Windy Ridge: A Prehistoric Site in the Inter-Riverine Piedmont in South Carolina

John H. House
Ronald W. Wogaman

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WINDY RIDGE
A PREHISTORIC SITE IN
THE INTER-RIVERINE PIEDMONT
IN SOUTH CAROLINA

by John H. House and Ronald W. Wogaman

Anthropological Studies 3

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Institute of Archeology and Anthropology
The University of South Carolina
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IN SOUTH CAROLINA

by

John H. House and Ronald W. Wogaman

South Carolina Institute of
Archaeology and Anthropology
University of South Carolina
Columbia, South Carolina 29208

Anthropological Studies 3

Prepared by the
INSTITUTE OF ARCHEOLOGY AND ANTHROPOLOGY
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August, 1978
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The graphics in this report were drawn and, in part, designed by Mr. Darby Erd, Institute Artist. The excellent artifact photography in this report is the work of Emily Short and Gordon Brown of the Institute of Archeology and Anthropology.

Preparation of this published report from the Windy Ridge manuscript is the work of Susan Jackson, Institute Editor. Susan not only undertook the massive and painstaking task of producing a finished monograph after being presented with a chaotic and hastily prepared draft manuscript but was a constant source of good advice and encouragement during the writing of the report. Sue Jane Alsing, Institute Typist, not only typed the manuscript but helped us excavate at the site one day.

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Two University of South Carolina geologists made major contributions to the Windy Ridge research. Mr. Jerry Weisenfluh, then a graduate student in geology not only carried out the technical tasks of thin-sectioning and describing the petrology of chipped stone raw materials but also participated in long and informative discussions with the writers on the methods of petrological analysis in archeological research.

-x-
Dr. Leonard Gardner of the faculty of the Department of Geology volunteered his expertise in the analysis and interpretation of soils data from the site. Dr. Gardner visited the site during the excavations and observed and discussed exposed profiles and subsequently read and critiqued portions of the manuscript dealing with soils and stratigraphy.

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Though we received much good advice from many persons, we undoubtedly did not always heed it to the extent we should have. We take full responsibility for any unwarranted inferences, logical inconsistencies or misrepresentations of other peoples' ideas which may be present in this report.
FOREWORD

Windy Ridge was one of those "typical" Piedmont upland lithic scatters that archeologists for several years have acknowledged in an offhanded way to exist in the Southeast. I fear, though, that describing Windy Ridge as an "upland lithic scatter" is analogous to referring to the Statue of Liberty as a "skywardly oriented pile of bronze." While both expressions may be correct descriptively, the very morphological nature of these terms reveals a complete ignorance about what each has to do with human beings.

The basic upland or inter-riverine lithic scatter has been ignored by southeastern archeology and for the most part continues to be underestimated and undervalued even in today's conceptually expanding framework of cultural resource management. Roy Dicken's excavation and analysis of a similar site in Stone Mountain, Georgia in 1962 provides a noteworthy exception to this trend. Until recently, inter-riverine sites such as Windy Ridge were regarded as having little research value since they were quite unlikely to be stratified, contained monotonously simple artifact assemblages, were often only lightly deposited, probably had no features, and practically all of them had been plowed and to some extent eroded. But for studies that view culture as an adaptive system and the archeological record a consequence of such systems, sites like Windy Ridge are indispensable since they constitute over 90% by type of site and by geography of the Piedmont archeological record. To not incorporate such sites into their rightful regional and functional positions would be to construct badly distorted models of prehistoric settlement and subsistence.

The methodological contributions of this report are real and apparent. To date, between 700 and 800 Piedmont lithic scatters have been recorded and surface collected in South Carolina. Windy Ridge, however, because of the way it was excavated, constitutes our first such site whose artifact proveniences do not come to us from a spatially uncontrolled surface collection with the results all placed inside a single paper bag. House and Wogaman excavated the site, in part, to test the assumption that these sites are not represented by spatially unorganized masses of lithic material that have accumulated irregularly from the occupations of numerous groups over the millennia. Their assumption is well born out in the results and provides empirical proof of our belief that even the most ephemeral of these sites is loaded with behavioral and spatial information. Such patterning is both recognized and explained by the models of site formation explicitly provided by the authors, models that incorporate natural and behavioral variables. Particularly valuable among these is the biface reduction model. The view taken and used to good end in the analysis of Windy Ridge, is that the hafted biface, like any element of material culture, has a life cycle that begins with raw material procurement and ends as a form of archeological refuse. Unless our classifications are capable of recognizing at which stage and why an element left the systemic state and became part of the archeological record, then we cannot hope to understand a site in terms of human behavior. Human behavior is a dynamic thing, artifacts are not.
Another methodological contribution of this study, although incidental to the overall goals of the research design, is the evaluation of our currently practiced survey techniques. All of our knowledge about the content, occupational history, size and function of Piedmont sites in South Carolina has come from surface collections that are made under highly variable ground conditions. From most of our site surveys we usually attempt to make statements about the nature of sites related to these properties. As a good illustration of the pitfalls of making such statements using this kind of data, Windy Ridge was originally discovered and described from an intensive surface collection made in a dirt road. In the analysis during the I-77 survey, the only cultural periods represented were those of the Guilford and Morrow Mountain phases. Upon excavation of approximately 12% of the site, components related to Palmer, Stanly, Savannah River, Otarre, and Early and Middle Woodland were added to the occupational history of the site. The point is, until several more sites are excavated in the manner of Windy Ridge and compared with the results of survey findings, we are in no position to evaluate the efficacy of our Piedmont survey methods. The excavation of Windy Ridge constitutes our first step in this direction and provides one site of which there must be many more added to have the necessary excavated comparative data base.

What can the study of sites like Windy Ridge eventually tell us about prehistoric life in the Piedmont? Ultimately such studies will allow archeologists to understand how the inter-riverine zone was used by aboriginal groups, how certain organizations were employed, and why they were adaptive. In order to do this three important properties of these sites must be controlled to enable the building and testing of processual models. These are their geographic or regional locations as they may have related to the activities carried out there; the technological and functional contents of sites as they indicate what activities were conducted there; and the intra-site or spatial distributions of artifactual refuse. The question of site distributions on the regional level is largely in the domain of survey. Site contents and the spatial distributions of those contents is a matter for excavation.

House and Wogaman show that the artifactual contents of Windy Ridge, when compared to those sites suspected to be loci of habitation among Archaic sites in the Southeast, are quite limited in both a technological and functional way. The dominant tool form throughout the 8,000 or so years of human activity at Windy Ridge was the hafted biface, presumably used as a butchering implement. By controlling for all techno-functional variability in the technological refuse of inter-riverine sites and appreciating the adaptive capacities of each tool system through time, we are in a position to say rigorously what activities took place at these locations.

The property of intrasite artifact distributions must be controlled in order to comprehend how a site was used. Such data are critical since they preserve in several ways evidence of how tasks were performed or organized. This is true since all activities have a spatial context.
If one kind of hunting strategy involves the reuse of the same knoll as a camping and butchering location over several successive trips or seasons, hunters are more likely to reuse the same camp facilities such as butchering and drying racks and lean-tos or other forms of temporary shelter. Archeologically this could mean the reoccupation of former working "floors." But under another set of logistical conditions where less time is spent by a hunting group in a hunting catchment or where larger catchments are used, reoccupation of a single site, and much less a former floor, will be rendered less probable. These and other hypothetical strategies of hunting all have differing consequences for the formation of sites. To be succinct, there are plenty of reasons why significant variation should exist in the organization and spatial expressions of site use both within a single cultural system and between different systems through time.

Regarding variability in intra-site artifact distributions, one of the more intriguing findings of the authors at Windy Ridge was the heterogeneity across the site in terms of culture-historical components. The differences in size and density of the Morrow Mountain phase loci compared to other temporally identified loci, such as the Savannah River phase, are fascinating if not yet understood. Although they were not able to fully uncover and isolate these various loci, House and Wogaman have easily demonstrated that such variability exists and the authors provide some stimulating thinking as to why such differences in size and density might occur.

The intra-site study of Windy Ridge by House and Wogaman is a beginning. It is a first step toward the building of a multi-site data base that will allow us to see the ranges in artifact content and intra-site spatial arrangements of Piedmont sites. Unless we have some appreciation for the total range in content and distributional tendencies for these sites, our attempts to discern modes and regularities will be hopelessly ill founded. But while we are gathering this kind of data, attention must also be paid to developing models that explain how certain activities operating within broader organizational strategies could leave such archeological records. At a minimum, there is no doubt we will eventually have more complex taxa for describing these sites than "upland lithic scatters."

Albert C. Goodyear  
Institute of Archeology and Anthropology  
University of South Carolina  
Columbia, South Carolina  
August 1978
ABSTRACT

Windy Ridge, 38FA118, is a prehistoric site located on a ridge top in the inter-riverine zone between the Catawba-Wateree and Broad rivers in Fairfield County in the Piedmont portion of South Carolina. In May and June, 1977, archeological excavations were conducted at Windy Ridge by John H. House and Ronald W. Wogaman of the Institute of Archeology and Anthropology, University of South Carolina, Columbia. These excavations were funded by the (then South Carolina Highway Department) South Carolina Department of Highways and Public Transportation for the purpose of mitigating the loss of archeological resources due to construction of Interstate 77.

It has been requested that Windy Ridge and thousands of similar lithic artifact scatters on upland land surfaces throughout the southern Piedmont represent hunting camps that were occupied for brief periods, perhaps seasonally, throughout the Archaic. The archeological research at Windy Ridge was designed to examine this hypothesis in the case of a single site. Two alternative hypotheses of the overall function of such a site in prehistoric settlement systems and two hypotheses of the potential biotic resources extracted from the environment at such a site were formulated and a set of archeological test implications were outlined for each hypothesis. The sampling strategy and excavation techniques together with the analytical methods employed in the laboratory were designed to fulfill the data requirements of these hypotheses.

Artifacts from diverse cultural periods spanning 8000 years of prehistory were found throughout the sandy loam upper soil horizons at Windy Ridge. Though no stratigraphic separation of components was present, it was possible, analytically, to make some minimal segregations of the assemblage into chronologically and functionally meaningful units. It was inferred that throughout most of prehistory the aboriginal utilization of Windy Ridge consisted of many brief episodes of occupation, each involving the manufacture and/or use of a relatively narrow range of stone tools. The assemblage appears to be dominated by the outputs of manufacture of local raw materials and the use of hafted bifacial cutting tools. The spatial structure of the site suggests that quantitatively and spatially small units of cultural deposition characterized its formation during most prehistoric periods. The Middle Archaic component at Windy Ridge, however, seems to represent rather large units of synchronic deposition such as might be expected if prolonged or frequently recurrent use of permanent facilities had occurred during this interval at Windy Ridge.

On the whole, the data tend to support the hypothesis that Windy Ridge represents a series of brief episodes of occupation involving specialized extractive activities, perhaps hunting and butchering of white-tailed deer. This inference is far from conclusive, and the data suggest significant technological, functional and organizational differences among prehistoric components at Windy Ridge.
CHAPTER I
INTRODUCTION

Background to the Windy Ridge Excavations

From May 4 to June 4, 1977, archeological investigations were conducted at Windy Ridge, 38FAll8, a prehistoric site in the Interstate 77 right-of-way in Fairfield County, South Carolina. The excavations were directed by the writers, John H. House and Ronald W. Wogaman of the Institute of Archeology and Anthropology, University of South Carolina, Columbia. This research was funded by the South Carolina Department of Highways and Public Transportation (then South Carolina Highway Department) in order to mitigate the impending loss of archeological resources due to construction of a portion of Interstate 77.

The Interstate 77 route between Columbia and Rock Hill, South Carolina is one of the last Interstate routes to be built in South Carolina. Archeological investigation in the I-77 corridor has been underway for some years. Under contract with the South Carolina Department of Highways and Public Transportation, Systems Design Concepts, Incorporated, a Washington D. C. consulting firm, undertook a broad-based engineering, environmental and economic study of the proposed I-77 route, submitting its report in 1972 (Systems Design Concepts, Inc. 1972). At the request of Systems Design Concepts, Inc., Thomas M. Ryan of the Institute of Archeology and Anthropology conducted a review of extant site records for the Interstate 77 corridor area. This review was done as a contribution of the Institute to the highway program of the State. Ryan (1971a) recommended an intensive survey of the right-of-way and, prior to construction, some excavation at sites in the corridor.

The intensive survey of the Interstate 77 route, conducted by John H. House and David L. Ballenger (1976), was provided for by an agreement made in June 1975 between the South Carolina Highway Department and the Institute. By the time of this agreement, however, portions of the Columbia to Rock Hill route were already under construction and construction was scheduled to begin soon on additional portions. The remaining 38 miles of corridor were the focus of the intensive survey carried out by House and Ballenger between September 22, 1975 and January 14, 1976.

In planning the I-77 archeological survey, it was judged that both the archeological research and cultural resource management goals of the survey would be best fulfilled by a program of intensive sampling of the corridor rather than a superficial attempt to survey the whole corridor. Accordingly three data gathering strategies were employed in the field: (1) intensive survey of 10-acre (3.9 ha) quadrats comprising a 20% stratified random sample of the corridor, (2) investigation of the margins of all streams crossed by the corridor, and (3) reconnaissance
of selected additional portions of the corridor. To aid in assessing significance of the archeological resources in the corridor and to lay a basis for possible mitigation-stage research, a number of problem domains in the prehistoric and historical archeology of the region were identified prior to the survey. The field methods subsequently employed during the survey were designed to generate archeological data relevant to these problem domains. The most ambitious and intensively explored problem domain was investigation of prehistoric human utilization of the inter-riverine zones in the Piedmont. A total of 59 loci visited by the I-77 survey were designated as archeological sites. Fifteen of these had early historic components and 51 had prehistoric aboriginal components. Site 38FAII8, Windy Ridge, was discovered and recorded on January 14, 1976, the last day of the I-77 survey fieldwork.

The major cultural resource management recommendation resulting from the I-77 archeological survey was a program of research at several sites for the purpose of mitigating the impact of construction of Interstate 77 on the archeological resource base of the region. The recommendations included a proposal for excavation at five prehistoric sites in the corridor, a set of sites chosen to encompass a number of different hypothesized functions in prehistoric settlement patterns (House and Ballenger 1976: 153-159).

The Interstate 77 archeological survey was the first major research project undertaken in the Piedmont by the Highway Archeology program of the Institute. It was also our first major attempt to put into effect the research strategies for contract archeology set forth in the General Research Design for Highway Archeology in South Carolina (Goodyear 1975a). Goodyear (1975a: 13) notes that one of the major methodological strengths of contract archeology is that the planning and execution of land-modification projects usually proceeds in a series of sequential stages. Archeological research pertaining to these projects may also, in parallel fashion, take place within a de facto multistage framework (cf. Redman 1973). Separation of a program of archeological research into a series of stages of data collection followed by data analysis allows for a creative feedback between data and concepts and allows for progressive refinement of research designs and ever more focused data collection and analysis relevant to the problems under investigation. It shall be seen below that the excavations at Windy Ridge, built on the results of the Interstate 77 survey and of more recent highway-related surveys in the Piedmont (Goodyear, Ackerly and House n.d.; Wogaman 1977a, 1977b), addressed one of the problem domains that was the major focus of the I-77 survey: aboriginal utilization of the inter-riverine Piedmont. Other Piedmont research projects carried out by the Institute more recently, notably the survey of the Richard B. Russell (Trotter's Shoals) basin on the Savannah River and the excavations at the Powell Shoals site on the Broad River, directed by Dr. Paul Brockington, are similarly built on the results of the Highway Archeology Program's work and are designed in part to generate data to complement those generated by our work in the inter-riverine zones in the Piedmont.
The Excavations at Windy Ridge

The Interstate 77 archaeological survey report recommending mitigation-stage excavation at sites in the highway corridor (House and Ballenger 1976) was submitted to the South Carolina Department of Highways and Public Transportation in December 1976. In the meantime, however, the construction of Interstate 77 continued to run ahead of the scheduling of archeological research. In February 1977, the Highway Department requested a revised mitigation proposal based on the extent of the resource base in the corridor still remaining intact. The seven sites originally recommended for investigation were revisited by House at this time. It was discovered that four of the sites had already been destroyed by highway construction and two additional sites were on a segment for which the construction contract had already been awarded and the beginning of construction was imminent. The remaining site, 38FAl18, Windy Ridge, was found to be still intact and on a segment of the route that was not scheduled to be let for bids until May (Fig. 1).

Although selection of Windy Ridge for excavation at this time had a fortuitous aspect, there are reasons why investigation of this particular site at this time was strategic in our ongoing efforts to explore aboriginal utilization of the inter-riverine Piedmont. Sites 38FAl17 and 38FAl18 were identified in the original I-77 mitigation proposal (House and Ballenger 1976: 155) as particularly well-preserved examples of a hypothesized Archaic upland hunting camp site type which, extrapolating from survey data, seemed to be the most abundant and widespread prehistoric site type in inter-riverine zones in the Piedmont. Sites 38FAl18 and 38FAl17 were conceived of as representing the high artifact density and low artifact density range, respectively, of this site type.

Before the revised mitigation proposal was prepared, shovel tests were made at Windy Ridge in an attempt to verify our initial impression that the site had a comparatively high artifact density and that it had fairly intact upper soil horizons. The results of this shovel testing (see Appendix A) were positive. In addition, Windy Ridge seemed particularly amenable to excavation in order to test the hypothesized function of ridge top sites because it appeared not to have undergone severe erosion as have most ridge tops in this portion of the Piedmont.

Clearing and gridding of the site area was begun by the writers and Albert C. Goodyear, then Director of the Highway Archeology Program at the Institute, on April 19, 1977. At this time the boundaries of the area to be investigated were defined and the Stage I sampling units were chosen.

Excavation began on May 4 with a crew consisting of the writers plus Marie Judy, David Sanders, Emily Short and John White, Jr. The Stage I sampling (see Chapter V) was completed on May 20 and excavation of the Stage II block area began immediately.

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Fieldwork at Windy Ridge was completed on June 4, 1977 and the subsequent analysis of the data and writing of this report continued through September 1977. In the meantime, construction has continued on Interstate 77 and the present roadbed at Windy Ridge is in a cut 80 feet below the land surface occupied by aboriginal inhabitants of the South Carolina Piedmont beginning some 9,000 years ago.

FIGURE 1. Windy Ridge, February 1977. Looking southeast from near Station A.
CHAPTER II
RESEARCH GOALS AND STRATEGY

Windy Ridge and Prehistoric Site Research
In the South Carolina Piedmont

Our knowledge of prehistory in the South Carolina Piedmont has been recently summarized by House and Ballenger (1976: 23-39). The region is known to have been inhabited by prehistoric Indians for 12,000 or more years. The sequence of projectile point types derived from Coe's (1964) excavations at stratified sites on the Yadkin and Roanoke Rivers in North Carolina is useful for distinguishing gross temporal divisions in Archaic assemblages in the South Carolina Piedmont. Work by Coe at the sites referred to and that by Caldwell (1950) in north Georgia and Keel (1976) and Dickens (1976) in the North Carolina mountains provides a preliminary framework for interpreting ceramic period remains in this part of the Southeast (see also Ferguson 1971).

Most of this previous research, however, has concentrated on individual stratified riverine-associated sites and on problems of culture history and chronology rather than on whole regions and the settlement patterning and cultural geography of past cultural systems. The extensive inter-riverine zones, which comprise over 90% of the land area of the Piedmont, have received comparatively little intensive archeological investigation.

The existence of numerous prehistoric, predominantly Archaic, sites in inter-riverine zones has long been recognized. Caldwell (1958: 9) notes that "Old Quartz Industry" (chiefly Early and Middle Archaic) sites are quite abundant in the Piedmont in northeastern Georgia and western South Carolina, many occurring on eroded clay hills. Caldwell further notes that most of these sites are quite small and suggests that they represent occupations of brief duration. Coe (1964: 6) likewise refers to the prevalence of prehistoric sites on knolls, ridges and terraces throughout the Piedmont, noting that these sites are usually eroded and quite shallow, exhibiting artifacts derived from chronologically-diverse occupations occurring in close proximity to each other. A small hilltop Archaic site in Stone Mountain Memorial Park near Atlanta, Georgia was excavated by Roy Dickens in 1962. The artifact content of this and similar sites in the Stone Mountain Park led Dickens (1964: 46-48) to hypothesize that Old Quartz Industry sites on ridge tops throughout the Georgia and South Carolina Piedmont represent temporary hunting camps that perhaps were seasonally occupied.

