were also analyzed revealing that patterns existed between the degree of site artifact variability and the distance of a site to chert acquisition areas, water resources and the type of soil on which the site is located. While the artifactual data only provides information associated with a segment of the total range of cultural activity, it seems that these sources are useful in gaining insight into the range of human activity variability in the research area.

A summary of intersite activity variability can be obtained by examining the diversity of lithic material recovered from sites in each of the three physiographic strata used in the analysis. Floodplain sites were found to exhibit the greatest degree of artifact variability among the three strata examined in the analysis. The results of the analysis tend to indicate that the widest range of stone tool manufacturing activities as reflected by debitage attributes and the widest range of other cultural activities as reflected by the diversity of stone tools occurred in the floodplain stratum.

A prime example of the degree of artifact diversity which occurred at sites in the floodplain stratum is the Tunacunnhee site (LV-64) (Figure 4). Tunnacunnhee exhibited the most diverse range of artifacts in the research area as indicated by the diversity scores in both of the diversity index analyses (1.0 and .92 respectively). The site was included in Cluster II in the analysis of artifact variability which was characterized by the presence of sites having a wide range of artifact types. Data supporting the unique nature and extreme diversity of the site can be found in other areas of the Tunacunnhee site. Tunacunnhee is the only Woodland site in the research area known to have burial mounds in association with the habitation area. An extremely diverse range of artifacts including examples made of copper, silver, mica and other exotic raw materials were associated with burials found in the mounds. The results of the analysis of lithic material from the Tunacunnhee site led to the formulation of the hypothesis of the occurrence of a wide range of subsistence related activities at the site. Examination of the remains of other sectors of the society provide more supporting evidence of the extreme diversity of the site.

The valley upland sites tend to occupy a middle range position on the continuum of site activity variability. The degree of diversity of artifacts is less than that found at the more diverse floodplain sites, but greater than that found at other sites located in the floodplain. Debitage attributes also indicate that stone tool manufacturing activities are more diverse than those found at many floodplain sites, but more restricted than those found at others.

Upland plateau sites occupy the end of the continuum of activity diversity represented by specialized activities and more restricted stone tool manufacturing activities. The range of artifact diversity is very restricted in the upland plateau stratum. Most of the sites in this stratum tend to reflect more specialized activities than found at sites in the floodplain or valley upland zones. Debitage attributes support the hypothesis of a very limited range of stone tool processing activites. These attributes generally reflect those activities expected to be associated with tool resharpening and modification instead of primary or secondary reduction.

The techniques presented in this study seem to be quite useful in identifying, measuring and analyzing the nature of activity diversity in the research area as reflected by the variability and diversity of stone tools. The nature of the association between certain environmental factors and the presence of sites sharing similar levels of diversity has been examined revealing certain consistent patterns.

Future research will involve the expansion of the data base used in this study in an attempt to increase the sample size of sites. A larger sample would be expected to be more representative of the total range of activity variability in the research area and provide an opportunity to further refine the model of human activity variability during the Woodland Period in the Lookout Valley area of northwest Georgia.

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# APPENDIX I

## Site Descriptions

| Site | Physiographic Strata* | Distance to Nearest $H_2O$ (Meters) | Elevation (Meters) | Soil Class |
|---|---|---|---|---|
| LV - 1 | 1 | 50 | 284 | 2 |
| LV - 3 | 1 | 30 | 213 | 2 |
| LV - 4 | 1 | 20 | 244 | 4 |
| LV - 5 | 3 | 270 | 405 | 5 |
| LV - 6 | 1 | 60 | 244 | 4 |
| LV - 8 | 2 | 220 | 280 | 4 |
| LV - 11 | 1 | 110 | 235 | 2 |
| LV - 13 | 1 | 80 | 235 | 2 |
| LV - 15 | 1 | 40 | 247 | 2 |
| LV - 18 | 2 | 160 | 253 | 2 |
| LV - 21 | 1 | 30 | 232 | 2 |
| LV - 23 | 1 | 30 | 244 | 2 |
| LV - 24 | 1 | 40 | 226 | 2 |
| LV - 25 | 1 | 40 | 229 | 3 |
| LV - 28 | 3 | 25 | 610 | 5 |
| LV - 29 | 3 | 15 | 594 | 5 |
| LV - 32 | 1 | 80 | 210 | 2 |
| LV - 33 | 3 | 25 | 558 | 5 |
| LV - 36 | 1 | 150 | 213 | 2 |
| LV - 37 | 1 | 90 | 213 | 2 |
| LV - 39 | 1 | 70 | 210 | 2 |
| LV - 40 | 3 | 15 | 576 | 5 |
| LV - 41 | 3 | 10 | 576 | 5 |
| LV - 43 | 1 | 150 | 210 | 2 |
| LV - 44 | 1 | 130 | 210 | 2 |
| LV - 45 | 1 | 190 | 210 | 2 |
| LV - 48 | 3 | 10 | 549 | 5 |
| LV - 51 | 1 | 60 | 220 | 3 |
| LV - 55 | 1 | 70 | 290 | 2 |
| LV - 64 | 1 | 250 | 210 | 2 |