Recent archeological surveys in the South Carolina Piedmont (Kelly 1972; House and Ballenger 1976; Goodyear, Ackerly and House n.d.) have further demonstrated the prevalence of low density Archaic sites on ridge tops and hilltops in inter-riverine zones. Prehistoric sites recorded by the Interstate 77 survey were in almost every case characterized by a very low artifact density and a comparatively narrow range of functional
artifact categories (House and Ballenger 1976). The subsequent survey of the Laurens-Anderson Connector Route in the western portion of the South Carolina Piedmont (Goodyear, Ackerly and House n.d.) revealed that the archaeological record in inter-riverine zones is probably more complex, both chronologically and functionally, than the I-77 results would suggest but that, nonetheless, the majority of inter-riverine Archaic Piedmont sites are on ridge tops and are characterized by low density and diversity of artifacts when compared with riverine Archaic sites such as Doerschuk and Gaston (Coe 1964), Stalling's Island (Clafin 1931) and the Archaic levels at the McCollum site (Ryan 1971b).

**A Preliminary Settlement System Model for the Archaic in the South Carolina Piedmont**

In the process of gathering and analyzing the above survey data, a model has been formulated stating that, throughout much of the Archaic, settlement was concentrated along major rivers in the Piedmont. The inter-riverine zones saw little protracted settlement but were regularly exploited by riverine-based human groups, especially in the fall when the availability of acorn mast in upland hardwood forests would result in a high and predictable concentration of white-tailed deer (cf. Smith 1975). The numerous ridge top sites are then seen as coinciding in location with these prehistoric upland hardwood forests and as corresponding in content with the expected outputs of the manufacture from locally-available lithic raw materials, use, resharpening, breakage or exhaustion, and discard of hafted bifaces (i.e. "projectile points") in the process of butchering white-tailed deer and minor maintenance of a hunting tool kit. The structure of these sites, characterized by low density and high dispersion of artifacts, is seen as deriving from the occurrence of dozens, or perhaps hundreds, of discrete, brief episodes of occupation occurring over centuries throughout upland hardwood forest zones (House and Ballenger 1976; House 1976). The goal of the present Windy Ridge research is to test, in so far as it is possible within the context of a single site, this model of prehistoric site function and site formation processes in the inter-riverine Piedmont in South Carolina.

**Single Site Excavations in Regional Research**

The above model was formulated largely on the basis of survey derived, rather than excavated, data and attempts to test the model have thus far employed only survey data from inter-riverine zones. This emphasis on regional vs. single site data is based on the assumption that past societies existed and functioned on a regional level and involved diverse localized—though systemically integrated—articulations with the environment (cf. Binford 1964). The archeological record at a set of sites formed by a single past society, then, may be expected to exhibit functionally-derived intersite variability (Binford and Binford 1966; Struver 1971). The assumption that people-land relationships constitute a system is particularly relevant here. It emphasizes the dynamic nature of interaction between humans and the differentially distributed biotic and abiotic resources in their environment. It also
identifies site location with respect to local environment as one of
the major categories of data relevant to investigation of the cultural
ecology of a past society (Winters 1969; Jarman, Vita-Finzi and Higgs
1972).

Though ultimate confirmation or disconfirmation of any model of
past culture ecology will center on analysis of regionally-extensive
data sets, intensive single-site studies have a crucial role to play
in this cumulative process of hypothesis testing. First, the processes
forming the archeological record must be understood on both the artifact
level and on the level of intrasite structure in order to establish
concrete epistemological links between relevant variables of human
behavior (as specified by region-level models) and presently observable
archeological variables—whether those archeological variables are to
be observed on a regional or single site level (Schiffer 1976: 11-41).
Second, a number of sampling problems must be resolved before we can
know the degree to which survey data collected by any given set of
techniques can provide an adequate base for estimating the content of
the archeological record on a single site or regional level. These
formation process questions also relate to the problem of sampling
archeological remains in such a way that the units of analysis generated
by the sampling are behaviorally meaningful (Reid, Schiffer and Neff
1975). The artifactual data generated by the I-77 and Laurens-
Anderson surveys consist primarily of total surface collections of all
classes of artifacts from various-sized portions of space within the
areas surveyed (House and Ballenger 1976: 49-50; Goodyear, Ackerly
and House n.d.). Evaluation of these methods is best accomplished by
comparing sets of rigorously-collected excavated data with sets of
previously-collected survey data from the same or similar sites.

Overview of the Windy Ridge Research
Design and Organization of this Report

The logical structure of the research design at the time of the
initiation of fieldwork at Windy Ridge is adequately reflected by
the hypotheses, test implications and proposed behavioral correlates
in the section of the Interstate 77 survey report entitled "Aboriginal
Utilization of the Interstate 77 Corridor Area" (House and Ballenger
1976: 79-120). The sampling strategy operationalized by the Windy
Ridge excavations is basically that outlined in the section of the
I-77 report entitled "Mitigation: Recommendations and Budget Proposals"
(House and Ballenger 1976: 160-162). Some further inferences about
behavioral variables influencing the content and structure of Piedmont
sites, however, had been subsequently derived from data generated by
the survey of the Laurens-Anderson Connector route and by the Winthrop
College Archeological Field School excavations directed by Veletta Canouts
(1976) at the Mt. Holly site (38YK25A) at the edge of the Interstate
77 route in York County, South Carolina.
House and Ballenger (1976, Figure 14) outline three major categories of data relevant to testing cultural-ecological hypotheses on a regional level: environmental variables, site attributes, and artifactual variables. The relevance of the location of Windy Ridge in terms of the environmental diversity within the South Carolina Piedmont will be briefly discussed in the next chapter. Succeeding chapters will pertain specifically to the data generated by the 1977 excavations at Windy Ridge. These data will be relevant to the major categories of archeological information subsumed under "site attributes" and "artifactual variables." The excavation data will be introduced by chapters describing the archeological site at Windy Ridge and the sampling design and data recovery techniques employed in these excavations.

"Artifactual variables" refers to the contents of the site described in terms of multiple typologies of discrete artifacts and in terms of the statistical parameters of certain attributes of artifacts in various subsets of the population of artifacts at the site. In Chapter VIII, these archeological variables will be defined and justified as archeological means of indirect observation of relevant variables of human behavior in past systemic context (cf. Fritz 1972; Schiffer 1976). Dimensions of behavioral variability of interest include chronology, technology and function. In this way we will attempt to operationalize the hypotheses outlined below. Description of the Windy Ridge data in terms of these artifactual variables will be presented in Appendixes B, C, D, E, and F.

The major artifact category at Windy Ridge is humanly-modified lithic material. These materials are conceived of as outputs of the manufacture, use and modification of stone tools in the past. The technology and function of the tool systems represented will be the immediate focus of the analysis of the Windy Ridge lithics. This "technomic" problem domain, however, is not to be conceived of in isolation. Other subsystems of cultural behavior, e.g., social organization, settlement patterning, and patterns of inter-regional exchange are articulated with tool manufacturing subsystems and can be identified as contingencies affecting the character of outputs of this technological subsystem. These other problem domains, then, are seen as amenable to investigation partially by means of the analysis of processes of stone tool manufacture, use and modification.

In succeeding chapters, diverse categories of archeological data from the Windy Ridge excavation will be formally described and articulated, one with another, to yield information of the formal-spatial structure of the site (cf. Binford, et al. 1970). This category of information (in addition to specific locational and physically descriptive characteristics of the site; i.e., extent, shape, etc.) constitutes the analytical domain corresponding to "site attributes" in the I-77 survey design. Archeological features representing prehistoric facilities (see Chapter VII) may be considered an additional category of "site attribute" data usually not observable during archeological survey.
The goal of elucidating the formal-spatial structure of the area excavated at Windy Ridge will be an attempt to "explain" the assemblage in terms of the specific behavior and cultural and non-cultural formation processes acting to form the site (Schiffer 1976). This domain of intrasite analysis has been termed "activity analysis" by Goodyear (1975a: 23; cf. House and Ballenger 1976: 94-102).

In addition to the qualitative behavioral correlates invoked in the formulation of artifact typologies and the selection of variables to be observed on the artifact level of analysis, activity analysis entails additional formation process concepts. Particularly, the concept of "behavioral chains" of cultural elements (Schiffer 1975) will be used to integrate specific artifact-behavior correlations into higher-order behavioral constructs. It will be assumed for the time being that virtually all of the prehistoric artifacts at Windy Ridge entered the archeological record as primary rather than secondary refuse, that they were discarded more-or-less at the location where they ceased to be useful in some on-going activity (Schiffer 1976: 30). Following Schiffer (1976: 63) quantitative transformation models for tool-debitage relationships in the process of manufacture will be employed to reconstruct the degree of import vs. export of certain tool classes to and from Windy Ridge.

In the final chapters of this report, we will evaluate the hypotheses and test implications outlined below in terms of the archeological patterns and inferred activities derived from the Windy Ridge data. In this context, a few retrospective observations about the strengths and weaknesses of the Windy Ridge research design will be made.

**Hypotheses and Test Implications**

**Introductions**

The following two sets of hypotheses and test implications are basically those employed by House and Ballenger (1976: 79-94) in the formulation of the survey research design for investigation of aboriginal use of the Interstate 77 corridor area. These hypotheses, however, have been modified slightly to better address a set of excavated data from a single site.

The archeological variables identified in the test implications of these hypotheses will be justified and given operational definition in later chapters. It is emphasized that the relevance of each of the archeological variables to the behavioral variables of interest remains to be fully demonstrated by replicative experiments, contextual analysis, ethnoarcheological observation or other means. It is hoped that the Windy Ridge research will contribute to the process of evaluating these archeological variables as instruments for "observing" past behavior (cf. Fritz 1972: 150-156).
Structural Poses and Site Variability

These hypotheses incorporate a very generalized model proposed by Binford and Binford (1966) for interpreting functional variability among sites and site samples representing hunting and gathering groups. They suggest that it is possible to distinguish between maintenance and extractive tasks: "the former involving activities related to nutritional and technological requirements of the groups and the latter activities related to direct exploitation of environmental resources" (Binford and Binford 1966: 291). They further suggest that the tasks should be differentially distributed about the landscape and it should be possible, on the basis of artifact assemblages and locational variables, to distinguish base camps and work (or extractive) loci as two types within the settlement system. The concept of a "structural pose," originally formulated by Gearing (1958) is used here in the sense of its reformulation by Wilmsen (1970: 3). It may be defined as "the way a simple human society is appropriately organized at a particular moment for a particular purpose."

It is acknowledged that the maintenance/extraction dichotomy does not exhaust our knowledge of structural poses and dimensions of location-use variability among hunter-gatherers (for examples, see Ray 1963; Rogers 1963, 1972; Stuart 1977; Watanabe 1972). Hypotheses involving some of these additional dimensions of hunter-gatherer behavioral variability should be formulated and used in the observation and analysis of prehistoric site data from the Piedmont.

H-1. The area investigated at Windy Ridge represents a locus of intensive habitation.
   I-1. Midden staining will be present.
   I-2. Remains of relatively non-portable artifacts such as steatite or pottery vessels will be present.
   I-3. Fire-cracked rock will be present.
   I-4. A wide variety of tool forms representing a wide variety of functions—especially maintenance functions such as hide preparation, heavy-duty wood working, etc.—will be present.
   I-5. A wide variety of debitage types, reflecting manufacture of a wide variety of tool types, will be present.
   I-6. Debitage indicating early stages in the manufacture of stone tools (of both local and nonlocal raw materials) will be present.
   I-7. High densities of diverse tools and debitage will be found in some areas within the site.
   I-8. Various archeological features, representing graves, postholes, earth ovens and storage pits, will be present.
   I-9. The site as a whole will be in a favored location, one with adequate, fairly level, living space for a large group and a close proximity to water.

H-2. The area investigated at Windy Ridge was the scene only of procurement and preliminary processing of a specific biotic resource.
   I-1. No midden staining will be present.
I-2. Few if any sherds of steatite or aboriginal pottery will be present.
I-3. Little if any fire-cracked rock will be present.
I-4. A comparatively narrow range of tool forms will be present.
I-5. A comparatively narrow range of debitage types will be present.
I-6. Debitage representing early stages in the manufacture of stone tools of non-local raw materials will be absent.
I-7. No dense concentrations of diverse artifacts will be present within the site.
I-8. Archeological features representing aboriginal subsurface facilities will be absent.
I-9. The site may not necessarily be in a favored location in terms of living space requirements of a large group and proximity to water.

Identification of Specific Biotic Resources Extracted

Review of environmental data for the Piedmont (see Chapter III) indicates that Windy Ridge can be considered optimally located for extraction of at least two food resources occurring seasonally in a Southeastern hardwood forest: (1) acorns and hickory nuts, and (2) white-tailed deer. Both are known to have been major components of Archaic and Woodland diet in the Southeast (see House and Ballenger 1976:32-34). If an extractive vs. settlement function for Windy Ridge can be assumed, it remains to generate some expectations for the content of the archeological record given either of these two alternative target resources. Therefore, two additional hypotheses are offered in this regard, each with a set of test implications.

H-1. The area investigated at Windy Ridge represents a gathering/processing station for acorns and hickory nuts.

I-1. Stone plant processing tools (mortars, pestles, etc.) should be present.

H-2. The area investigated at Windy Ridge represents a hunting and butchering camp occupied for procurement of game animals, especially white-tailed deer.

I-1. The artifact assemblage should be dominated by the expected outputs of the manufacture (from locally-available raw materials), use, resharpening, and discard of butchering tools.
CHAPTER III
ENVIRONMENT AND PREHISTORIC HUMAN ECOLOGY
IN THE SOUTH CAROLINA PIEDMONT

Biophysical Environment

The biophysical environment of the South Carolina Piedmont has recently been discussed from an archeological perspective by House and Ballenger (1976: 5-20) and Goodyear, Ackerly and House (n.d.). Only a very brief and slightly updated summary of this discussion will be presented here.

Windy Ridge is located within the Piedmont physiographic province of North America. The boundary between the Piedmont province and the Coastal Plain to the south and east is the Fall Line where metamorphic rocks of Paleozoic age dip under Cretaceous and more recent formations of the Coastal Plain. The boundary between the Piedmont and the mountainous Blue Ridge province to the west is approximately where the metamorphic rocks of the Piedmont end against upthrust pre-Cambrian formations. The Piedmont in South Carolina is an area of rolling hills with elevations ranging from about 500 feet at the Fall Line to almost 1000 feet at the foot of the mountains. A glance at a topographic map of a typical inter-riverine area reveals considerable local relief—a maze of ridges, ravines and stream valleys—but the horizon is typically flat, reflecting the development of the Piedmont as a dissected peneplain.

The most conspicuous topographic features in the Piedmont are large rivers that rise in the Appalachian Mountains and flow generally southeast into the Coastal Plain and ultimately into the Atlantic Ocean. Therefore, we can initially divide the Piedmont into narrow riverine zones comprising the major rivers and their floodplains and the extensive inter-riverine zones between the rivers. Windy Ridge is located within the inter-riverine zone between the Broad and Catawba-Wateree Rivers.

The bedrock geology and geologic history of the Piedmont in South Carolina have been summarized by Overstreet and Bell (1965). Their map of upland South Carolina (Overstreet and Bell 1965, Plate 1) shows sedimentary rock of Mesozoic and younger age and metamorphic and igneous rocks of Paleozoic and possibly pre-Cambrian age generally distributed in northeast tending belts. These belts are considered to represent major overthrust fault blocks. Six of these are underlain by crystalline rocks. From southeast to northwest, these are the Carolina slate belt, Charlotte belt, Kings Mountain belt, Inner Piedmont belt, Brevard belt and Blue Ridge belt.
In general, rocks in the Piedmont are characterized by a higher metamorphic grade as one proceeds north and west from the Fall Line to the Blue Ridge. Windy Ridge is located within the Charlotte belt, only a few miles from the boundary between the Charlotte and Carolina slate belts. Overstreet and Bell (1965, Plate 1) indicate extensive areas of muscovite schist, mica gneiss, granite and granitoid gneiss and amphibolite in the locality of the site. Vein quartz, being more resistant to weathering than any surrounding rock, is abundant as residual fragments in the soil mantle in many localized areas throughout this portion of the South Carolina Piedmont. Intrusive diabase dikes of Triassic age are also common in the region. It should be borne in mind that most of the information on the Overstreet and Bell map is based on extrapolation from soils data and no detailed information on the petrology of the Windy Ridge locality is yet available.

This brief review of climate in the South Carolina Piedmont is based on Kronberg (1959). Windy Ridge is located in the northern temperate zone at a latitude of approximately 34°30'. Temperatures in this portion of South Carolina are characterized by daytime highs of approximately 90°F (32°C) in the summer and 56°F (13°C) in the winter. The frost-free growing season for this part of South Carolina lies between the 199 day average for the mountains and the 257 day average for the southern part of the Coastal Plain. The mean annual rainfall is 46 inches (118 cm).

Summers are warm and humid and highs greater than 100°F (38°C) frequently occur. One to four cold waves take place every winter with night temperatures of 20°F (-7°C) or lower. Temperatures below 0°F (-18°C), however, are extremely rare.

Summer rains occur most frequently in the form of local thundershowers. Autumn, on the other hand, is usually dry. Winter and spring rains are increased by the upslope of the land where lifting of moist air currents from the southeast increases condensation and precipitation. Dry periods affecting plant growth occur almost every year but significant droughts occur infrequently.

Upland soils in the South Carolina Piedmont were formed in residuum from weathered igneous and metamorphic rocks (Craddock and Ellerbe 1966) and are classified as Red and Yellow Podzolic soils or Ultisols characterized by deep weathering of parent material on very old land surfaces (Soil Survey Staff 1960: 226; United States Department of Agriculture 1960: 59). Zonal upland soils developed under humid forest vegetation are most common in this part of the Piedmont. Soils of the Cecil and Appling series, with granular, sandy loam upper horizons and conspicuous red and yellow clay lower horizons are major constituents of most soil associations overlying the Charlotte belt (Craddock and Ellerbe 1966). Azonal soils with impermeable B horizons have developed over certain types of igneous rocks and are associated
with grassland or open forest types. The contrasting vegetation associated with these soils (Oosting 1942: 111) may have contributed to localized vegetational variability or patchiness in the prehistoric environment of the region.

The entire South Carolina Piedmont is included by Braun (1950) and Kuchler (1964) in the Oak-Pine forest region. The present vegetational cover of the Piedmont—a patchwork of fields, stands of pine, mixed stands, deciduous hardwoods, and old fields in various stages of succession—reflects repeated agricultural use and abandonment of various tracts beginning in Colonial times. The climax type, however, is apparently predominantly oak-hickory. In pre-contact times, the forests of the region were apparently dominated by oaks and hickories with pines persisting from an earlier successional stage only on poorer soils and drier sites. Braun (1950) and Oosting (1942) suggest that considerable localized variation in forest type existed even in pre-contact times, reflecting edaphic variables such as azonal soils, drainage and aspect. A bottomland hardwood community seems to have been present on the floodplains of rivers and major tributaries.

The South Carolina Piedmont is included by Shelford (1963: 57) in the Oak-Hickory zone of the Southern Temperate Deciduous Forest Biome. Terrestrial animal dominants in this zone are white-tailed deer, turkey, squirrel, grey fox, oppossum, skunk, black bear, bobcat and wolf. Rostlund (1952: 73-74) characterizes the food fish resources of the Atlantic province, including the South Carolina Piedmont, as some of the best in North America in terms of quality and quantity during annual runs. Anadromous species present in Piedmont rivers (prior to construction of numerous dams in this century) included shad, alewife, herring, striped bass and sturgeon. Ethnohistoric data suggest that the optimum time to harvest anadromous fish was in the spring (see below). It seems likely that the seasonal availability of anadromous species was largely confined to major rivers such as the Catawba-Wateree, Broad and Saluda rather than tributary streams (personal communication from Mr. Otho May, South Carolina Department of Wildlife and Marine Resources). Important freshwater species in this part of the Atlantic province include bullhead, bowfin, channel cat, largemouth bass and crappie.

**Holocene Environmental Change**

House and Ballenger (1976: 12-15) and Goodyear, Ackerly and House (n.d.) have recently summarized our knowledge of late Pleistocene and Holocene environmental change in the South Appalachian area. There are yet few direct data on stability or change in the environment in the South Carolina Piedmont during the Holocene but pollen and other types of data from surrounding regions suggest general trends that might have affected the South Carolina Piedmont.
On the basis of present evidence, it seems that there were no major changes in floral composition of Southeastern forests during the Holocene, but minor fluctuations in worldwide climate (Bryson and Wendland 1967; Bryson, Baerreis and Wendland 1970) may have had some effect on the parameters of human adaptation in the Piedmont. There is some evidence that Oak-Hickory forests in the Southeast attained their maximum development during the 8000-3000 B.C. interval, the latter part of which has been characterized as the Altithermal or Climatic Optimum. Following 3000 B.C. there seems to have been some increase in pine development in this part of the Southeast, especially in the Coastal Plain.