*1 = Floodplain
2 = Valley Uplands
3 = Upland Plateau

# APPENDIX II

## Frequency of Tool Types by Site

| Tool Types | LV - 1 | LV - 3 | LV - 4 | LV - 5 | LV - 6 | LV - 8 | LV - 11 | LV - 13 | LV - 15 | LV - 18 | LV - 21 | LV - 23 | LV - 24 | LV - 25 | LV - 28 | LV - 29 | LV - 32 | LV - 33 | LV - 36 | LV - 37 | LV - 39 | LV - 40 | LV - 41 | LV - 43 | LV - 44 | LV - 45 | LV - 48 | LV - 51 | LV - 55 | LV - 64 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thick Bifaces | 6 | 2 | 2 | | | 1 | 8 | 3 | 10 | 4 | 11 | | 1 | | | | 4 | | 4 | 14 | 3 | | | | 2 | 19 | | | 1 | 20 | 115 |
| Thinned Bifaces | 8 | 8 | 3 | 1 | | 1 | 11 | 3 | 9 | 6 | 8 | | | | 1 | | 12 | | 6 | 6 | 8 | | | 1 | 6 | 8 | | 1 | 2 | 59 | 168 |
| Unifacial - Straight Endscrapers | | | | | | | | | | 1 | | | | | | | 1 | | | | | | | | 1 | 1 | | | | 6 | 10 |
| Unifacial - Convex Endscrapers | 1 | 1 | | | 1 | | | 1 | 5 | 2 | 2 | | 1 | | 1 | | 1 | | 11 | 5 | 3 | | | | | 6 | | | | 14 | 55 |
| Bifacial - Straight Endscrapers | | | | | | | | | | | | | | | | | | 1 | | | | 1 | 1 | | | 1 | | | | | 4 |
| Bifacial - Convex Endscrapers | | | 1 | | | | 1 | | | | | | | | | | 2 | | 2 | 3 | | | | | 1 | 3 | | | | 4 | 17 |
| Nosed Endscrapers | | | | | | | | | | 1 | | | | | | | 1 | | 2 | 1 | | | | | | 1 | | | | 6 | 12 |
| Unifacial - Single Edge- Convex Sidescraper | 2 | | | | | | | | 2 | | | | | | | | | | | | | | | | | 3 | | | | 5 | 12 |
| Unifacial - Single Edge - Straight Sidescraper | | | | | | | 2 | | | | 2 | | 1 | | | | 2 | | | | | | | | 2 | 1 | | | | 3 | 13 |
| Unifacial - Single Edge - Concave Sidescraper | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | 2 | | | | 5 | 9 |
| Unifacial - Double Edge - Biconvex Sidescraper | | | | | | | 2 | | 2 | | | | | | | | | | | | | | | | | | | | | | 4 |

Appendix II (Continued)

| Tool Types | LV - 1 | LV - 3 | LV - 4 | LV - 5 | LV - 6 | LV - 8 | LV - 11 | LV - 13 | LV - 15 | LV - 18 | LV - 21 | LV - 23 | LV - 24 | LV - 25 | LV - 28 | LV - 29 | LV - 32 | LV - 33 | LV - 36 | LV - 37 | LV - 39 | LV - 40 | LV - 41 | LV - 43 | LV - 44 | LV - 45 | LV - 48 | LV - 51 | LV - 55 | LV - 64 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bifacial - Single Edge - Convex Sidescraper | 1 | | | | | 1 | 2 | | | | 1 | | | | | | 2 | 1 | 2 | 1 | 1 | 1 | | | 2 | 1 | | | | 6 | 22 |
| Bifacial - Single Edge - Straight Sidescraper | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 |
| Bifacial - Double Edge - Biconvex Sidescraper | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | | | | 4 | 6 |
| Bifacial - Convergent Straight/Convex Sidescraper | | | | | | | 1 | | | | 1 | | | | | | | | 2 | 2 | | | | | | 2 | | | | 3 | 11 |
| Perforators | | 1 | | | | 2 | 5 | | 3 | 1 | 2 | | | | 2 | | 3 | 1 | 1 | 5 | 3 | | | 3 | 4 | 3 | | | | 23 | 62 |
| Pedunculates | | 1 | | | | | | | | | | | | 1 | | | 1 | | | 1 | | | | | | 2 | | | | 4 | 10 |
| Beaked Implements | | | | | | 2 | 5 | | 1 | | 1 | | | | | | | | | 1 | | | | | 1 | 4 | | | | 2 | 17 |
| Gravers | | 1 | | | | | 1 | 1 | 3 | | 1 | | 2 | | | | 1 | 1 | 1 | 2 | | | | | | 2 | | | | 9 | 25 |
| Nibbled Edge Pieces- Straight | | 1 | | | | | | | | | 1 | | | | | | | | | | 1 | | | 1 | | 6 | | | | 11 | 21 |
| Nibbled Edge Pieces - Convex | | 1 | | | | | | | | | 1 | | | | | | | | | | | | | | | 6 | | | | 10 | 18 |
| Nibbled Edge Pieces - Concave | | | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | | | 16 | 18 |
| Projectile Points - Complete | 6 | | 2 | | 1 | 3 | 5 | 4 | 2 | 2 | 2 | 2 | 3 | 1 | 4 | | 3 | | 1 | 2 | 7 | 2 | 2 | | 4 | 23 | 2 | | 1 | 113 | 197 |