Historic Land Use and Environmental Change

Perhaps more than any other portion of North America, the southern Piedmont has undergone drastic transformations as a result of historic land use. The invention of the cotton gin in 1793 quickly led to the development of a system of cotton monoculture, which can be characterized as labor intensive but land extensive. Almost all of the land in the southern Piedmont was soon cleared and put under cultivation. The system was extremely productive and profitable in the short run, but severe erosion and soil exhaustion resulted in declining yields and declining human population in many areas of the South Carolina Piedmont by as early as 1825. As old lands became exhausted, they were abandoned and new lands were cleared and underwent the same process (Trimble 1974; Oliphant 1964: 216-217).

Millions of acres in the southern Piedmont lost virtually all of their topsoil to erosion. This eroded topsoil was discharged into nearby river and creek floodplains resulting in major changes in stream hydrology and the accumulation of sediments averaging over a meter in depth in virtually every stream valley in the Piedmont (Trimble 1974). Fairfield County, South Carolina, a major cotton producing area of the Old South in the early nineteenth century, was one of the most severely eroded and depleted areas in the nation by the late nineteenth century. This led to abandonment of most of the fields in the county and their reversion to forests dominated by pines.

Seasonality of Nondomesticated Food Resource Availability

In the South Carolina Piedmont

Introduction

The hypothesis that artifact scatters in upland zones in the Piedmont represent temporary hunting camps has been advanced by Dickens (1964) and House and Ballenger (1976: 84-85). In order to refine and elaborate this hypothesis and generate more specific expectations for the content and structure of the archeological record on the regional level, it is necessary to articulate this hypothesized hunting subsystem
with a model of a total subsistence settlement system. One of the main requirements of such a model is information on the location, seasonality and potential yields of major food resources in the environment.

The present-day Piedmont environment, however, has been drastically altered by human activity in the historic period. Therefore, as well as looking at present-day environmental information, which can be projected into the pre-1700 period only with caution, we will look at ethnohistoric data on aboriginal exploitation of the nondomesticated food resources available in the environment and the optimum scheduling and organization of hunter-gatherer economic activity in terms of this seasonal pattern. This approach is closely related to the strategy embodied by Jochim's (1976) "Predictive Model of Hunter-gatherer Subsistence and Settlement," the "Optimum Diet Model Strategy" outlined by Perlman (1976: 15-34) and the "Multivariate Ecological and Behavioral Dynamics" approach outlined by Goodyear (1975b, Figure 47).

The Creek Seasonal Round

By the late 1600's, a loose confederation of Muskho­gan-speaking peoples known as the Creek Nation occupied the portion of the southern Piedmont and adjacent Coastal Plain in the Savannah, Altamaha-Oconee-Okmulgee and Flint-Chattahoochee drainage systems in present-day Georgia and South Carolina. The details of the late prehistoric and protohistoric archeological sequence of this region are yet rather vague but these groups are apparently descended from some of the South Appalachian Mississippian groups inhabiting this region in prehistoric times (Fairbanks 1952; Ferguson 1971).

Environmental, ethnohistoric and archeological data relevant to construction of explanatory models of Creek and pre-Creek cultural ecology have recently been compiled by Veletta Canouts (1971). Canouts' excellent compilation and extrapolation from these data of information relevant to ecological parameters and dynamics of human adaptation in the southern Piedmont form the basis of the following brief summary of the Creek seasonal round.

The Creek new year began in August, "big ripening month," with the major harvest of domesticated crops. This time which seems to have been the season of greatest food abundance in the annual cycle was the time of the major ceremonial, the Busk.

"Chestnut month," in September or October was, as the name implies, the season when chestnuts, hickory nuts, acorns and other nuts were harvested. Part of the nut harvest was processed for extraction of oil and part was stored for later use. Short hunting expeditions began at this time and preparations were made for winter.

In October and November, the agricultural settlements located in major river valleys were abandoned by all but the old and infirm as entire families set out for winter hunting quarters located at distances ranging
from about 25 miles to as much as 120 miles from the agricultural villages. White-tailed deer were the major focus of these hunts, but black bear and turkey were also taken in the fall and winter. Deer meat was often dried and prepared for storage and packed back to the settlements at intervals during the fall and winter hunt. In early historic times, this hunting subsystem seems to have been considerably intensified by the participation of the Creek in the hide trade with Europeans.

Planting of gardens and fields by both men and women began in early spring. Houses were repaired and depleted winter stores were supplemented by harvests of wild plant foods. The Creek also took advantage of the spring runs of anadromous fish, harvesting fish primarily with weirs and traps rather than spear, arrow or hook and line techniques. War parties composed of adult males set out after planting and spring fishing were complete.

Women tended gardens and harvested wild fruits and berries during early summer months while both men and women carried out various maintenance tasks about the village. In July and August, whole neighborhoods turned out to harvest freshwater fish trapped in drying pools along rivers and major tributaries. Poisons such as horse chestnut (*Aesculus sylvatica*) hulls and devil's shoe string (*Cracca virginia*) were used to capture large quantities of fish in a short time.

In August, the whole community gathered in the harvest from the fields, and with the re-occurrence of the Busk, the annual cycle began again.

**PROJECTING AN ARCHAIC SEASONAL ROUND**

As a preliminary approach to a predictive model of the Archaic seasonal round in the southern Piedmont, it may be useful to look at the dynamics of the Creek seasonal round and then subtract three factors which probably did not obtain in Archaic times: (1) food production involving maize and beans as storable food staples, (2) production of deer hides and other hides for exchange on the world market, and (3) transformation of a significant portion of the environment involving disturbance of climax vegetational communities. Subtracting these three factors from Canouts' (1971) model still, of course, leaves many unknowns in the equation and makes a number of unsupported assumptions about the comparability of human ecosystems between early Holocene and late prehistoric and early Historic times in the Piedmont.

For instance, we do not yet know the degree to which demographic pressures on the ecosystem may have operated similarly under both conditions, nor do we know whether or not significantly different climatic regimes were in effect during the Atlantic or Boreal episodes (cf. Bryson and Wendland 1967; Bryson, Baerreis and Wendland 1970). An additional question to be raised at this point is whether or not Archaic peoples at any time might have significantly transformed their environment. It is known that many early historic Indians in the South Atlantic area burned the woods to drive deer and other game animals during communal hunts (Swanton 1946: 317-320). This may have had the
(unintentional?) side-effect of maintaining a significant portion of the environment in a disclimax successional stage characterized by a higher net productivity than that of climax vegetational communities (Odum 1971: 267-268; cf. Green 1976: 71-76).

Arrived at by the above transformations, a model of an Archaic seasonal round in the southern Piedmont would begin with acorn and nut harvests in the early fall followed by intensive effort to procure white-tailed deer in upland hardwood forest zones as these animals concentrated there to feed on acorn mast. It should be observed in this context, however, that hunting pressures on white-tailed deer populations may have been significantly less in prehistoric times than in the Historic era when hides were being produced for the world market as well as for local consumption. Indeed, ethnohistoric data point to an instability in the deer hunting subsystem characterized by steadily declining yields (Canouts 1971: 65). Accordingly, the magnitude of the seasonal movements necessary to procure sufficient deer meat may have been much less during prehistoric times.

At whatever time the acorn mast on upland ridge tops began to be exhausted or the returns from deer hunting began to diminish for whatever reason, there would be a return to more consistent occupation of settlements by the whole kin group. Even though winters in this portion of North America are comparatively mild, it would probably have been advantageous at this season to occupy substantial shelters located in close proximity to stored foods. The location of such settlements is difficult to predict theoretically but, empirically, Archaic sites corresponding to our expectations for the outputs of intensive habitation seem to be concentrated along major rivers throughout the Southeast.

The potential importance of harvesting tubers, shoots and other wild plant foods available in early spring is difficult to estimate. It is highly probable however, that with the beginning of fish runs in the spring, human groups would be concentrated on major rivers at shoals and other locations suitable for constructing weirs or placing nets or basket traps (cf. Speck 1946: 16-17) or even spearing individual fish as they swam through the shallows. Jochim (1976: 63) suggests that it can be generalized that anadromous fish resources, being characterized by predictability and high yields, will always have a major influence on the location of hunter-gather settlement during the season of availability. The potential importance of anadromous fish resources in this environment is demonstrated by the fact that protohistoric agriculturalists emphasized anadromous fish harvests even though their scheduling corresponded closely with the planting season and, indeed, in some cases even located their permanent settlements near shoals and rapids in order to maintain fishing territories (Canouts 1971: 53). One factor detracting from the potential importance of anadromous fish resources in this environment, however, is that fish may have been difficult to store, given their availability in the spring, preceding the warm and humid summer months (cf. Schalk 1977). It is likely in any event that the time of the spring fish runs would have been the season of highest resource abundance in any localized area and, hence
the time of the major aggregation of social units on a level higher than the single band. Such an aggregation, usually characterized by the occurrence of ceremonial activity, provides a mechanism for exchange of mates and information between local groups and is critical to the reproduction and long-term survival of a hunter-gatherer population (cf. Birdsell 1968; Wobst 1974: 152; Jochim 1976: 76; Yengoyan 1968).

Fresh-water fish would have undoubtedly constituted an important food resource in the summer when they were trapped in isolated ponds and vulnerable to capture by poisoning or other techniques. Unless numerous pools and sloughs were present along major rivers, it might have been most profitable to harvest freshwater fish in major tributary streams in the inter-riverine zone.

Wild fruits and berries such as strawberries, plums, blackberries, blueberries and grapes are available in the southern Piedmont at various times from May through September. It is difficult to estimate their location and potential yields in a stable climax habitat as they all seem to be primarily found in disturbed habitats. Their potential importance in the trophic structure of a hunter-gatherer ecosystem, indeed, may be contingent on the amount of disturbed, disclimax habitat present.

Though the above model is rather simplistic and based on rather minimal environmental information, it may nonetheless serve as a useful baseline against which to analyze archaeological data from surveys and excavations in the Piedmont. Deviations from expectations generated from this model may lead not only to recognition of weaknesses in the environmental assumptions on which the model is built but also to recognition of previously unsuspected technological changes occurring over the long span of the Archaic in the South Carolina Piedmont.

White-Tailed Deer as a Food Resource

Introduction

It has been pointed out by House and Ballenger (1976: 86) that the location of Piedmont ridge tops corresponds with the location of upland hardwood forests in precontact times. Given a hypothesized extractive or special activity function vs. a settlement function for prehistoric sites on Piedmont ridge tops, this location seems optimal for extraction of either of two resources known to have played a significant role in prehistoric diet in the Southeast: 1) white-tailed deer and 2) nuts and acorns. Since the locational implications of these hypotheses are identical, evaluation of either hypothesis (and the possibility that both or neither is true) revolves on comparison of site contents and structure with expectations based on the nature of the hypothesized resources being extracted and the technology and organization used to extract it.
White-tailed Deer Ecology and Habits

The following brief outline of white-tailed deer ecology and habits is summarized primarily from Smith (1975: 17-42). The relevance to the present case of Smith's discussion of white-tailed deer and human predation, it should be observed, rests on the assumption of a similarity in deer ecology between the oak-hickory forests of the Ozarks and the oak-hickory forests of the Piedmont.

White-tailed deer (Odocoileus virginianus) occur in various subspecies throughout eastern North America. It is not a herd animal, but is typically found singly or in small groups (but see Hudson 1976: 275). The fawning season is in late spring or early summer while the rutting season is in September through November. In regions with comparatively little snowfall, such as the southern Piedmont, they do not seem to yard or collect in small, sheltered areas during the winter.

The diet of white-tailed deer consists of tender shoots, twigs and leaves, and a wide assortment of herbaceous foodstuffs, acorns of a number of oak species and certain fruits. This diet, however, varies predictably from season to season. During the spring and summer, deer are widespread in the environment, eating herbaceous plants in open forest zones or sedges and ferns in timbered stream bottoms. In early fall, however, deer abruptly shift their attention to acorns that begin to litter the ground beneath various types of oaks. Throughout the deciduous forest zones of the Southeast, this food item seems to be most abundant in upland hardwood forests. In years of high acorn mast abundance, deer may remain in the upland hardwood zones through the winter. In the South Carolina Piedmont, acorns of the upland white oak group seem to be the acorns most preferred by white-tailed deer (David Urbston, U.S. Forest Service, Columbia, personal communication to Albert Goodyear). Seasonal movement, however, seems largely restricted within a home range, which is quite small, on the order of 1 mi.².

One of the most interesting aspects of white-tailed deer ecology is its population dynamics. Deer apparently possess no innate mechanism to regulate their numbers at a level optimum for equilibrium with the productivity of their habitat. In the absence of predation by humans or other large carnivores, deer populations will soon exceed available food resources, resulting in starvation, disease and a sudden, rapid decline in numbers (a crash cycle). On the other hand, hunting pressure on a deer population in a wooded or brushy environment elicits such effective avoidance behavior, including prolonged hiding and night-time feeding, that it is almost impossible even for modern gun hunters to reduce deer population below a certain level, termed "security density," for that environment. "Optimum density" refers to a population density between "security density" and the absolute maximum density that a habitat will support over a short period of time. It is characterized by an equilibrium between predation and recruitment and the maximum health, growth and productivity of deer in a given habitat.
Density Estimates

It is difficult to estimate optimum density of white-tailed deer in prehistoric forests in the Southeast. Modern optimum density ranges from about 20/mi.² in hardwood forests in the Ozarks to over 50/mi.² in some floodplain forests. The limiting factor for deer population levels seems to be the acorn mast abundance in the habitat (Smith 1975: 39-42).

Modern density values, however, can be projected into the prehistoric past only with caution. Deer reach highest densities in environments with large amounts of edge area between habitat zones. This condition is perhaps much more prevalent in modern disturbed environments than in prehistoric times. Even within the prehistoric era, disturbed habitats might have been more widespread in Mississippian times when disclimax communities would have been associated with shifting agricultural plots, than in Archaic times. It is possible that climax forest communities in the Piedmont were characterized by a closed canopy, a predominance of mature and even senile trees, and an overall low net productivity.

The question of density, though basic to attempts to model Archaic subsistence and settlement systems in the Piedmont, cannot be resolved at this time. If the minimum modern figure of 20 deer per mi.² can be accepted as a reasonable estimate and coupled with a recruitment rate of 0.5 per year (Smith 1975: 42), then aboriginal harvests of 10 deer per square mile per year are a theoretical possibility in the absence of serious competition from wolves, panthers and other non-human predators.

Food and Non-food Yields

The weight of adult white-tailed deer varies by sex, latitude and season of the year, but 200 lb. (91 kg) is considered to be a useful average figure. This figure apparently represents maximum weight of deer in the fall and early winter after feeding on acorns in upland hardwood zones. Of this 200 lb. live weight, roughly 50% is edible meat (Smith 1975: 33-34). In considering the importance of deer in hunter-gatherer economies, however, it should be borne in mind that non-food yields from deer procurement are also important. Deer hides were presumably a basic material for clothing and similar articles; brains were used in tanning hides; and long bones and antlers seem to have been the basic raw materials for a wide variety of tools and tool elements, including projectile points.

Hunting Considerations

Smith (1975: 36-39) notes that two factors make fall and early winter the optimum season for aboriginal white-tailed deer hunting. First, as noted above, there is a high and predictable concentration of white-tailed deer in upland hardwood forest zones. Second, there is a "personality" change, especially in males, during the rutting season; deer may be decoyed within bow and arrow (or atlatl and dart?)
range by rustling bushes with a stuffed deer head or the use of similar tactics. In addition this is the season of maximum weight and hence, maximum meat yields. The prevalence of fall deer hunting in aboriginal times is indicated by both ethnohistoric (Swanton 1946) and archeological data (Smith 1975, Figure 7; see also House and Ballenger 1976: 85) from throughout the Southeast. Some faunal data from Shell Mound Archaic sites (Morse 1967: 254), however, indicate that deer procurement was not exclusively a fall and winter activity during the Archaic.

Canouts (1971: 54) cites ethnohistoric data suggesting that stalking, ambushing and decoying individual deer were the major hunting techniques employed though trapping (see Speck 1946: 16), fire drives and a variety of other techniques are also known to have been used. The frequent occurrence of dog burials in Late Archaic middens suggests that dogs were highly prized and may have been important in Archaic hunting strategies. From the contrasting low frequency of dog burials in Mississippian sites, Smith (1975: 102-110) inners that Mississippian dogs were held in comparatively low esteem and probably played a relatively minor role in hunting.

Knowledge of white-tailed deer behavior also has implications for the use of the catchment of an extractive site occupied for purposes of deer procurement. A comparatively small catchment, on the order of 500 m radius, located in an upland hardwood forest zone, might contain 20 or 30 deer, given the optimum density estimates arrived at above. If stalking and ambush techniques vs. driving with dogs or other means were relied upon, a hunting party should be small, consisting of only a few men, in order to avoid alerting deer to the presence of hunters. Hunting pressure, as noted above, elicits effective avoidance behavior so the yield of a given hunting catchment would probably decline rapidly after the first few days as the surviving deer became increasingly wary of humans. At this time it would probably be advantageous for hunters to shift their effort to another catchment. Frison (1974: 15) suggests that game animals have short memories and, within a comparatively short time after being hunted, would lose their fear of humans. Some modern Southeastern deer hunters suggest, on the contrary, that individual deer increasingly learn avoidance over their lifetime. In any event, given the high recruitment rate, it is probable that the same catchment could be reused for short periods year after year.

Butchering Considerations

Once killed, a white-tailed deer carcass would have to be gutted, skinned, and dismembered. The question of where these processing steps would occur, in relation to the locus of the kill, is basic to archeological consideration of the butchering process. If carcasses were butchered at the kill locus, the structure of the archeological record resulting from many such episodes should contrast markedly with the record produced by a pattern of carcasses being transported to a centralized location for processing (assuming that the butchering process has outputs which would be preserved in the archeological record). This question is best addressed by considering (1) the feasibility of transporting an intact or only partially slaughtered deer carcass for some hundreds of meters, and (2) the advantage of transporting the carcass to a centralized location for processing.
Given a live weight of 200 Lb. it would not be difficult for two people, or prohibitive for even a single person, to transport an intact carcass for a short distance. A deer carcass is readily carried by slinging it over one's shoulders and holding it by the forelegs. The weight to be transported would be significantly less if the deer harvested tended to be younger individuals. The weight would also be much less if the carcass were promptly gutted to promote rapid cooling of the meat, thereby inhibiting spoilage. Though immediate gutting is not necessarily recommended to deer hunters today (Davis 1976), it may have been most advantageous to Archaic Indians who had no access whatsoever to refrigeration.

Butchering, skinning and dismembering a carcass, a time-consuming process, would be facilitated if the animal could be hung on a butchering rack and all of the appropriate tools were on hand. A butchering rack would be a relatively non-portable facility. A hafted knife would be quite portable but it might be desirable to have extra knives on hand plus preforms for replacement blades—and possibly other tools such as chippers or cobbles for use in smashing skulls or pelvic bones.

During early Historic times, deer meat was often prepared for drying and storage by being cut into small pieces (Canouts 1971: 63). The autumn scheduling of major hunts, coinciding with the driest time of the year, would have been ideal for drying meat. Whether this final processing of meat would be carried out at loci in the hunting catchment, however, probably depends on the duration of occupation at that locus and its distance from settlements.

**Nuts and Acorns as a Food Resource**

**Evidence of Utilization of Nuts and Acorns in the Prehistoric Southeast**

Citing evidence from a world-wide sample of ethnographically-documented cases, Lee (1968: 42) suggests that in lower latitudes, below about 40°, gathering of wild plant foods vs. hunting or fishing, is the major mode of subsistence of non-agricultural groups. The Southeast spans this generalized 40° latitude threshold and, indeed, archeological evidence is beginning to support the inference that foraging for wild plant foods played a significant role in Archaic subsistence (Webb 1974: 243; Winters 1969: 102; Morse 1967; Asch, Ford and Asch 1972; Chapman and Yarnell 1974; Marquardt and Watson 1976). The persistence of plant food collection into the subsistence strategies of aboriginal maize agriculturalists in the historic era testifies to the potential productiveness of wild plant food harvests in this part of the world.
Of all of the nondomesticated plant food resources in the Southeast, it appears that nuts, especially hickory nuts, were the most important in prehistoric times. Nut species utilized in early historic times include chestnut (Castanea dentata), chinkapin (Castanea pumila), hickories (Carya sp.) and acorns of various oaks (Quercus sp.) (Canouts 1971; Hudson 1976: 286).

The Occurrence of Nuts and Acorns in the Environment

The chestnut, prior to its decimation by the chestnut blight in this century, was found in hardwood communities on rich, well-drained soils in both uplands and lowlands. Chinkapin has a similar distribution. Various hickory species are found in various habitats ranging from bottoms to dry upland sites and oaks, similarly, have a wide range of habitats according to species (Harrar and Harrar 1962). Black walnut (Juglans nigra), which has a highly desirable fruit, is found on rich moist soils but tends to be highly dispersed since its roots secrete a hormone that inhibits the growth of other individuals of this species in the vicinity (Harrar and Harrar 1962: 120; Asch, Ford and Asch 1972: 27). In the southern Piedmont, white oak (Quercus alba) and other species of the white oak group tend to be abundant on richer soils and more mesic upland sites while species of the red oak group, especially black jack (Quercus marilandica) tend to be more associated with poorer soils and drier sites. Upland hickories tend to co-occur with white oaks. Both white oaks and hickories may have been especially abundant on the north-facing slopes of upland ravines (Braun 1950; Oosting 1942: 90; see also House and Ballenger 1976: 11).

The writers were unable to find estimates of per-acre productivity of nuts or acorns for any area in the Southeastern Deciduous Forest Biome. As noted above, modern productivity values derived from disturbed, sub-climax communities should be projected into the climax communities, which may have predominated in the prehistoric past, only with caution.

Nutritional Values

Data on nutritional values of certain nuts and acorns have been compiled by Asch, Ford and Asch (1972: 11, 25). Hickory nuts are comparatively high in protein and fats, representing nutritional values that are in some ways comparable to the meat of large animals. Acorns, in contrast, are low in fats and protein but high in carbohydrates. Noting the preponderance of hickory nut remains among ethnobotanical specimens recovered from Archaic levels at the Koster site in Illinois, Asch, Ford and Asch (1972: 27) observe that hickory nuts, more than any other plant resource represented at prehistoric sites in the region, can be considered an example of a "first line" food resource in terms of its abundance, ease of collection and nutritional values. This can presumably be generalized to the South Carolina Piedmont. Chestnuts, a food resource unavailable in the area of the Koster site but formerly abundant in the Piedmont and Appalachians, presumably also had high food values as attested to
by its seasonal importance in the diet of early historic agriculturalists in these areas (Hudson 1976: 286).

Harvesting

The relative return values for harvesting nuts are contingent on their comparative concentration in the environment, and year to year fluctuations in their production. Walnuts, as noted above, tend to be highly dispersed while, in contrast, hickories and oaks tend to be found in high densities in appropriate habitats. Hickories tend to have fairly short and consistent mast cycles, occurring every two to three years. The mast cycles of oaks tend to be longer and more irregular (Asch, Ford and Asch 1972: 24-25). The production of acorns by individual oak trees, however, can be predicted months in advance by observing developing acorns on the branches.

It would be desirable to promptly harvest both acorns and hickory nuts as they accumulate on the ground in early fall. Humans would be in competition with both deer and squirrels for acorns and with the latter for hickory nuts. The writers have observed that seemingly intact hickory nuts remaining on the ground after the passage of weeks usually contain no meat and, on close inspection, exhibit tiny holes bored through the shell by some unidentified insect or larva.

One obvious point should perhaps be made in comparing the harvesting of nuts and acorns with the harvesting of white-tailed deer. Trees are quite sessile and cannot respond to predation by fleeing their home ranges or hiding. Over the short run, at least, the availability of this resource in a given location, should be unaffected by proximity to settlements.

Processing

Though some nuts were apparently cracked one by one and eaten raw, the primary mode of utilization of hickory nuts by early historic Indians was extraction of oil. A documented technique of extraction of oil involved cracking the nuts and putting the fragments—meat, shells and all—into a container of water where the shells would eventually sink and the oil would be skimmed off and preserved. The resulting milky emulsion, called "hickory milk" by the Europeans, was stored and used in cooking and seasoning (Hudson 1976: 301).

The equipment used for processing nuts is difficult to postulate. Most historic Indian groups in the Southeast used an upright log mortar and wooden pestle for grinding corn; perhaps similar equipment was used in Archaic times to process hickory nuts or acorns. Speck (1946: 7-8) noted with surprise that his early twentieth century Catawba informants had no knowledge of the use of log mortars by their forebears who used a stone pestle in conjunction with a small wooden trough or a flat stone with a shallow depression in its face for this purpose.
Pitted cobbles found in archeological contexts are often thought to have functioned as nut crackers but the alternative hypothesis, that they were anvils for bipolar flaking of stone, seems generally more credible (see Spears 1977).

The weight of a hickory nut, even after its removal from the hull, is composed mostly of inedible shell. Therefore it would be most effective to gather nuts in close proximity to the settlement or to process them at the location of gathering. As the processing is quite labor intensive and requires the use of cumbersome tools, it seems that processing would occur either at settlements or at loci where the appropriate tools were cached in anticipation of reuse year after year.

Whole hickory nuts can apparently be stored in their hulls for some time. The nature of nut storage facilities which might have been used by aboriginal Southeasterners remain unknown, but the deep pits found at many Late Archaic sites in the Southeast (see Chapter VII) may have functioned in this way.
CHAPTER IV

SITE DESCRIPTION

Location and Modern Environment

The Windy Ridge site (38FA118) is located in Fairfield County, South Carolina, about twelve kilometers northeast of the town of Winnsboro. It occupies the flat top of a Piedmont ridge, at an elevation just under 150 meters above sea level. This ridge is part of the northeast-southwest trending system of ridges that comprises the Piedmont. These ridgetops provide a high percentage of all flat land to be found in the Piedmont. Windy Ridge is at N34°27'30", W80°59'35", on the Flint Hill, South Carolina 7.5' USGS quadrangle with Universal Transverse Mercator coordinates of 00781275.

The scatter of artifacts comprising the Windy Ridge site extends for at least 100 meters north-south and 300 meters east-west along the top of the ridge. Only a portion of this, an area slightly less than 800 square meters located within the Interstate 77 right-of-way, was actually subjected to subsurface examination during this research. The northern boundary of the sampled area is a dirt county road; immediately north of this road is a deeply eroded nineteenth century roadbed. The area is bounded on the south by gullies, where erosion has been active on the slope. Cutting southeast through the western end of the excavated area is a dirt logging road, while slightly beyond the eastern edge is another logging road that is only partially visible through the vegetation (see Fig. 2).

Windy Ridge lies between two major streams, Big Wateree and Little Wateree Creeks, in the inter-riverine zone between the Broad and Catawba-Wateree Rivers. Big Wateree Creek is about 2.5 kilometers downslope to the north, while Little Wateree Creek lies approximately 1.5 kilometers to the south. Both are tributaries of the Catawba-Wateree River, and are at an elevation of 75 meters above sea level. The 75 meter elevational difference between Windy Ridge and local stream floodplains approaches the maximum local topographic relief to be found in this portion of the South Carolina Piedmont. The construction of Lake Wateree, in this century, flooded the mouths of these streams where they entered the Catawba-Wateree River, and also altered the channel of the river. Prior to this alteration, nine kilometers separated Windy Ridge and the river channel.

Windy Ridge, in the heart of an inter-riverine zone, is ten kilometers east of the watershed divide between the Broad and the Catawba-Wateree Rivers. The Broad River lies approximately 37 kilometers to the west. An intermittent stream is about 700 meters south of the site, and a small permanent stream is about 800 meters to the north. A plat map accompanying a 1938 property deed indicates the existence of a spring immediately north of the site, across the county road. No evidence of this spring was seen, however, during the excavation.
The site is in a wooded area that had been recently logged in anticipation of impending Interstate 77 construction. The soils at Windy Ridge are of the Cecil-Davidson-Appling association. The dominant vegetation is pine, chiefly loblolly (Pinus taeda L.), and sweet gum (Liquidambar styraciflua L.), dogwood (Cornus florida L.); oaks, chiefly black oak (Quercus velutina Lamarck), southern red oak (Q. falcata Michx.), willow oak (Q. phellos L.), and blackjack oak (Q. marylanticus Muench.); and hickories (Carya sp.) also occur. Trees represented by a few individuals include maple (Acer sp.), persimmon (Diospyros sp.), chickasaw plum (Prunus angustifolia Marsh.), tulip poplar (Liriodendron tulipifera L.) and cedar (Juniperus sp.). All of these are fairly small. Ground cover is predominately pine straw and leaves, with very little Andropogon or other grasses. Small shrubs bearing unripe berries were also observed at the site during excavation and tentatively identified as blueberry (Vaccinium sp.). These are known locally as gooseberry.

Much of the land in this portion of Fairfield County supports pine forest, cultivated by several paper companies for pulpwood. Pine is an early stage in the development of an oak-hickory climax forest. Little or no hardwood forest exists, except on steep ravine slopes and mesic bottomlands (see House and Ballenger 1976: 11). Plat maps of land in the vicinity of Big Wateree Creek, dating to the first half of the nineteenth century, however, indicate a predominance of hardwoods including post oak, white oak, red oak, blackjack oak, hickory, walnut, sycamore, sweetgum and sassafras.

Vegetational conditions at Windy Ridge provide data with which to make inferences about recent land use of the area. Pulpwood cutting in recent years was evident from the many stumps, both decayed and intact, which were observed. From the stage of development at which the forest now stands, it appears that Windy Ridge was last cultivated as recently as 30 years ago. Surface soil formations observed have been tentatively interpreted as remnant plow furrows. The absence of a distinct plow zone is another factor supporting the assumption that this ground has not been tilled more recently.

**Historic Utilization of the Windy Ridge Area**

Nonaboriginal activity in the South Carolina Piedmont began toward the end of the seventeenth century with trading between European settlements on the coast and Indian groups inhabiting the Piedmont and the mountains beyond (House and Ballenger 1976: 27; Brown 1966: 69-123; McMaster 1946: 9). The first nonaboriginal settlement in Fairfield County, according to McMaster (1946: 11), was established in 1740 on Little Wateree Creek, about six miles from the present site of Winnsboro. The latter half of the eighteenth century saw increased settlement in the county, when much of it was divided and distributed as land grants and memorials.
During the beginning of the nineteenth century Fairfield County experienced a tremendous increase in the cultivation of cotton. Relying upon slave labor and the ready availability of land, cotton agriculture was labor intensive and land extensive, concerned more with yields per laborer than yields per acre. This approach quickly resulted in severe soil erosion and the exhaustion of cropland (Trimble 1974). As additional land was acquired exhausted areas were abandoned and left to revert to forest growth.

As noted in Chapter III, this phenomenon has produced large depopulated areas in the Piedmont which were once heavily inhabited and extensively exploited. Windy Ridge is one such abandoned area which has overgrown back to relative wilderness. Nineteenth century records attest to the widespread occupations and activity that at one time occurred here. There is an oral tradition in Fairfield County, supported by Civil War documents, that a portion of General Sherman's army passed along the road by Windy Ridge, in 1865, on their way from Columbia to North Carolina.

Other reminders of extensive nineteenth century occupation lie several hundred meters west of the site. The overgrown ruins of a large house and a small burial ground occur here. Data collected from the graveyard and information gleaned from a search of documents at the South Carolina Department of Archives and History and at the Fairfield County Courthouse in Winnsboro reveal that this was the house of the Minor Gladden family, which first purchased land in Fairfield County in 1838, and of the Powell family, descendants of the Gladdens. Members of both the Gladden and Powell families are buried in the cemetery.

In hopes of acquiring detailed historic land use information relevant to interpreting post-depositional processes affecting the prehistoric record at the site, an effort was made, through archival research, to trace the ownership of Windy Ridge beyond the Gladdens. The vague nature of early nineteenth century records, however, made this task impossible to accomplish with any degree of certainty.

The Windy Ridge Catchment

In an attempt to discern patterning in prehistoric site location within the Interstate 77 corridor, certain environmental variables were measured within catchments (Jarman, Vita-Finzi and Higgs 1972) around all prehistoric sites recorded by the I-77 survey and around a set of random points (sampling units) from the corridor as a whole (House & Ballenger 1976). The specific analytical catchment radius employed—one-half mile—was selected in order to approximate a hypothetical zone of exploitation around a site occupied for the purpose of extracting a specific resource from the environment. The choice of such a small catchment size follows from Binford and Binford's (1966: 291) postulate that sites of work camps vs. base camps will be located in very close proximity to the location in the environment.
of the resource being extracted (cf. Hill 1972: 90-92). The environmental variables measured within these 1/2 mile radius catchments were selected on the basis of the settlement/subsistence hypotheses being operationalized by the I-77 survey research design.

The variable "area of stream bottom" should correlate positively with the location of sites occupied for extraction of stream bottom resources. This variable, on the other hand, should correlate negatively with the location of sites occupied for extraction of upland resources such as white-tailed deer (in autumn) or edible nuts (see Chapter III). The variables "number of rank 1 streams" and "number of rank 2 streams" were intended to measure the density of mesic, north-facing ravine slope habitat which was postulated as optimum for growth of white oak and upland hickories in prehistoric Piedmont forests. The system employed in ranking these streams is that outlined by Strahler (1964) and Morisawa (1968).

In excavating Windy Ridge, we are shifting the focus of our investigation of prehistoric settlement and subsistence in the Piedmont from the regional to the single-site level. Thus it may be useful at this point to review the catchment data for the site, presented in Appendix G of the I-77 survey report (House and Ballenger 1976). Table 1 presents values of the environmental variables defined above for Windy Ridge and compares them with the mean and standard deviation of these variables for the 43 random sample units investigated by the I-77 survey.

**TABLE 1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Windy Ridge (3BFA118)</th>
<th>43 Random</th>
<th>Sample Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream bottom area (mi.²)</td>
<td>0.00</td>
<td>0.05</td>
<td>0.9</td>
</tr>
<tr>
<td>Stream Bottom area (%)</td>
<td>0.00</td>
<td>5.86</td>
<td>11.46</td>
</tr>
<tr>
<td>No. of Rank 1 streams</td>
<td>5</td>
<td>3.21</td>
<td>1.63</td>
</tr>
<tr>
<td>No. of Rank 2 streams</td>
<td>1</td>
<td>0.84</td>
<td>0.75</td>
</tr>
</tbody>
</table>
From these data, it can be seen that Windy Ridge is located squarely within an upland zone but is in an area densely dissected by small streams. That the values for these variables for the corridor as a whole differ little from those for Windy Ridge reflects the fact that the corridor lies within a typical inter-riverine area with only scattered, narrow floodplain areas. Some prehistoric sites in the corridor were associated with catchments with high values for the floodplain variable but they were so few in number and data from them were so limited, that it was impossible to confirm or disconfirm the prediction that sites at such locations should exhibit a distinctive content and structure (House and Ballenger 1976: 117).

In relating the data presented in this chapter to the site function hypotheses under consideration, two general observations are relevant. First, Windy Ridge is located in a zone that seems optimal for autumn exploitation of either white-tailed deer or edible nuts; such catchments, however seem to be very common in this part of the South Carolina Piedmont. Second, documentary evidence indicating the presence of a spring in the immediate vicinity of the site forces us to revise our original supposition that Windy Ridge is distant from any good water source and would not have been a favorable location for a base camp or settlement.
Though the area of artifact scatter comprising site 38FA118 is as much as 100 m wide and extends for 300 or more meters east-west along the ridge top, the Interstate 77 route seems to intersect the most concentrated portion of the site. The area within the right-of-way chosen for investigation is bounded on the north by the present county road and abandoned nineteenth century roadbed, on the west by the logging road and on the south by an extensive area of gullies (Fig. 2). Shovel testing in the winter and early spring of 1977 indicated that this area contained a fairly high density of chipped stone debitage and had roughly 30 cm of artifact-bearing sandy loam overlying the reddish sandy clay subsoil (see Appendix A). The gridded and sampled area encompasses 792 m². Its maximum east-west extent is 54 m and its maximum north-south extent is 24 m.

**Intrasite Spatial Controls**

This area was staked out in a rectangular metric-unit grid with its N100R100 point at Station A near the intersection of the county road and the logging road. This grid was oriented with the county road rather than true or magnetic north. Grid north, then, is at 16° 20' east of magnetic north.

North-south and east-west base lines were laid out every 6 m across the site to correspond to sampling stratum boundaries. Vertical control was established with reference to a datum plane corresponding to instrument height, 1.58 m above ground surface at Station A. This datum plane corresponds approximately to 150.5 m above sea level and the topographic contours indicated on the site map (Fig. 2) are designated accordingly. For purposes of vertical control during excavation, the corner stakes of each 6 x 6 m sampling stratum were notched and labeled at known depth below datum (BD) when the topographic map was made. Vertical provenience data were recorded by absolute depth in cm BD.

Two by two-meter squares were the basic horizontal provenience unit within this grid. Each potential 2 m x 2 m square was named after the location of the stake at its southwest corner; e.g., "N94R114," "N86R126." Small excavation units were designated as portions of 2 m x 2 m squares; for instance, "N86R126, North Half" is the 1 m x 2 m excavation unit comprising the north half of N86R126.
NINETEENTH CENTURY ROADBED

FIGURE 2. EXCAVATIONS AT WINDY RIDGE 38FA118
FAIRFIELD COUNTY, SOUTH CAROLINA

CONTOUR ELEVATIONS IN METERS ABOVE SEA LEVEL

STAGE I EXCAVATION  STAGE II EXCAVATION

FIGURE 2.
Within squares, certain individual artifacts were point-provenience plotted with reference to their exact coordinates in terms of this three dimensional grid. For example, an artifact might be recorded as having been found at "N94.36R14.72 at 183 cm BD." Recording of ground surface at all excavation unit corners and recording of numerous stratigraphic profiles enabled these point-provenience data to be readily related to depth below ground surface or association with any other stratigraphic phenomena observed at the site.

Implementing a Two-stage Sampling Design

A two-stage sampling design was employed in the excavation of Windy Ridge (see Goodyear 1975c; House and Ballenger 1976: 156; Wogaman 1977a). Stage I was a probabilistic sample of the entire area selected for investigation; Stage II was a "block" excavation of an extensive contiguous area within the area previously random sampled.

Stage I. Stage I was designed to provide information on overall parameters of artifact and feature density and distribution about the site. We also hoped to discover "clusters" or "occupation floors" (i.e., outputs of discrete occupational episodes) suitable for large-scale block excavation in Stage II. The Stage I excavation also provided information on the physical stratigraphy of the entire site area. The Stage I sample consisted of 22 1 m x 2 m pits dispersed randomly about the site by a systematic unaligned scheme. Only the north half of each sample square was excavated during the Stage I sample of the site. These 22 sampling units constitute a 5.5% sample of the area under investigation, comprising a total of 44 m². The strata used for sample dispersion were 6 m x 6 m blocks. Within each stratum sampled, one of a potential nine 2 m x 2 m squares was chosen with the aid of a table of random numbers. In a few cases, the 2 m x 2 m square initially selected fell in the logging road or on the fringe of the gullied area to the south. In such cases, a second, previously-selected 2 m x 2 m square was substituted for the first. At the time of the Stage I sampling, the south halves of three of the Stage I squares also were excavated in order to gain a more extensive look at the subsurface of the site in the early phases of excavation and experiment with data recovery techniques.

Stage II. Contrary to our hopes, no discrete, isolated occupation floors were evident at the end of Stage I sampling. The site appeared to have a roughly uniform artifact density and complex, over-lapping pattern of component distribution. No one area stood out from the rest of the site as obviously more appropriate for block excavation for testing of the hypotheses under consideration.
We finally selected the area around N92R134 (North Half) for block excavation. This unit yielded the group of artifacts designated Feature 7: a Savannah River point of grey andesite, some large flakes of identical raw material and a large possible preform flake of opaque grey chert. Nearby in the same unit, a fragment of another Savannah River point, nearly identical in form and of identical raw material to the first, was found. Five meters to the south, excavation of another Stage I sample unit, N86R134 (North Half), had yielded a Savannah River point stem fragment. These data suggest that excavation of this portion of Windy Ridge might isolate the outputs of a single prolonged episode of Late Archaic occupation.

These two sample units also yielded evidence of other components. N92R134 (North Half) produced a probable Early Archaic endscraper of smoky quartz and N86R134 (North Half) produced a sidescraper and a single prehistoric potsherd. Other sampling units in the vicinity had yielded Morrow Mountain points. It was anticipated, then, that in addition to information on Savannah River phase occupation, block excavation in this portion of the site would produce information on Palmer, Morrow Mountain and Woodland occupations. Indeed, on the basis of our limited sample data, this vicinity seemed as likely as any other to yield data on these components.