Appendix II (Continued)

| Tool Types | LV - 1 | LV - 3 | LV - 4 | LV - 5 | LV - 6 | LV - 8 | LV - 11 | LV - 13 | LV - 15 | LV - 18 | LV - 21 | LV - 23 | LV - 24 | LV - 25 | LV - 28 | LV - 29 | LV - 32 | LV - 33 | LV - 36 | LV - 37 | LV - 39 | LV - 40 | LV - 41 | LV - 43 | LV - 44 | LV - 45 | LV - 48 | LV - 51 | LV - 55 | LV - 64 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Projectile Points - Tips* | 5 | 8 | 1 | | | 3 | 3 | 3 | 1 | 2 | 4 | | 1 | | 1 | 1 | 4 | 2 | 2 | 5 | 3 | 1 | | 3 | 4 | 5 | | 1 | | 26 | 89 |
| Projectile Points - Bases* | 3 | 7 | 1 | 2 | | 3 | 5 | 2 | 4 | 1 | 3 | | 2 | | | | 7 | 1 | 1 | 4 | | | 1 | 3 | 3 | 16 | | | | 75 | 144 |
| Denticulates | 3 | 3 | 1 | | | | 4 | 1 | 6 | 1 | | | | 1 | | | 3 | 1 | 2 | 13 | | | | | | 7 | | 1 | 2 | 13 | 62 |
| Notched Pieces | 2 | 2 | | | | | 5 | 2 | 3 | 3 | 5 | | 1 | | 1 | | 4 | 1 | | 2 | | | | | | 5 | | | | 28 | 64 |
| Total Tool Counts | 37 | 36 | 11 | 3 | 2 | 16 | 62 | 20 | 52 | 24 | 45 | 2 | 12 | 3 | 10 | 1 | 51 | 9 | 37 | 68 | 29 | 5 | 4 | 11 | 30 | 129 | 2 | 3 | 6 | 468 | 1188 |

*Used in analysis only where designated.

# APPENDIX III

Debitage Data for Sites With More Than 75 or More Flakes

| Site Number | Number of Cortical Flakes | Number of Noncortical Flakes | Mean Flake Weight (grams) | Number of Cores |
|---|---|---|---|---|
| LV-01 | 178 | 360 | 3.8 | 6 |
| LV-03 | 198 | 405 | 4.1 | 13 |
| LV-04 | 52 | 87 | 3.4 | 0 |
| LV-05 | 17 | 58 | 1.7 | 1 |
| LV-08 | 61 | 75 | 3.5 | 4 |
| LV-11 | 354 | 774 | 4.2 | 7 |
| LV-13 | 187 | 367 | 3.0 | 5 |
| LV-15 | 256 | 250 | 5.2 | 10 |
| LV-18 | 140 | 155 | 3.9 | 3 |
| LV-21 | 246 | 175 | 10.0 | 9 |
| LV-24 | 55 | 121 | 4.1 | 1 |
| LV-25 | 45 | 98 | 2.5 | 0 |
| LV-28 | 111 | 361 | 2.0 | 2 |
| LV-29 | 85 | 468 | 1.1 | 0 |
| LV-32 | 188 | 415 | 3.6 | 5 |
| LV-33 | 40 | 133 | 1.6 | 0 |
| LV-36 | 232 | 287 | 5.7 | 3 |
| LV-37 | 493 | 780 | 4.7 | 13 |
| LV-39 | 180 | 293 | 4.4 | 10 |
| LV-40 | 31 | 159 | 1.7 | 0 |
| LV-41 | 26 | 71 | 2.3 | 0 |
| LV-44 | 55 | 102 | 6.5 | 4 |
| LV-45 | 139 | 268 | 6.1 | 7 |
| LV-51 | 60 | 94 | 4.3 | 2 |
| LV-55 | 60 | 70 | 7.0 | 3 |
| LV-64 | 187 | 346 | 4.6 | 8 |