The system of 1 m x 2 m excavation units within 2 m x 2 m squares was retained in the Stage II excavations. Selection of the initial units in the block excavation was such as to produce a 2 m x 11 m "R134 trench" intersecting both N92R134 and N86R134. A continuous north-south profile along the west wall of this trench was desired and it was hoped that interpretable north-south gradients in the values of certain artifactual variables might be revealed by the linear arrangement of 11 excavation units. A one meter-wide east-west trench was similarly excavated in line with the north half of N92R134. This was designated the "N92 trench." Composite profiles of the west wall of the "R134 trench" and the north wall of the "N92 trench" are illustrated in Figure 3. Around this core of cross-trenches, additional 1 m x 2 m units were excavated until the time allotted for field work ran out on June 2.

The block area opened up at the completion of Stage II consisted of twenty-five 1 m x 2 m units, a total of 50 m². Three of these units, the two named above plus N96R132 (North Half) had been excavated during Stage I so the block excavations added merely another 44 m² to the area of the Stage I excavations. With the addition of 6 m² resulting from the excavation of the south halves of N94R114, N90R116 and N86R126 at the time of the Stage I sampling, 94 m² of the total area of Windy Ridge, roughly 12% of the total site area, was opened up (Fig. 4).
WINDY RIDGE (38FA118)

STRATIGRAPHIC CROSS-SECTIONS OF STAGE II
BLOCK EXCAVATION AREA

ZONE I - LOOSE SANDY LOAM (PLOW ZONE)
ZONE II - COMPACT SANDY LOAM
ZONE III - COMPACT SILTY CLAY-SILTY LOAM
ZONE IV - PLASTIC CLAY
(ZONE IV - SANDY CLAY NOT EXPOSED IN BLOCK EXCAVATION)

FIGURE 3. Stratigraphic cross-sections of the Stage II block excavation area at Windy Ridge, 38FA118.
FIGURE 4. View of Stage II block area during excavation, looking northeast.
**Data Recovery Techniques**

The basic unit of data recovery in both Stage I and II was a 1 m x 2 m pit, oriented east-west. This unit size was a compromise between the convenient but spatially gross 2 m x 2 m unit and the ideal but awkward and time-consuming 1 m x 1 m unit.

Almost all soil excavated during both stages of work at Windy Ridge was screened through 1/4" mesh hardware cloth. Our initial research design called for screening all of the Stage I sample units and every fourth meter square in Stage II for purpose of debitage recovery. The rest of the block was to be carefully excavated, with tools point-provenience plotted. We experimented with this technique in the southern halves of N90R116 and N86R126 and found that the fine-textured, powdery soil adhered to artifacts in such a way that it was very difficult to recognize them in situ, even when troweling. We concluded that reliable recovery of tools and debitage from this particular site required screening of all excavated soil. Accordingly, all areas excavated during the Stage II excavations were also screened through 1/4" mesh hardware cloth.

More thorough recovery techniques were not attempted. The soil abounded in weathered rock fragments of all sizes and we deemed it impractical to attempt to recover microdebitage through a very fine mesh screen. Nor did we encounter any deposits with sufficiently good prehistoric context to justify an attempt to recover charred plant macrofossils or any similar category of ecofactual data.

Our research objectives required precise spatial control over all tools, tool fragments, cores and blanks, so every recognized or suspected representative of these classes was plotted and placed in a small bag with precise point-provenience data in terms of the three dimensions of the site grid. The basic excavation tool was a shovel, however, the soil was removed from the units in such a way that even if a certain specimen was—as was frequently the case—not recognized in situ, its provenience could be reconstructed with 10 cm or so.

Excavation of the Stage I units was usually carried out in a single level from surface to a depth ranging between 25 and 35 cm below surface. At this point, reddish sandy clay, demonstrated to be sterile, usually appeared in the floor. If this stratum did not appear, an additional 10 cm level was excavated in all or part of the unit. This Level 2 usually produced little or no artifactual material indicating that the bottom of the artifact-bearing strata had been reached. Most of the Stage II units were dug in two arbitrary levels. Level 1 was from ground surface to a depth between 20 and 25 cm below surface, corresponding to an even 10 cm BD. Level 2 was an additional 10 cm deeper. In most of the block units, the preponderance of artifactual material was in Level 1. It would have been desirable to dig these units in natural levels corresponding to the plowzone and the subplowzone artifact bearing strata; however, the bottom of the plowzone was only, if at all, faintly discernable in most of the profiles from this portion of the site.
One of the major test implications of the site function hypotheses was the presence or absence of aboriginal features representing graves, storage pits, "refuse" pits, earth ovens, or post holes. Accordingly, the floor of each excavation unit below plowzone was excavated in a manner so as to reveal any features extending into subsoil. The depth below surface at which this was done varied, but was in any case close to the transition between artifact-bearing and sterile soil. The sterile soil was a horizon presumed to be less biologically-active than the overlying strata and sufficiently stable to preserve evidence of aboriginal features. The probability that evidence of aboriginal subsurface facilities would be archeologically-visible by these means will be discussed in Chapter VII.

The north wall of each Stage I excavation unit was profiled subsequent to excavation, providing stratigraphic data from which to infer overall physical stratigraphy of the site and select the excavation techniques appropriate to Stage II. In addition, a single 2 m x 2 m square, N94R114, was shoveled down to a depth of 60 cm below surface, well below the artifact-bearing strata, in order to observe and record deeper natural soil horizons in the site.

In Stage II, composite profiles of the west wall of the R134 trench and the north wall of the N92 trench were prepared. A number of additional profiles were also recorded in the block excavations.
CHAPTER VI

SOILS AND STRATIGRAPHY

Introduction

The ridgetop soils encountered at Windy Ridge are sandy loams of the Cecil-Davidson-Appling association (Craddock and Ellerbe 1966), described as deep, well drained soils with red to brownish-red firm subsoils. These are residual soils, formed in place through natural weathering and chemical processes acting upon the parent metamorphic rock. No soil deposition has occurred in addition to this natural pedogenesis. An archeological implication of this is that all past human activity and deposition of cultural materials at this ridgetop site occurred on the present-day land surface.

A major factor complicating this assumption is erosion. Great amounts of topsoil have been lost throughout the Piedmont as the result of erosive agricultural practices (Trimble 1974; House and Ballenger 1976: 15-20). Trimble concludes that erosion in the Piedmont was negligible prior to European contact and settlement, but that the cotton economy of the nineteenth century severely depleted Piedmont soils. Fairfield County lies within one of the most severely eroded regions (Trimble 1974: 59).

Windy Ridge, however, does not appear to have undergone such intensive damage. The approximately 30 centimeters of sandy loam found above the underlying clay deposits suggest that the site area is a fortunate exception to this pattern of severe erosion in the South Carolina Piedmont. Except for the southern and western fringes of the site towards the gullied areas, the ground surface has apparently remained relatively stable and only minimal sheet erosion seems to have occurred. Other explanations, then, must be found to account for the burial of cultural material.

Site Formation Processes

Interpretation of the processes, both cultural and non-cultural, which have acted to form the archeological record at a site is essential to the archeological interpretation of that site (cf. Schiffer 1976). A discussion of non-cultural site formation processes, as they are thought to have been operating at Windy Ridge, is presented here. Dr. Leonard Gardner of the Department of Geology, University of South Carolina, visited the Windy Ridge excavation and observed exposed profiles and discussed these soils data with the archeologists. Dr. Gardner's insights form, in part, the basis of the following discussion.
Soil is not a static, lifeless entity. Instead, it is constantly being disturbed by pedoturbators, agents which act to move and mix soils both horizontally and vertically (Wood and Johnson n.d.). It is this pedoturbation, specifically that producing vertical movement, which has shaped the archeological record at Windy Ridge.

Two types of floralturbation, to use the terminology of Wood and Johnson (n.d.), should be considered here: tree throw and root disturbance. The first of these refers to instances in which trees are uprooted and fall, producing depressions and pits from which trees and their root systems were pulled. These depressions become the scenes of filling and soil mixing, thereby rearranging the stratigraphy. Areas of sandy soils and of pine forest experience very little tree throw (Wood and Johnson n.d.). Only one feature, Feature 6, was interpreted as being the result of tree throw.

The second type of floralturbation is disturbance of the soil by roots, especially those of trees. This has no doubt played a role in forming the archeological record as it currently exists at 38FA118, especially during the centuries of oak-hickory vegetation. At the time of excavation deep tree molds with relatively small diameters and divergent roots, corresponding in shape to pine tree tap roots, appeared as dark soil intrusions into the surrounding lighter soils. A number of these were recorded in the field as archeological features and were carefully investigated.

Faunal agents of soil mixture include moles, squirrels, mice, and other burrowing mammals; insects such as ants and termites; and earthworms. Over the course of centuries these small creatures can accomplish tremendous amounts of mixing and turning over of soils. It is hypothesized that these forces are responsible for a major part of the vertical soil (and artifact) displacement and for the distribution as it exists today. This is a continuing process. During the excavation we observed the activities of moles, ants, earthworms and grubs, termites (which wreaked havoc with the subterranean portions of our stakes), and other microfauna in the soil at Windy Ridge.

Water movement, slope wash and percolation (aquaturbation) have no doubt contributed in some small way to the redistribution of soils and of artifacts. Soil creep, the gravity-induced downslope movement of soil, which displaces it from its point of formation, is probably not a factor at 38FA118 because of the site's location on the relatively flat summit of a ridge (Leonard Gardner, personal communication).

From this discussion, the processes that came into play to form the archeological record at Windy Ridge become apparent. No soil deposition occurred to bury artifacts and the ground surface has remained relatively stable. Centuries of soil mixing by natural agents have resulted in some degree of downward movement and mixing of cultural material that was initially deposited upon the ground surface.
Stratigraphy

The soil profile at Windy Ridge is not a straightforward one that can easily be separated into discrete horizons. Instead, a continuum exists from uppermost brown sandy loam to the underlying dark red, plastic clay that occurs at depths ranging from 10 to more than 50 centimeters below ground surface. The deepest profiles, with residual clays at greater depths, occur in the central part of the site, while erosionally truncated profiles were found on the southern and western fringes of the site toward gullied areas. Progressing downward from the ground surface the soil becomes gradually more compact, contains a higher proportion of weathered pieces of quartz and other rocks and crusty manganese concretions, and assumes a darker red color resulting from increasing clay content.

An additional problem in presenting a tidy profile is the variability that occurs throughout the site. At some points discrete strata can be discerned while elsewhere only slight variations of the stratigraphy or even areas where no horizontal stratification, but only a continuous transition, can be observed. For purposes of a convenient discussion of the stratigraphy, generalized soil zones are distinguished. Stratigraphic profiles for the R134 and the N94 trenches are presented in Figure 3, and the profile of the south wall of N94R114 appears in Figure 5. The former pair of profiles represents mostly artifact-bearing horizons, while the latter profile is of a unit extended well below artifact-bearing horizons to expose deeper natural soil layers at the site.

FIGURE 5. South wall of excavation unit N94R114. Artifact-bearing strata comprise only about the top one-third of the exposed profile.
A descriptive approach is used here to present data concerning soils and stratigraphy. Soil samples removed from strata at 38PA118 were analyzed for texture and composition following the methods described by Foth, Jacobs, and Withee (1971), and for color using the Munsell color charts. Eight samples were collected in the field. All were sealed into plastic bags, which retained moisture until the analysis of the samples was undertaken in the laboratory. The color analysis was undertaken with a 100 watt light bulb situated approximately 12 inches above the sample, in a room equipped with overhead fluorescent lighting. The colors of the samples did not always correspond precisely with colors found on the Munsell color chart, but an effort was made to match them as closely as possible, using the dominant color found in each sample.

Zone I. Zone I, composed of sandy loam, extends from ground surface to depths ranging from 10 to 15 centimeters. The soil in Zone I varies in color from "brown" (7.5YR4.5/4) to "olive-brown" (7.5YR5/4). This zone is lighter in color than underlying zones, probably the result of eluviation.

This stratum is interpreted as being a plowzone. It is indistinct in places, and totally invisible in others, no doubt due to the fact that this area was probably last cultivated 30 or 40 years ago. A major determining factor in distinguishing the plowzone from other strata is the rapidity with which it loses moisture. When a vertical face is freshly exposed and moist, the plowzone is often indistinguishable. Drying occurs quickly, however, in the upper 10 to 15 centimeters, producing a light grey, sandy textured layer.

An organic stratum (corresponding to the traditional "O horizon") caps the plowzone. This stratum varies from one to three centimeters in depth and consists of a dark grey sand containing a network of fine surface roots overlain by pine straw and other undecomposed litter.

Zone II. Zone II represents a gradual transition from the sandy loam of Zone I to a more compact sandy loam with occasional small quartz fragments. A distinction between Zone I and Zone II could not be consistently observed throughout the site. This stratum begins about 10 to 15 centimeters below surface and extends downward for 10 to 15 centimeters. Soil samples taken from this zone vary in color from one area of the site to another: a Munsell reading for Zone II at the south wall of N94R114 was "olive-brown-light olive-brown" (7.5YR4.5/4), while the reading from the corresponding layer along the west wall of N90R134 was "yellowish red" (5YR4.5/6), indicating a higher clay content at this point. This is the deepest zone at the site that contained any appreciable amount of prehistoric cultural material.

Zone III. Zone II grades slowly into Zone III, a compact silty clay/silty loam. This loam is given a hard rocky character by the occurrence of numerous small weathered rock fragments and black crusty manganese concretions. Munsell readings of this soil are "yellowish red" (5YR4.5/6) and "yellowish red-reddish yellow" (5YR5.5/6), showing that a high proportion of clay exists in the soil. Zone III begins at roughly 20 to 35 centimeters below the surface and extends for at least 10 to 20 centimeters.
Zone IV. Zone IV is reddish sandy clay with abundant weathered rock fragments. This zone, which represents the transition from the upper sand to the lower clay, does not occur consistently throughout the site. Instead, a sharp discontinuity sometimes is seen between these two zones—the lighter sand and the darker plastic clay. In N94R114, which was excavated to a depth of approximately 65 centimeters for stratigraphic analysis, the upper boundary of Zone IV fluctuates from 20 to almost 40 centimeters below the surface. In part of the profile Zone IV extended beneath the floor at 65 centimeters, while at one point it encountered plastic red clay (Zone V) at 50 centimeters. Remnant quartz veins were found to exist indicating that this soil has weathered in place.

Zone V. Zone V, red clay, is the only soil horizon having distinct boundaries at 38FA118. In N94R114 this appears at a depth of 50 centimeters. Occasionally this clay is mottled with brown and contains small amounts of small rock, but generally it is free of such inclusions. As the ridge slopes away to the south, toward the gullies, a purer red plastic clay appears much closer to the surface. In N78R122, N80R116 and N82R116 clay was encountered less than 20 centimeters below the surface, perhaps reflecting extensive sheet erosion on that portion of the site. The upper surface of this clay is undulating throughout the site, with low rises and shallow troughs. The Munsell reading for this clay is 2.5YR3.5/6, "dark red-red."

Soil Process and Archeological Phenomena

Because of the constant mixing of the upper soil horizon by pedoturbation, there is no temporal stratigraphic positioning of artifacts. Instead, one finds a haphazard mix of artifacts covering a time span of over 9,000 years.

Artifacts appeared to have been concentrated within the top two stratigraphic zones (I and II), to depths of 20 to 35 centimeters below ground surface. These two strata are sandy, as opposed to the underlying Zone III with its higher clay content and greater compactness. A very few artifacts, primarily small thinning flakes, had moved down into the upper regions of Zone III.

From this vertical distribution of artifacts, it can be assumed that, for the most part, Zone III has not undergone a great amount of pedoturbation. If this were not the case, we would expect artifacts to have worked their way downward into Zone III.

Any aboriginal features that may have existed within the upper 20 to 30 centimeters would presumably have been obliterated by this pedoturbation. Beneath this disturbed stratum, however, in Zone III and below, archeological features might be expected to have remained intact. The paucity of such features suggests that no aboriginal features deeper than 20 or 30 centimeters below present ground surface existed in the areas excavated at Windy Ridge (see Chapter VII).
CHAPTER VII

ARCHEOLOGICAL FEATURES

Introduction

A key test implication of the site-function hypothesis is the presence or absence of archeological features representing subsurface portions of aboriginal facilities. Such facilities (i.e., post holes, earth ovens, storage and/or refuse pits and graves) would represent a considerable investment of time and energy in a specific locus and would be expected to have been constructed only at places that were occupied for prolonged periods and/or were consistently and frequently re-occupied.

Accordingly, a great effort was made to observe and record any archeological evidence of such subsurface facilities during the excavations at Windy Ridge (see Chapter V). Any observed staining or disturbance possibly representing an aboriginal facility was given a feature number and examined to determine its origin. The stratigraphic profiles observed and recorded throughout the excavation augmented this effort. In addition to suspected pits, etc., artifact clusters observed in the soil were also issued feature numbers.

The twelve numbered archeological features are briefly described in Table 2. With one possible exception (Feature 2) all of the subsurface soil disturbances seem readily attributable to root action rather than aboriginal digging. The two artifact clusters (Features 7 and 10) probably represent objects deposited together but buried by natural processes (see Chapter VI). Early in the excavation, a number of root stains were issued feature numbers and excavated or otherwise examined.

Classification and Description of Archeological Features

Tree Root Stains. Features 1, 3, 4, 8 and 9 are representative of a group of stains readily attributable to tree root growth in the recent past. They appeared as roughly circular areas of dark grey, comparatively loose soil, ranging from 5 to 38 cm in diameter, extending into the lighter and more compact subsoil at the site. A number of these were carefully trowelled-out and found in every case to be devoid of artifacts. In cross-section, these features proved to be gradually tapering holes extending deeply into the subsoil; their shapes corresponded exactly with that of the numerous undecayed pine tap roots exposed by the excavations. We consider these disturbances to be comparatively recent, representing a predominantly-pine successional stage post-dating
<table>
<thead>
<tr>
<th>Feature Number</th>
<th>Type</th>
<th>Location</th>
<th>Horizontal Size</th>
<th>Maximum depth</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Root stain</td>
<td>N90R142</td>
<td>5 m dia.</td>
<td>n.d.</td>
<td>Not excavated</td>
</tr>
<tr>
<td>2</td>
<td>Post hole(?)</td>
<td>N90R142</td>
<td>irregular</td>
<td>57 cm</td>
<td>Abrupt termination, perhaps not a root</td>
</tr>
<tr>
<td>3</td>
<td>Root stain</td>
<td>N86R126</td>
<td>38 cm dia.</td>
<td>62+cm</td>
<td>Excavated, classic pine root shape</td>
</tr>
<tr>
<td>4</td>
<td>Root stain</td>
<td>N86R126</td>
<td>18 cm dia.</td>
<td>n.d.</td>
<td>Not excavated, soft and dark like Feature 3</td>
</tr>
<tr>
<td>5</td>
<td>Root stain</td>
<td>N98R140</td>
<td>n.d.</td>
<td>n.d.</td>
<td>Not excavated, but an obvious tree root</td>
</tr>
<tr>
<td>6</td>
<td>Tree throw</td>
<td>N82R116</td>
<td>150 x 130 cm</td>
<td>60+cm</td>
<td>See text</td>
</tr>
<tr>
<td>7</td>
<td>Cluster of artifacts</td>
<td>N92R134</td>
<td>Not applicable</td>
<td>17 cm</td>
<td>See text</td>
</tr>
<tr>
<td>8</td>
<td>Root stain</td>
<td>N92R134</td>
<td>35 cm dia.</td>
<td>57+cm</td>
<td>Excavated, classic pine root shape</td>
</tr>
<tr>
<td>9</td>
<td>Root stain</td>
<td>N9R126</td>
<td>18 x 30 cm</td>
<td>36+cm</td>
<td>Excavated, classic pine root shape</td>
</tr>
<tr>
<td>10</td>
<td>Cluster of heated quartz rocks</td>
<td>N86R120</td>
<td>ca. 40 cm dia.</td>
<td>24 cm</td>
<td>See text</td>
</tr>
<tr>
<td>11</td>
<td>Unidentified disturbance</td>
<td>N98R120</td>
<td>25 x ? cm</td>
<td>30 cm</td>
<td>Exposed in profile</td>
</tr>
<tr>
<td>12</td>
<td>Burned tree root(?)</td>
<td>N92R136</td>
<td>30 x 35 cm</td>
<td>33 cm</td>
<td>Contained charcoal but was root-shaped</td>
</tr>
</tbody>
</table>
the initial historic period clearing and cultivation of Windy Ridge. Faint mottling was observed in Zone III throughout the site; this perhaps represents many thousands of years of hardwood root growth in prehistoric times.

**Tree Throw Disturbance.** Feature 6 in N82R116 and adjacent squares appeared as a large (150 x 130 cm) oval disturbance extending from the bottom of the plowzone. The fill was quite sandy and comparatively loose in contrast to the surrounding red plastic clay and red sandy clay subsoil. In horizontal plan, the center of the feature was a mottled dark brownish-grey with a lighter tan sand around the periphery. These two internal soil units intergraded but the boundary of the light sand and surrounding red clay was, in most places, quite distinct. Upon excavation, the dark core of the feature was found to extend vertically into the soil while the surrounding light sandy soil within the feature tapered sharply inward. The feature contained no prehistoric or historic artifacts. The hypothesis that Feature 6 represents a tree throw disturbance is not wholly satisfactory but, in any event, it seems non-aboriginal in origin and comparatively recent. The dark core of the feature may represent pine root development promoted by the looseness of soil in an earlier tree throw disturbance. As noted by Wood and Johnson (n.d.) tree throw is more prevalent on some soils than others, with poorly drained soils being especially susceptible. Canouts (1976) suggests that a high incidence of tree-throw at the Mt. Holly site (38YK25A) in York County, South Carolina, may be expected if tree root development were inhibited by the presence of almost impermeable plastic clay (Tredell and Mecklenburg series) just below the ground-surface (cf. Oosting 1942: 111). The soil profile at unit N82R116 is atypical of Windy Ridge in that the sandy loam extends only to the bottom of the plowzone. In this way it resembles the soil profile at 38YK25A (excavation records on file at the Institute of Archeology and Anthropology). This is attributable to the occurrence of severe sheet erosion on this localized portion of 38FA118. While this hypothetical episode of tree throw clearly occurred before the most recent plowing at the site, it probably occurred after the initial clearance and cultivation—and subsequent erosion—of this part of the site. In any event, both Feature 6 and the soil profile associated with it are atypical of the excavated area at Windy Ridge.

**Burned Stump Disturbance.** Feature 12 was a shallow, irregularly shaped disturbance filled with compact, dark grey, ashy, reduced soil and abundant small charcoal flecks. Excavation of this disturbance yielded no artifacts and revealed small root-like extensions protruding from the bottom of the feature. This feature is interpreted as a burned stump.

**Post Hole(?)** Feature 2, a single small circular disturbance in N92R142 (North 1/2) resembled the pine root disturbances described above but, when excavated, proved to bottom-out rather abruptly at ca. 57 cm below surface. The shape and diameter of this feature correspond rather well to that of a small (if deep) aboriginal post hole but the feature was devoid of artifacts and appeared to be recent. No other potential post holes were observed in the adjoining Stage II block and it seems likely that this feature, too, is natural in origin.
Feature 7. A basal fragment of a Savannah River point of grey andesite, a large biface thinning flake of the same material, and a large preform (?) flake of opaque grey chert were found, seemingly clustered, in the northeast corner of N92R134 (North 1/2). Another, morphologically-similar Savannah River point of identical raw material had previously been found only about 70 cm away in the same excavation unit. This association did not seem fortuitous and it was designated Feature 7. No evidence of an associated pit was observed; the specimens were, in any event, just below the plowzone. It seems probable that they were buried by pedoturbation rather than aboriginal activity.

Feature 10. Two large pieces of fire-reddened and cracked quartz and a piece of slightly reddened metamorphic rock were found at about 24 cm below surface in a small area at N86R120 (North 1/2). Smaller pieces of heated quartz were abundant throughout this unit. It was first thought that this feature might be similar to the earth ovens or "hearths" frequently encountered in Archaic sites in this portion of the Southeast (cf. Coe 1964; Broyles 1971; Chapman 1975). The quartz, however, seems to be of a much higher quality (for chipping) than is typical of the quartz naturally occurring in the soil mantle at Windy Ridge, corresponding to the "heated quartz" category defined in Chapter VIII. There was no sign of an associated pit.

In retrospect, it seems apparent that the content and structure of "Feature 10" are not greatly atypical of the overall character of the site. Subsequent analysis revealed that the two quartz pieces from Feature 10 fit together very tightly, indicating a recent break. This perhaps accounts for their close juxtaposition in archeological context. The density of fired quartz fragments does, however, seem variable within the site and unusually high in N86R120 (North 1/2). The burial of these specimens, like those constituting Feature 7, is attributed to pedoturbation rather than aboriginal activity. An attempt at functional interpretation of heated quartz will be presented in a succeeding portion of this report.

The Preservation of Archeological Features at Windy Ridge

No convincing evidence of aboriginal subsurface facilities was observed in any portion of the area excavated at Windy Ridge. Before the relevant test implications of the site function hypotheses can be affirmed or rejected, however, these negative data must be evaluated in terms of our understanding of the natural processes operating on the archeological record at the site (cf. Schiffer 1976: 15-16). We must ask if the apparent absence of archeological features permits the inference that no subsurface facilities were constructed in the past. This evaluation involves three issues: (1) the degree and depth of pedoturbation at the site, (2) modal dimensions of the classes of Archaic features predicted by the site function hypotheses, and (3) the degree to which ground surface--on which occupation occurred during the Archaic--has been lowered by sheet erosion.
As noted in Chapter VI, our present understanding of soil processes operating at Windy Ridge suggests that virtually all of the artifactual materials at the site were deposited on the surface and that their subsequent burial—to a depth of no greater than ca. 35 cm—reflects pedoturbation rather than deposition of soil derived from elsewhere. A corollary to this inference is that, since no artifactual material was found deeper than 35 cm below surface, the strata beneath this level have undergone comparatively little pedoturbation during the Holocene. Portions of features extending below the 35 cm threshold should be more-or-less intact.

A brief review of some literature on excavated Archaic sites in the Southeast may provide estimates for the modal dimensions of subsurface facilities we would expect to have been constructed at Windy Ridge if the site indeed ever functioned as a settlement or base camp. Coe (1964: 60, 93) refers to pits dug by preceramic inhabitants of both the Hardaway and Gaston sites in North Carolina but does not give detailed descriptions of these features. Chapman (1975: 170-199) presents detailed data on 196 Early Archaic features at Rose Island in eastern Tennessee. These data reveal that few early Archaic features at this site—whether globular pits, large basins or large irregular pits—were dug more than 30-40 cm below original ground surface. Data on Late Archaic grave dimensions at Indian Knoll are similarly discouraging. Webb (1974: 137) indicates that "typical" graves at Indian Knoll are seldom more than 40 cm deep. Other classes of Late Archaic features observed in Archaic middens, however, seem to be much deeper. Morse (1967: 17-18) notes that "refuse pits" at the Robinson site in the Cordell Hull Reservoir in eastern Tennessee extended as much as 5.0 feet (150 cm) below surface, deep into subsoil. The depth of these pits below original ground surface was apparently impossible to determine because of their origin in midden strata at the site but it appears likely that many of these were significantly deeper than 30-40 cm. Bowen (1975) reports frequent refuse-filled Ledbetter Phase pits extending 60 cm or more deep at a number of sites in the Normandy Reservoir basin in Middle Tennessee.

This review of Archaic features is cursory but suggests that various Early Archaic features and Late Archaic graves typically may have been shallower than the inferred 30-40 cm threshold required for archeological visibility at Windy Ridge. Remnants of large Late Archaic pits constructed for storage and subsequently filled with refuse, however, should have been encountered during the excavations if they were ever constructed in appreciable numbers at Windy Ridge.

An additional consideration is relevant to the question of feature preservation at Windy Ridge. If the ground surface has been appreciably lowered by sheet erosion, this might serve to obliterate even rather deep Archaic features. While we have no certain knowledge of the degree of sheet erosion at the site, the presence of 30 cm or more of sandy loam on most portions of the site suggests that sheet erosion on the site has been minimal.
Conclusions

In summary, no firm evidence of subsurface portions of aboriginal facilities was observed in any portion of the 94 m² area excavated at Windy Ridge—even though a great effort was made to recognize such evidence if it was present. This finding is consistent, then, with the hypothesis that the site represents only extractive activities and very ephemeral occupations through its 7000 years of sporadic prehistoric use. These negative data, however, need to be evaluated cautiously. We do not know that evidence of subsurface facilities would survive thousands of years in upland forest soils. Furthermore, for even their basal portions to have remained intact, it appears that features would have had to extend below the biologically-active upper soil horizons. The inference that very few Archaic subsurface facilities were ever constructed at Windy Ridge would be stronger if we had good evidence of just one such feature, which would demonstrate that such evidence is preserved.
CHAPTER VIII

ARTIFACT ANALYSIS

Introduction

The artifacts recovered from excavation units at Windy Ridge will be described in terms of multiple taxonomies intended to provide a basis for measurement of systemic variables of interest. The dimensions of artifact variability with which we are concerned include chronology, technology and function. The selection of specific attributes to be observed and the partitioning of the range of artifact variability at the site into discrete "types" was determined by the data requirements of the hypotheses, test implications and other operational considerations outlined in Chapter II.

In this chapter, the artifact typology and attributes employed in the analysis of the Windy Ridge materials will be defined and their potential relevance to the systemic variables under consideration will be discussed. The actual description of the assemblage in terms of these taxonomies will be presented chiefly in the following chapters and in Appendices C through F. There were few prehistoric ceramic artifacts from Windy Ridge and these will be described in the final section of this chapter. In following chapters, data in these diverse categories of observation will be articulated, one category with another, in an attempt to reconstruct aspects of prehistoric human behavior and test the hypotheses outlined in Chapter II.

Though numerous artifacts were collected in areas of exposed soil surrounding the 792 m² area intensively investigated at Windy Ridge, only samples from screened proveniences have been thoroughly analyzed here. In the few unscreened proveniences (see Chapter V) only hafted bifaces and unifaces have been analyzed and are described in Appendices E and F.

Lithic Raw Materials at Windy Ridge

Introduction

Information on lithic resource procurement and utilization in nonmetal-using societies may be relevant to testing hypotheses about varied aspects of the technology and organization of such societies. These aspects include patterns of inter-regional exchange, raw material requirements and technological change, and settlement patterning (see House and Ballenger 1976: 125).
Of particular interest in the present research is Gould's (1974) suggestion, based on ethnographic data from the Western Desert of Australia, that manufacture of tools of non-local "expensive" raw materials vs. locally-available raw materials usually takes place at base camps rather than extractive loci. Use of this tentative cross-cultural principle obviously requires successful discrimination of local vs. exotic raw material. This distinction is also relevant to the "Biface Thinning Flake Model" discussed by House and Ballenger (1976: 94, 99) and Goodyear, Ackerly and House (n.d.). This model, which has not yet been rigorously tested, states that sites of habitational loci, where biface tool manufacture took place, will be characterized by the presence of large and varied biface thinning flakes while sites of extractive loci, where only use and resharpening of biface tools took place, will be characterized by comparatively small and homogenous biface thinning flakes. It now seems likely that the implications of this model apply only to exotic raw materials in regional data bases and not to materials, such as quartz, which are so abundant and widespread that they could be procured casually during the course of extractive activities.

Articulation of lithic raw material data with cultural-historical types has revealed that some raw materials in this portion of the South Carolina Piedmont were used almost solely during certain prehistoric time periods. Kelly (1972: 79) reports that materials he designated as "granodiorite," "andesite," and "slate" were used primarily in Late Archaic times. The distribution of debitage in these raw material categories at Windy Ridge, then, may be used as an indicator of the scope of manufacture of Savannah River points and related tool forms at the site.

These raw material-point type correlations are perhaps technologically significant as well. Andesite and "slate" (our "argillite," see below) are considerably softer and more susceptible to rapid edge damage than are the much harder raw materials emphasized in earlier and later biface tool systems in the prehistory of the region.

With these considerations in mind, it was decided that a major focus of the Windy Ridge analysis should be analysis of lithic raw materials with respect to variables of chronology, technology and geographical origin. The geology and petrology of the Piedmont are quite complex, however, and previous research reveals considerable intra-regional and inter-regional movement of chippable stone by prehistoric people. In order to carry out the research outlined above, then, it is necessary to begin putting our raw material categories on a much firmer petrological basis.

Analytical Methods

Recent prehistoric archeological research in this portion of the South Carolina Piedmont has resulted in the recognition of several frequently-occurring categories of raw material for chipped stone tools (Kelly 1972: 30–32; House and Ballenger 1976: 126–127). A
series of ten archeological specimens representing these and other major categories of lithic raw materials at Windy Ridge were submitted for petrological analyses to Mr. Gerald Weisenfluh, a graduate student at the Department of Geology, University of South Carolina—Columbia. The results of his detailed analyses of thin sections of these specimens are presented in Appendix B of this report.

The materials of these specimens and the categories they represent are designated in this study by a "handle" which reflects current usage in the archeological community. These designations are employed here not only to facilitate communication but also in the belief that the archeologically-recognized categories may encode functionally-significant variability in materials along dimensions that might not necessarily correspond to those dimensions of variability of interest to geologists. It is emphasized that in most cases, only one specimen of a raw material category was thin-sectioned. Subsequent identification of other archeological specimens with the thin-sectioned specimens is based on impressionistic, hand-specimen comparison by one of the writers (House).

Categories Used in the Windy Ridge Analysis

Quartz. Crystalline vein or "bull" quartz, usually translucent white but occasionally reddish, greyish, yellowish-brown or clear, forms in veins ranging from a few centimeters to several meters in thickness throughout the Piedmont. It is much harder and more resistant to weathering than any surrounding rock and, hence, is usually left behind as residual chunks in the soil mantle. Occurrences of solid, uniform, relatively unweathered quartz—often associated with prehistoric quarry and workshop debris of this material—are frequently encountered throughout the South Carolina Piedmont but do not seem to be present on quite every ridge. Cobbles of quartz are also readily obtainable in the gravels of major rivers in the Piedmont. Quartz from this source is often yellow or brown in color in contrast to the white, grey or clear quartz more typical of residual upland sources.

The crystalline structure of this material interferes greatly with conchoidal fracturing and makes it a relatively difficult material for manufacturing chipped stone tools. Archeological specimens of quartz are, however, frequently much more "glassy" and isotropic than the best unmodified quartz we have observed, suggesting that this material may have been frequently heat treated (cf. Crabtree and Butler 1964). This hypothesis, however, has not been tested experimentally. An alternative hypothesis has recently been suggested by James L. Michie (personal communication). Michie has noticed that some quartz crystals, when flaked, exhibit white, glossy interior surfaces similar to archeological specimens. This suggests that similar material at archeological sites may represent procurement of especially high-quality quartz occurring in large crystals at a relatively few loci within the Piedmont. Windy Ridge is somewhat anomalous in the Interstate 77 corridor area in that quartz is not the predominant lithic raw material present at the site.
Carolina slate (banded). This material is a very fine-grained, isotropic, hard, siliceous rock with a good conchoidal fracture. Unweathered specimens are very dark grey to black. Archeological specimens dating from the Archaic or earlier, however, usually exhibit surfaces weathered to a grey, light grey, blue grey or light greyish-brown color. The weathering emphasizes the banding or lamination in the rock. This material is probably the "argillite" described by Kelly (1972: 32).

Banded Carolina slate is quite common at archeological sites in the portion of the South Carolina Piedmont east of the Broad River and on the Coastal Plain northeast of the Santee River (James L. Michie, personal communication). Its geological origin, however, has not yet been precisely determined. Mr. David Howell of the Geology Division of the South Carolina State Development Board (personal communication) notes its similarity to ignimbrite, which occurs in the Uwharrie Formation in the Carolina slate belt in south-central North Carolina and adjacent portions of South Carolina. House and Ballenger (1976: 126) note its very close similarity in appearance to some specimens of quarry and workshop debris from the Hardaway site and Morrow Mountain in North Carolina (cf. Coe 1964). These observed similarities have led us to hypothesize that the banded Carolina slate at prehistoric sites in this part of South Carolina is an extraregional exotic raw material originating in the Morrow Mountain area in North Carolina or in an area of similar lithology elsewhere in the slate belt in North Carolina or extreme north-central South Carolina.

In order to partially test this hypothesis, three pieces of banded Carolina slate were submitted to Gerald Weisenfluh for petrological analysis: (1) a biface fragment of somewhat atypical strongly banded material from Windy Ridge; (2) a large flake of very typical banded Carolina slate from Powell Shoals (38FA121), a hypothesized Archaic base camp site on the Broad River in Fairfield County, South Carolina (Brockington 1977); and (3) a large flake of faintly banded slate from a prehistoric quarry/workshop (31ST18) on Morrow Mountain in Stanly County, North Carolina.

The results of these analyses are presented in Appendix B. The strongly banded specimen from Windy Ridge was identified as a laminated metasiltstone strongly showing its sedimentary origin. The specimens from Powell Shoals and Morrow Mountain were both identified as metafelsites but the Powell Shoals specimen exhibited some evidence of sedimentary working after deposition. All three specimens, it will be noted, have a very similar mineral composition and all three contain round cavities filled with radiating (spherulitic) chalcedony.

These data generally support the hypothesized origin of "banded Carolina slate" but also emphasize the variability within this archeologically-derived category. The hypothesis needs further testing by analysis of additional archeological specimens from South Carolina and additional comparable specimens from known geological contexts.
Carolina slate (unbanded). Macroscopically, this material usually appears identical to the banded Carolina slate described above except that it does not exhibit banding or lamination on weathered surfaces and is in most cases quite uniform. Unbanded, as opposed to banded, grey Carolina slate appears much more commonly at prehistoric sites west of the Broad River in the South Carolina Piedmont (see Goodyear, Ackerly and House n.d.). A light green variant of this category occurs at Windy Ridge and is conspicuous at some sites along the Catawba-Wateree River.

A specimen of grey, unbanded Carolina slate from Windy Ridge was thin-sectioned and analyzed by Gerald Weisenfluh and identified as a porphyritic metadacite or metafelsite. Weisenfluh notes that it is texturally and compositionally very similar to the "grey andesite" category but is much finer-grained (Appendix B).

Grey andesite. This material was lumped in the category "tuffaceous" by House and Ballenger (1976: 126-127) but seems to correspond to the "andesite" described by Kelly (1972: 32). Grey andesite is a comparatively coarse-grained rock including many tiny but megascopically-observable particles of diverse materials. This rock is quite isotropic, exhibiting conchoidal fractures with rough surfaces. Specimens usually exhibit weathered light grey surfaces which are often stained red or yellow by clay soils. Fresh breaks reveal a dark grey unweathered core. Red-brown cortical surfaces are present on some flakes from Windy Ridge.

Grey andesite was the most abundant raw material in the chipped stone debitage at Windy Ridge. The large size of many flakes of this material at Windy Ridge and other sites in the I-77 corridor area argues for a local origin, but we have yet to discover any quarries for this material.

Two specimens of this category, from different portions of the area excavated at Windy Ridge, were submitted to Gerald Weisenfluh for petrological analysis. The specimens were found to be virtually identical, both classed as meta-andesite or dacite prophyry (Appendix B).

Coastal Plain chert. A number of prehistoric quarry/workshops for Coastal Plain chert are known in Allendale County, South Carolina (Institute of Archeology and Anthropology site files) and elsewhere in nearby portions of South Carolina and Georgia.

In its unmodified state, this chert is usually a mottled light grey or grey-white though occasionally it is cream-colored, yellow or brown. Other generally useful identifying characteristics are the presence of tiny fossils in the interior of nodules and the presence of a chalky, fossiliferous cortex. Artifacts of Coastal Plain chert dating to the Paleo-Indian and Early Archaic periods are usually highly weathered, yellow, soft and chalky. An extremely fossiliferous variant of Coastal Plain chert seems to have been procured by prehistoric Indians.
Experiments by David G. Anderson (Anderson 1977) and the writers, indicate that the chipping properties of Coastal Plain chert can be markedly improved by heat treatment. Red, pink, dark brown, green and blue tints observed on many very glossy archaeological specimens seem readily attributable to heat treatment.

Opaque grey chert. This designation refers to an opaque, very fine-grained, siliceous material, light or dark grey in color, with somewhat irregular fracturing properties. Another identifying characteristic of this material is the presence of numerous tiny, crystal-filled seams (House and Ballenger 1976: 127). Specimens occasionally exhibit areas with a red tinge over-ridden by subsequent greyer flake scars. This attribute is strongly suggestive of heat treatment.

Petrological analysis by Gerald Weisenfluh confirms that this material is indeed chert (Appendix B). Weisenfluh suggests that it originated outside the Piedmont Province but David Howell (see House and Ballenger 1976: 127) has suggested that such cherts may occur in infrequent carbonate-rich sediments in the Piedmont. Purely archaeological data from Windy Ridge—the occurrence of abundant, large, early reduction-stage flakes of this material—suggest a local origin for "opaque grey chert." Some specimens from Windy Ridge exhibit areas of a shallow, light tan cortex suggesting that this material was frequently procured from stream gravel.

Quartz porphyry. This is a raw material category characterized by tiny (ca. 1mm) but conspicuous, clear phenocrysts in a very fine-grained groundmass. Fresh interior surfaces are light grey while weathered surfaces are a buff or pale grey-yellow. A specimen in this category was thin-sectioned and analyzed by Gerald Weisenfluh (Appendix B) and identified as quartz porphyry. Most of the phenocrysts are quartz crystals but comparatively large plagioclase and potassium feldspar crystals are also present. The frequent occurrence of large flakes of this material at Windy Ridge argues for a local origin.

Argillite. Argillite is defined as "a rock derived from siltstone, claystone, or shale that has undergone a somewhat higher degree of induration than is present in these rocks. Argillite holds an intermediate position between the rocks named and slate" (American Geological Institute 1962: 23). Specimens from Windy Ridge and elsewhere in the I-77 corridor are usually grey to light grey-green, rather soft and exhibit marked laminations that interfere with conchoidal fracture. The argillite described here is probably the "slate" described by Kelly (1972: 32). Argillite is one of the major constituents of the Carolina slate belt in South Carolina (Overstreet and Bell 1965).

Amphibolite (low grade). This category is characterized by the presence of tiny, black, needle-like crystals and aggregates of crystals of hornblende and/or actinolite in a very fine-grained, light grey
groundmass. These crystals are frequently aligned in such a way as to give specimens a laminated appearance. Weisenfluh notes that this material is more properly designated as a variety of "andesite tuff" or "intermediate tuff" and is of a lower metamorphic grade than the rocks more properly designated "amphibolite." The term "amphibolite" is, however, frequently used to designate this material. The results of the petrological analysis of a specimen of this material are presented in Appendix B.

**Amphibolite (high grade).** This material is characterized by larger hornblende crystals and a blacker appearance and coarser texture than the amphibolite (low grade) category. Alignment of large hornblende crystals is quite conspicuous in the fabric of the rock. No specimens of this category were thin-sectioned but Gerald Weisenfluh (personal communication) suggests that this material is properly called "amphibolite" and probably originates in the Charlotte belt as it exhibits a higher metamorphic grade than the category described above.

**Diabase.** This raw material category has been frequently designated "basalt" by archeologists (Kelly 1972: 32; House and Ballenger 1976: 127). It is a dense, very grainy-textured rock, black to grey when fresh but weathering to a mottled earth brown. Archeological specimens usually exhibit a very weathered, pitted surface on which only the larger more prominent flake scars are still observable. A specimen in this category has been thin-sectioned and identified as "olivine diabase" by Weisenfluh (Appendix B) who notes that such material occurs in ubiquitous dikes of Mesozoic age throughout the Piedmont. This comparatively soft raw material is abundant in some proveniences at Windy Ridge and was probably procured from an outcrop in the general vicinity.

**Other identified raw materials.** A few other raw materials could be tentatively identified but occurred in very small quantities at Windy Ridge. These include: (1) an end scraper and scattered tiny flakes of blue-grey smoky quartz from the block excavation, (2) an endscraper and a few tiny flakes of an orthoquartzite thought to originate in the Santee River drainage in the middle Coastal Plain, and (3) a single flake of grey translucent chert thought to have originated in the Ridge and Valley Province beyond the Blue Ridge Mountains (House and Ballenger 1976: 127; Goodyear, Ackerly and House n.d.).

**Unidentified raw material.** A small minority of lithic specimens in most proveniences at Windy Ridge were not readily assignable to any of the above categories. These specimens are diverse but for the most part seem to be varieties of metamorphic or metavolcanic rocks.
The functional typology used in the analysis of the Windy Ridge lithics is basically that employed by House and Ballenger (1976) in the analysis of materials from the I-77 survey and by Goodyear, Ackerly and House (n.d.) in the analysis of collections from the survey of the Laurens-Anderson Connector route. The typology is based on presumed correlates between observable physical attributes of artifacts in the present and variables of human behavior in the past. The category biface thinning flakes, for instance, will be used to measure the amount of biface manufacture represented by an assemblage. While we cannot determine the past behavioral context of any artifact with certainty, this typology does incorporate the results of a considerable amount of replicative experimentation. We feel, then, that it is a useful tool for approximate measurement of past systemic variables.

It should be emphasized that some of the "types" defined below, especially those pertaining to debitage, represent somewhat arbitrary segmentation of continuous processes into sequential stages. A certain amount of error in classification, in terms of the operational definitions below, is probable.

Description of the Windy Ridge materials in terms of this typology will be presented in two appendixes and in the text of following chapters. Appendix C will present a breakdown of the debitage by raw material, lumping all three debitage categories (chunks, other flakes, biface thinning flakes). Appendix D will present provenience data for tool and core categories. The chunk/other/thinning distinction will be employed in Chapter X in reconstructing the differential occurrence of different reduction stages among different raw materials at Windy Ridge.

Fire-cracked rock. Fire-cracked rock is considered an output of "hot rock" cooking in earth ovens or by stone boiling. Though this archeological variable is crucial to evaluation of the site function hypotheses (see Chapter II) it will not be employed quantitatively here since it has proved virtually impossible to operationalize within the context of excavation at a site like Windy Ridge. First, it is very difficult, even in the laboratory, to distinguish heat-induced cracking and discoloration of weathered rocks occurring in residual upland soils. Cursory experimentation suggests that heated upland quartz will crack but may differ very little in appearance from un-modified quartz. Second, the artifact-bearing soil horizons at Windy Ridge abound in rock fragments and it is extremely difficult in the field to recognize subtly discolored and cracked examples of native rocks given the powdery soil that adheres to all rocks even while they are in the screen. Fortunately neither of these difficulties obtain at most riverine sites. Reddening and cracking of cortex-bearing river cobbles is usually quite distinctive and the absence of any but humanly-introduced rock in alluvial terrace soils permits bringing of all excavated rock material to the lab for final sorting.
In hopes of nonetheless making a qualitative statement about the occurrence of fire-cracked rock at Windy Ridge, we did watch, in both the field and the lab, for any material that might be interpretable as fire-cracked rock. Only a small amount of such material could be recognized, leading us to conclude that comparatively little aboriginal fire-cracked rock was present at the site.

Heated quartz. This category includes pieces of reddened, angularly fractured, fine-textured quartz. The definition of the category derives from the recognition of pieces of quartz at Windy Ridge that appeared "fire-cracked" but were of a much higher quality (for knapping) than the naturally-occurring quartz in the site area. It does not seem likely that high quality quartz would be imported simply to use for "hot rocks" in cooking. We have, however, no satisfactory hypothesis for the function of heated quartz. It may perhaps represent abortive heat treatment (cf. Crabtree and Butler 1964) of quartz raw material for manufacture of stone tools. This variable is probably under-represented in Appendix D, as it was difficult to recognize this material during screening and small amounts of "heated quartz" were occasionally observed on back dirt piles after heavy rains. Both count and weight data for this class are given in Appendix D.

Chunks. These are angular pieces of debitage, of various sizes. They are distinguishable from flakes by the lack of observable striking platforms, dorsal and ventral faces and other characteristics of flakes. They are distinguishable from cores by lack of scars of detached flakes. Chunks are considered to have been produced in greatest numbers in the very earliest stages of the reduction of a piece of stone for tool manufacture.

Flakes. These are pieces of chipped stone debitage which, if whole, have observable striking platforms and dorsal and ventral faces. They are usually fairly flat and have observable flakes scars on their dorsal faces. The distinction of primary, secondary and tertiary flakes was observed, when possible, during analysis but is not employed to any great extent here since cortical surfaces are difficult to recognize on many of the raw materials. This class includes biface thinning and other flakes.

Other flakes. This category is a catch-all for pieces that exhibit recognizable flake morphology but do not correspond to the definition of biface thinning flakes below. As a catch-all, they may represent a variety of tool-making processes but, in an assemblage dominated by bifaces, they are conceived of as primarily representing a reduction stage intermediate between those represented by chunks and by biface thinning flakes.

Biface thinning flakes. These flakes are assumed to have been removed during the process of thinning or resharpening bifaces. Their morphology reflects detachment from a bifacial core-form. They are relatively flat, have broad, shallow flake scars (from detachment of previous thinning flakes) on the dorsal face, and tend to exhibit "feathering-out" of lateral margins. When the platform is present, it
usually exhibits a low angle and/or crushing and grinding. The operational definition of this type is presented graphically in Figure 15 of the I-77 report (House and Ballenger 1976). In the present analysis fragments representing half or more of biface thinning flakes are counted in this category but smaller fragments were counted with the other flakes, reflecting greater uncertainty about their origin.

Flake tools. These are flakes of various types exhibiting marginal modification of edges in the form of flake scars averaging less than 2 mm long. This is interpreted as functional edge damage resulting from the use of the flake as a tool in modifying fairly hard materials such as bone or wood (cf. Tringham, et al. 1974). In Appendix D, both the total number of pieces and the total number of modified edges per provenience are enumerated (i.e., no. of pieces/no. of edges).

Unifaces. These are unifacial tools with regular steep marginal retouching producing flake scars averaging greater than 2 mm long. These longer flake scars are interpreted as the result of intentional retouch to produce a unifacial working edge of a desired shape. This category subsumes a number of specialized tool forms.

Cores. Cores are masses of material exhibiting flake scars resulting from removal of one or more flakes. The piece must lack prepared tool edges and edge damage indicative of use as a tool. These may represent cores for production of flake tools or simply amorphous by-products of very early stages of biface or uniface production. A single example of a specialized core type, a bipolar core or pièce esquilleé, will be discussed in Chapter X.

Bifaces. These are bihedral pieces of chipped stone with two faces and flake scars on both faces. This class includes points, biface blanks, and other bifaces.

Points or hafted bifaces. These are symmetrical, pointed bifaces which are modified, on the end opposite the pointed tip, for hafting. The term "hafted biface" is used frequently in this analysis to avoid the functional connotations of the more conventional term "projectile point." Edge damage analysis suggests that many of these tool forms actually functioned as knives or saws.

Blanks. (1) Bifaces which lack even, regular edges formed by careful retouching. These are usually asymmetrical and thick and are interpreted as representing unfinished biface tools, usually pieces that were rejected and discarded during manufacture. Some biface blanks approximate the morphology of finished biface tools but lack carefully formed edges. These are considered preforms. (2) Large (greater than ca. 100 g) roughly bihedral flakes of suitable raw material. These are considered blank flakes intended for production of biface tools.

Other bifaces. Bifaces which have regular finished edges but are not points as defined above are included in this grouping. This category potentially subsumes a number of specialized tool forms but, in Appendix D, it is used chiefly as a catch-all for small, unidentifiable fragments of biface tools.
Hammerstones. Large (greater than ca. 100 g) rounded pieces of rock with observable zones of battering on prominent corners are interpreted as hammers. Specimens of very hard material were probably used for percussion knapping. Specimens of softer materials were presumably used in other tasks, perhaps including bone crushing for marrow extraction or other purposes during butchering (cf. Frison 1974: 31).

Pitted cobble. This is a cobble with one or more well-defined zones of battering or small pecked or abraded depressions on a face (as opposed to a corner). Current hypotheses for the function of pitted cobbles include nut cracking and use as an anvil for bipolar flaking. Recent experiments by Spears (1977) shed light on the pattern of functional damage resulting from these alternative uses. A single example of a pitted cobble was recovered at Windy Ridge. This artifact will be discussed in Chapter X.

Metric Attributes of Chipped Stone Debitage

The size distribution of various classes of chipped stone debitage is relevant to Test Implication 6 of the alternative site function hypotheses under consideration (see Chapter XI). Particularly, this information is required for application of the Biface Thinning Flake Model (House and Ballenger 1976: 94–99) in order to infer the amount of biface tool manufacture vs. resharpening represented by an assemblage (see Chapter X).

Four metric attributes were observed on individual specimens of whole biface thinning flakes:

- **Flake length.** Maximum length of a flake measured parallel to the axis of force.
- **Flake width.** Maximum width measured perpendicular to length.
- **Flake thickness.** Maximum thickness of a flake.

To these attributes defined by House and Ballenger (1976, Fig. 15), a fourth has been added to measure variability in fabricator type or technique used in the detachment of a flake:

- **Platform width.** Width of the platform measured parallel to flake width and perpendicular to flake thickness.

Measurement of the above attributes is extremely time-consuming. Therefore, these measurements were made only for the three raw materials for which specific frequency distributions had been predicted on the basis of hypothesized differential raw material procurement patterns and hypothesized site function. Measurements of a random sample of whole quartz, grey andesite, and Carolina slate (Banded) thinning
flakes from Stage I proveniences were used to provide estimates of these distributions for the whole site population.

For all frequently-occurring raw materials in all screened proveniences, weight of debitage specimens was used to approximate the information required by the Biface Thinning Flake Model. Weight of a piece of debitage varies directly with the sum of length, width and thickness and, probably better than any other single attribute, reflects the rate at which the mass of a piece of stone is reduced by knapping. In measurement of this attribute, debitage from each provenience was segregated by raw material category, then by type (i.e., chunk/other/thinning), and then each resulting group was weighed by lot. Though this method does not distinguish between whole and fragmentary flakes and does not yield information on sample variance, it quickly yields sample means for this variable. The data observed in this fashion, for both Stage I and Stage II proveniences, are presented in Appendix C.

**Metric and Functional Attributes of Hafted Bifaces**

Hafted bifaces ("points") from the excavation units at Windy Ridge were categorized by over-all morphology and technological characteristics into classes identified with named cultural-historical types defined in the literature. These categorizations are our major chronological control on the archeological phenomena at Windy Ridge and will be discussed in the following chapter.

In Appendix E, each of the hafted bifaces from Windy Ridge is described in terms of the set of metric attributes illustrated graphically in Figure 6. The use of these attributes is intended to facilitate rigorous comparison of the Windy Ridge specimens with points from absolutely or relatively dated contexts elsewhere in this part of the Southeast.

Though hafted bifaces are primarily used by archeologists as "index fossils" for chronological controls, these "diagnostic" artifacts were also elements of functioning tools and their deposition at the locus of past activity is a result of their use, breakage, exhaustion and discard or loss during the course of an activity. Variability in many of the metric attributes defined in Figure 6 then, may have functional implications. Blade length may be affected by the stage of resharpening of a tool (cf. Goodyear 1974), while the shape and size of the haft element is presumably related to hafting technique and the direction and magnitude of stresses anticipated by the intended function of the tool. Accordingly, these two elements of a hafted biface are distinguished analytically rather than lumped into a single unit to be measured by a "maximum length" attribute.
METRIC ATTRIBUTES OF PROJECTILE POINTS
(ADAPTED FROM AHLER 1970: 21-24)
Experimentation has shown that use of hafted biface tools in certain tasks produces patterned functional damage (Ahler 1971: 81-87). Use of hafted bifaces as projectile points may produce characteristic impact fractures on the tip while use as cutting implements may produce rounding and dulling of blade edges. Other nonmetric attributes such as edge angle and blade edge outline may be functionally significant (Semenov 1964: 20; Wilmsen 1970: 70; Ahler 1971: 84). Breakage patterns likewise may be a clue to the function of a tool (cf. Frison 1971: 83). Though inference of specific function of hafted bifaces from their physical attributes does not seem feasible, given the present state of the art, observation of patterning in these attributes should enable us to narrow the range of possibilities and evaluate such disparate hypothetical alternatives as projectile point and knife functions.

The following functional attributes were observed for each hafted biface from the excavations at Windy Ridge and the resulting data are presented in Appendix E.

**Raw material.** The raw material categories defined earlier in this chapter were used in the observation of this attribute. The raw material used in tool manufacture reflects differing technological requirements of different tool systems and exchange networks available to the makers of the tools. Most important in the present analysis, observation of this attribute of tools allows correlation ofdebitage and tool forms within a site.

**Edge angle.** Edge angle was measured by holding the artifact against a sheet of polar coordinate paper and looking down the blade edge to find the angle that best typifies the edge. This is a crude and imprecise method but it is probably more accurate than the use of a goniometer on a highly variable and irregular piece of stone. The edge angle of one edge of a hafted biface blade often differed significantly from the other; the edge angle value given in Appendix E is the mean of the two observed edge angles.

**Edge damage.** All instances of functional blade edge damage recorded in Appendix E are varieties of what Semenov (1964: 14) has termed "polishing" or "rubbing" and what Ahler (1971: 38) has termed "rounding" or "smoothing." Additional varieties of functional damage on hafted biface working edges are recorded under "Comments" in Appendix E. Only cursory microscopic examination was carried out. Because of the nature of the prevalent raw materials—semi-transparent quartz and weathering-prone metavolcanic rocks—only rather extreme, macroscopically-observable cases of rounding and smoothing are readily distinguishable by any technique. Experiments by Ahler (1971: 83-84) demonstrate that this type of edge damage may result from butchering but suggests that more severe examples of edge damage result primarily from contact of the tool edge with bone during the butchering process. Many of the specimens exhibiting damage to blade edges also exhibit evidence of resharpening. This takes the form of discontinuous prominent zones of edge dulling over-ridden by subsequent flake scars forming a sharp, slightly inset, rejuvenated cutting edge. The occurrence of other forms of functional working edge damage and information on breakage of hafted biface tools is presented in the "Comments" column of Appendix E.
The excavations at Windy Ridge yielded nine prehistoric pottery sherds plus one tiny piece of fired clay of unknown function. All nine sherds were from excavation units in the central portion of the site, the area selected for the Stage II block excavation.

These sherds vary somewhat in color and in texture but all seem to represent a single ware. Two types of surface treatment, however, are distinguishable, suggesting that perhaps two vessels are represented. All nine sherds are body sherds; no rim or basal fragments were recognized. A formal description of this assemblage is presented below and provenience data for Windy Ridge ceramic materials are presented in Table 3.

Method of Manufacture: Most specimens exhibit obvious coil breaks. Paste: Temper. Consists of medium or coarse sand. Examination of sherds under a microscope reveals that most of the tempering particles are smooth and rounded indicating origin in alluvial sand deposits rather than as intentionally crushed grit. The predominant mineral is quartz but a few other minerals are observable among the tempering particles. Tempering particles 1 mm or more in diameter are frequent but particles larger than 2 or 3 mm in diameter are rare. Texture. The paste tends to be somewhat lumpy. Color. Brown, grey-brown or red-brown surface colors predominate while the core is typically dark grey or grey. The interior surface is in some cases slightly darker than exterior surfaces.

Surface Treatment: Two types of exterior surface treatment are distinguishable:

Punctated. Five specimens exhibit sets of shallow punctations arranged in horizontal rows. These rows appear to be widely spaced since only a single row is observable on any one sherd. Within a single row, punctations are somewhat irregularly spaced but average roughly 5 mm apart. The punctations are quite shallow and seem to have been made by lightly jabbing a pointed instrument into the clay at a low angle.

Cord-marked. Three specimens exhibit coarse, parallel cord impressions which seem to have been placed perpendicular to the mouth of the vessel. One additional specimen exhibited indistinct surface modification which could possibly also represent cord-marking. Interior surfaces seem to have been carefully smoothed.

Vessel Form: None of these body sherds are more than a few centimeters along their longest dimension, so no inferences of vessel form are possible.

Sherd Thickness: Every sherd was between 7 and 8 mm thick.
### TABLE 3

**PREHISTORIC CERAMIC ARTIFACT PROVENIENCES AT WINDY RIDGE**

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>N96R132(N1/2)</td>
<td>1 cord marked body sherd</td>
</tr>
<tr>
<td>N86R120(N1/2)</td>
<td>1 piece of unidentified fired clay</td>
</tr>
<tr>
<td>N86R126(N1/2)</td>
<td>1 punctated body sherd</td>
</tr>
<tr>
<td>N86R134(N1/2)</td>
<td>1 punctated body sherd</td>
</tr>
<tr>
<td>N92R132(N1/2)</td>
<td>1 punctated body sherd</td>
</tr>
<tr>
<td>N92R138(N1/2)</td>
<td>1 punctated body sherd</td>
</tr>
<tr>
<td>N90R132(N1/2)</td>
<td>1 cord marked body sherd</td>
</tr>
<tr>
<td>N88R132(N1/2)</td>
<td>1 punctated body sherd</td>
</tr>
<tr>
<td>N88R134(N1/2)</td>
<td>1 cord marked body sherd</td>
</tr>
<tr>
<td>N88R134(S1/2)</td>
<td>1 body sherd with unidentified surface treatment</td>
</tr>
</tbody>
</table>

These sherds are not readily assignable to any previously defined ceramic complex from the Carolina Piedmont area. The cord marked specimens correspond in paste and surface treatment to the Badin Cord marked type defined by Coe (1964: 28) but similar combinations of attributes are widespread in time and space in the Southeast. Coe reports no punctated sherds in the Badin complex or any succeeding complex in the North Carolina Piedmont. Kelly (1972: 13-19) reports only rare cordmarked sherds and no punctated sherds in his survey collections from this portion of the South Carolina Piedmont.

The jabbing punctation technique exhibited by the Windy Ridge punctated sherds is reminiscent of a technique used on Thom’s Creek and Stalling’s Island ceramics (Stoltman 1974, Plates 21, 22) from the South Carolina Coastal Plain. This remembrance, however, is slight and the paste of the Windy Ridge specimens is very different from that typical of Thom’s Creek and Stalling’s Island sherds.

Some functional implications of these ceramic data will be discussed in Chapter X.
CHAPTER IX

CULTURAL IDENTIFICATION

Chronological Controls

A general outline of the prehistoric sequence for the South Carolina Piedmont is presented in Figure 7. It is based on Coe (1964), Phelps (1964), Broyles (1971), Ferguson (1971), Dickens (1976), Keel (1976) and Chapman (1976). The last source has been especially valuable, combining new radiocarbon dates for Archaic complexes in the Tellico basin in east Tennessee (about 200 miles to the west of Windy Ridge) with an up-to-date compilation of radiocarbon dates for comparable complexes throughout the Southeast. The archaeological units employed in Figure 7 are variously defined. Most have been formulated as "phases" (Willey and Phillips 1958), by Phelps (1964), and others but no attempt has been made here to summarize these data in terms of any integrated system of cultural-historical data. The reader is referred to Griffin (1967) and House and Ballenger (1976: 23-26, 29-39) for general discussions of prehistoric cultural development in this portion of the Southeast.

FIGURE 7. Summary outline of the prehistoric sequence in the South Carolina Piedmont.
This chapter will attempt to relate the prehistoric cultural remains excavated at Windy Ridge to the sequence outlined in Figure 7. It is emphasized that our chronological controls on the Windy Ridge data consist solely of identification of certain artifacts—chiefly hafted bifaces (points)—with cultural-historical "types" defined elsewhere. These types are normative and somewhat intuitively defined but their general usefulness for recognition of broad temporal horizons seems amply demonstrated.

This type of chronological control is less than ideal but, given the depositional context of most, if not all, inter-riverine zone ridge top sites, it is probable that excavation of these sites will never yield hearths or stratified deposits suitable for deriving direct absolute or relative dates for discrete components. In the absence of such direct dates, stylistic patterning will have to be exclusively relied upon for chronological control over materials from these sites and the behavioral subsystems they represent. Hopefully, these morpho-stylistic taxonomies will soon be refined by the acquisition of stratified sequences and absolute dates from sites in nearby riverine zones.

Hafted bifaces were functioning parts of dynamic behavioral systems in the past and underwent various transformations in this context. Correlation of bifaces and debitage on the basis of attributes of technology and raw material then may provide a basis for tentative segregation of the temporally-diverse—but mechanically-mixed—debitage at Windy Ridge into approximations of discrete, synchronic units.

One final note on chronological controls: all of the dates given here are in radiocarbon years. No attempt has been made to convert any of these dates into absolute calendar years using the bristlecone pine calibration recently reported by Ralph, Michael and Han (1974).

The Occupational History of Windy Ridge

Early Archaic

Three hafted bifaces (Fig. 8 a–c) have been assigned to the Palmer type (Coe 1964: 67–69). The Coastal Plain chert specimen (Fig. 8a) is particularly interesting. Its shape and size are atypical of Piedmont Palmers and it closely resembles specimens of this type frequently found in the Coastal Plain in extreme southern South Carolina and adjacent portions of Georgia.

The unifaces and the single bipolar core recovered from excavation units at Windy Ridge are also tentatively assigned to the early Archaic component. Three specimens correspond to Coe's (1964: 73, 76) end-scraper Type I which, as Coe observes, resembles endscraper forms found in Paleo-Indian and Early Archaic contexts elsewhere in North America.
FIGURE 8. Palmer and Stanly points from 38FA118: a. Palmer, N92R130(N1/2); b. Palmer base, N88R132(S1/2); c. Palmer base, N94R114(N1/2); d. Stanly base, N90R116(N1/2).
FIGURE 9. Morrow Mountain points from 38FA118: a. N98R148(N1/2);
b. N90R150(N1/2); c. N94R134(N1/2); d. N94R134(S1/2); e. N92R136(S1/2);
f. N92R136(S1/2).
The correct temporal assignment of the other unifaces is somewhat more obscure. Coe (1964: 51) reports the occurrence of various uniface forms—including end scrapers, side scrapers, and oval scrapers—in Morrow Mountain and Stanly levels at Doerschuk. Goodyear, Ackerly and House (n.d.), however, report that varied, somewhat crudely fashioned, unifaces seem most closely associated with Palmer points in surface collections from the Laurens-Anderson corridor.

Small bipolar cores, apparently associated with the manufacture of pièces esquilléé (McDonald 1968: 85-87) frequently form a part of Paleo-Indian and Early Archaic components in eastern North America. These tool and core forms are becoming widely recognized in the Southeast only as samples of chipped stone debitage are beginning to be intensively analyzed. Pièces esquilléé, bipolar cores, and pitted cobbles were quite conspicuous in Early Archaic levels at Rose Island in the Tellico basin (Chapman 1975: 142-145). A few examples of bipolar cores were also found by the Laurens-Anderson survey.

Recent radiocarbon dates from throughout the Atlantic Seaboard and Appalachian area place the Palmer-Kirk type cluster very early in the Holocene, between 8000 and 6500 B.C. The Palmer component at Windy Ridge seems to represent the earliest human occupation of the site.

**Middle Archaic**

Artifacts attributable to Middle Archaic occupation are especially abundant at Windy Ridge. A single Stanly point (Coe 1964: 35, 122) (Fig. 8d) was found in N90R116(N1/2). Recent dates for the Stanly phase in the Tellico basin (Chapman 1976) support Coe's (1964, Figure 116) original estimate that this complex dates between 5000 and 6000 B.C.

The Morrow Mountain phase, 5000-4500 B.C. (Chapman 1976) seems to have seen the most intensive utilization of Windy Ridge, in terms of the number of hafted bifaces used, exhausted, broken or otherwise entering the archaeological record at the site. Nineteen contracting-stemmed points identified with the Morrow Mountain type (Coe 1964: 37-39, 43) were found at Windy Ridge. Examples of these are illustrated in Figures 9 and 10. Most of these specimens correspond well with Coe's (1964: 37, 39) definition of the Morrow Mountain II subtype; they have a comparatively long, somewhat inset, tapering stem. The specimens which superficially seem to have short stems (e.g., Figure 9e, 10d), upon close inspection exhibit transverse breaks on their proximal ends. Tiny stem fragments, weighing about 1g, are correspondingly abundant in the excavations. Most of the Morrow Mountain points from Windy Ridge are, indeed, so similar to one another that it seems likely that they represent the product of a single society over a comparatively short period of time.

One caution should be borne in mind in identifying contracting-stemmed points with the Morrow Mountain type: small contracting-stemmed points were found by Bullen and Green (1970) stratigraphically associated with fiber tempered ceramics at Stallings Island. These points, called "Garys" by Phelps (1964: 95) almost certainly date more
than 2000 years later than the Morrow Mountain type, even though they are morphologically and, in all likelihood, functionally similar to the latter type. Given the presence of a Late Archaic component at Windy Ridge, it is possible that two of the non-quartz specimens categorized as Morrow Mountains, one of opaque grey chert (Fig. 10a) and one of an unidentified material (not illustrated), belong to the Late Archaic component.

Inspection of Appendix E reveals that the Morrow Mountain points from Windy Ridge, as throughout the South Carolina Piedmont, are overwhelmingly made of quartz. Though a few examples of other hafted biface categories are also made of quartz, it is probable that most of the quartz debitage at Windy Ridge resulted from the manufacture or modification of Morrow Mountain points. In this light it is particularly interesting that the spatial distributions of both classes, Morrow Mountain points and quartz debitage (see Fig. 20) are non-uniform and seem to be positively correlated.

Only two fragments of Guilford (Coe 1964: 43-44) points (Fig. 10e, f) were recovered from excavation units at Windy Ridge. Interestingly, both specimens were found within about a meter of each other in the block excavation. The temporal placement of the Guilford phase in the Carolina Piedmont is bracketed by its stratigraphic position above Morrow Mountain at Doerschuk and below the Halifax component, dated 3484 B.C., at Gaston (Coe 1964: 123).

Late Archaic

Eight hafted biface specimens recovered during the excavations are readily identified with the Savannah River type (Claflin 1931; Coe 1964: 44-45). The Windy Ridge specimens, however, are thicker than the mean 1:10 thickness: width ratio found by Coe at the Doerschuk site. This perhaps reflects a difference between the technological potentials of the raw materials used at the two sites. Two radiocarbon dates from preceramic levels at Stalling's Island are 2750 B.C. and 2500 B.C. (Stoltman 1972: 54). Bullen and Green's (1970) excavation at Stalling's Island revealed that Savannah River points are found mainly in preceramic levels, suggesting that they ceased to be made in the earlier part of the estimated 2500-1500 B.C. span of the Stalling's Island culture. Again, it should be mentioned as a possibility that some of the small, contracting-stemmed points at Windy Ridge, here classified as Morrow Mountains, are actually part of the Savannah River component or a slightly later component.

The use of Windy Ridge during Savannah River phase times seems to contrast with its use in earlier and later times. Previous survey data suggest that certain coarse-textured lithic raw materials seem to have been used in this region almost exclusively for the manufacture of Savannah River points (see Chapter VIII). This implies a difference in tool function between Savannah River points and earlier and later hafted
FIGURE 10. Morrow Mountain and Guilford points from 38FA118: a. Morrow Mountain, N88R134(S1/2); b. Morrow Mountain, N88R132(S1/2); c. Morrow Mountain, N88R134(S1/2); d. Morrow Mountain, N90R134(N1/2); e. Guilford, N92R134(S1/2); f. Guilford, N90R134(N1/2).
biface forms. In addition, given the tentative point type-raw material correlation stated above, a disproportionate amount of the tool manufacture which took place at the site in the past is associated with the Savannah River component (see Chapter X).

Three broad-bladed, broad-stemmed ("corner-removed") points (Fig. 12, a-c) have been tentatively identified with the Otarre Stemmed type defined by Keel (1976: 194-196). One of the specimens classified as a Savannah River point (Fig. 11, f) resembles these and would perhaps be just as well classified as an Otarre point. Keel places this type in the Savannah River component at the Warren Wilson site in the North Carolina mountains and considers it to represent the latest point type produced in the South Appalachian area prior to the introduction of ceramics. The dates 2000 B.C. and 800 B.C. would probably bracket its temporal position.

Forms similar to the Otarre Stemmed type are widespread in the South Carolina Piedmont and adjacent Fall Line area (House and Ballenger 1976, Figure 13b; Goodyear, Ackerly and House n,d.). It should be emphasized that none of these points have yet been recovered from datable contexts in South Carolina and their identification with the Otarre Stemmed type is based solely on morphological and technological similarities.

Woodland

The nine sherds of prehistoric pottery found at Windy Ridge (Fig. 13) probably represent the latest prehistoric utilization of the site. As noted in the preceding chapter, punctated ceramics similar to the Windy Ridge specimens do not seem to have ever been reported in the literature from the Carolina Piedmont. The cordmarked sherds correspond well enough with the Early Woodland Badin Cordmarked type defined by Coe (1964: 28) but this particular cluster of attributes, cordmarking on coarse sand tempered paste, is widespread in time and space in this part of the Southeast. The nine sherds recovered during the excavation of Windy Ridge all came from the same portion of the site, suggesting that they represent a single episode of occupation.

The four hafted bifaces categorized as "unclassified stemmed" (Fig. 12, d-g) are possibly contemporary with the Woodland ceramics. These small points, though varying somewhat among each other, resemble various point forms associated with Early Woodland components in the Appalachian Summit area. Specimens 12d and g resemble the Plott Short Stemmed type (Keel 1976: 126-128), 12e resembles the Bradley Spike (Keel 1976, Figure 20k) and 12f corresponds roughly to the Swannanoa Stemmed type (Keel 1976: 196-198). Quite similar forms were encountered at a number of sites recorded by the Laurens-Anderson survey. They showed some tendency to co-occur in surface collections with coarse sand tempered fabric impressed pottery. Given these tentative typological assignments, the final prehistoric occupation of the area investigated at Windy Ridge can be inferred to date roughly between 800 and 200 B.C.
If an Early Woodland component is present at Windy Ridge, the absence of triangular arrow points in the assemblage is difficult to account for. Badin and Yadkin type points (Coe 1964: 45-49) are associated with Woodland occupations in the Yadkin River area in Piedmont North Carolina and similar forms seem to be associated with fabric impressed pottery at various sites in the Laurens-Anderson corridor (Goodyear, Ackerly and House n.d.). It is interesting to note that the unclassified small stemmed points from Windy Ridge do seem to have functioned as knives (and, in one case, as a drill) and are, indeed, almost functional equivalents of the Morrow Mountain and Guilford points which entered the archeological record at Windy Ridge perhaps some thousands of years earlier.
FIGURE 12. Otarre-like and unclassified stemmed points from 38FA118:
a. Otarre-like, N98R140(N1/2); Otarre-like, N92R124(N1/2); c. Otarre-
like, N90R142(N1/2); d. unclassified stemmed N90R116(S1/2); e. unclassified
stemmed, N90R150(N1/2); f. unclassified stemmed, N96R134(S1/2); g.
unclassified stemmed, N92R132(N1/2).
FIGURE 13. Prehistoric ceramics from 38FA118; a-c punctated; d,e cord marked.
CHAPTER X

ACTIVITY ANALYSIS

Introduction

In the "General Research Design for Highway Archeology in South Carolina," Goodyear (1975a: 23) defines activity analysis as explanation of an archeological record as the outcome of patterned human behavior and the subsequent action of natural process. Goodyear notes that this kind of analysis necessarily entails behavioral correlates between past activities and their archeological outputs and application of models of cultural formation process of the archeological record (cf. Schiffer 1972, 1976).

In the present discussion, activity analysis will be treated as reconstruction of behavior patterns on a very basic level, drawing inferences about aspects of (archeologically visible) behavior that took place at Windy Ridge in the past. Activity constructs, operationalized by means of concrete behavioral correlates (see Chapter VIII) will form the basic behavioral unit resulting from this synthesis. As activities are integrated into activity systems and behavioral chains, higher order constructs can then be formed to address the hypotheses under consideration and other aspects of the overall functioning to prehistoric cultural systems in the region (cf. Schiffer 1975; Wilcox 1975).

The present analysis is focused on a single site and very little data from other sites will be cited for comparison. The raw material data from Windy Ridge alone, however, allow us to infer with confidence that the past human activity at Windy Ridge was at all times an open system, exchanging matter and, it may be presumed, energy and information with a larger cultural system. Comparison of the Windy Ridge data with expectations derived from appropriate transformation models should allow us to make preliminary inferences about which parts of behavioral chains or activity systems are not represented by the assemblage and which therefore must have occurred at other loci in the settlement system.

From the list of hypotheses and test implications outlined in Chapter II, a number of activities and activity system constructs may be identified for consideration:

1. Biface tool manufacture and modification
2. Biface tool use
3. The technology and function of other tool systems
4. An interrelated set of activities involving occupation of a permanent settlement by a whole kin group: facility construction, cooking and disposal of the dead.

The Windy Ridge data will be discussed below in terms of each of these activity system constructs. It will be noted that the major emphasis
in this analysis is reconstruction of the biface tool manufacture and use systems. Particularly, the chipped stone debitage will be treated as if it were solely an output of bifacial reduction. Though other chipped stone tool systems are minimally represented at Windy Ridge, this simplifying assumption is considered justified since the descriptive analysis of the assemblage revealed comparatively few artifacts that could not be readily attributed to the manufacture, modification and use of biface tools. This point will be discussed further below.

**Biface Tool Manufacture and Modification at Windy Ridge**

**Raw Material Procurement**

The behavioral chain of a biface tool may be conceived of as beginning with the procurement of the raw material from which the tool is to be fashioned. No outcrop of chippable stone was present in the area sampled at Windy Ridge; all of the stone utilized therefore had to have been procured elsewhere and imported to the site. The petrological data presented in Appendix B and other lithic resource information currently available (see Chapter VIII) indicating that the lithic raw materials represented by tools and debitage at Windy Ridge were derived from a great variety of sources, some located in the immediate vicinity, some located a hundred or more miles distant. These data indicate that Windy Ridge not only constituted part of a larger settlement system but that it was also a node in a vast network of exchange that extended far beyond the region in which the site is located.

In attempting to derive settlement pattern inferences from lithic artifact samples, it is important to distinguish between locally-available and nonlocal or "exotic" raw materials. A tentative categorization of the major raw materials present at Windy Ridge by proximity of source is presented in Table 4. It must be emphasized, however, that this categorization is based, for the most part, on general lithological information rather than on precise knowledge of the nature and extent of outcrops of comparable material or knowledge of aboriginal quarry/workshops associated with these sources. The information upon which this categorization is based is presented in Chapter VIII.

Quartz is probably the most unambiguously local raw material. Though no outcrops of chippable quartz were observed in the immediate vicinity of Windy Ridge, extrapolation from the Interstate 77 survey data suggests that small quarry/workshops associated with residual vein quartz occurrences in the soil mantle occur in a density on the order of one to several per square kilometer throughout the Piedmont. Close examination of the quartz debitage from Windy Ridge, however, reveals a low but consistent frequency of gravel cortex and yellow and brown staining on these specimens indicating that a significant portion of the quartz raw material reduced at Windy Ridge was derived not from residual occurrences in the vicinity, but rather from gravels in the beds of major streams such as the Catawba-Wateree River.
TABLE 4

TENTATIVE CATEGORIZATION BY AVAILABILITY
OF LITHIC RAW MATERIALS AT WINDY RIDGE, 38FA118

<table>
<thead>
<tr>
<th>Raw Material Category</th>
<th>Proximity of availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey andesite</td>
<td>Local</td>
</tr>
<tr>
<td>Quartz</td>
<td>Local</td>
</tr>
<tr>
<td>Amphibolite (Low Grade)</td>
<td>Local</td>
</tr>
<tr>
<td>Amphibolite (High Grade)</td>
<td>Local</td>
</tr>
<tr>
<td>Opaque grey chert</td>
<td>?</td>
</tr>
<tr>
<td>Carolina slate (Banded)</td>
<td>Nonlocal</td>
</tr>
<tr>
<td>Carolina slate (Unbanded)</td>
<td>?</td>
</tr>
<tr>
<td>Quartz porphyry</td>
<td>Local</td>
</tr>
<tr>
<td>Coastal Plain chert</td>
<td>Nonlocal</td>
</tr>
<tr>
<td>Argillite</td>
<td>?</td>
</tr>
<tr>
<td>Diabase</td>
<td>Local</td>
</tr>
<tr>
<td>Other and Unidentified</td>
<td>?</td>
</tr>
</tbody>
</table>

One activity that may occur early in the behavioral chain of a biface tool is heat-treatment of raw material. As noted in Chapter VIII, there is some reason to believe that quartz may have sometimes been heat-treated to improve its chipping properties, although this possibility has not been evaluated experimentally. If the "heated quartz" occurring in some proveniences at Windy Ridge is indeed a by-product of heat-treatment (see Chapter VIII), then its presence implies some fairly prolonged and intensive use of the site by quartz-using groups. This hypothetical function, however, remains totally untested.

The categorization of grey andesite, low grade amphibolite, high grade amphibolite, quartz porphyry and diabase as "local" is based on knowledge of the occurrence of similar lithologies in the Charlotte and Carolina slate belts in this part of South Carolina (see Appendix B). Argillite is a major constituent of the slate belt but Overstreet and Bell's (1965, Plate 1) map shows argillite occurring primarily in the outer portion of the slate belt rather than in the inner portion near Windy Ridge.

Weisenfluh (Appendix B) suggests that lithologies similar to the opaque grey chert category are more to be expected in the Coastal Plain or Ridge and Valley province than in the Piedmont. The morphological occurrence of debitage in this category and the presence of occasional cortex-bearing pieces at Windy Ridge, however, suggest a local origin.
In the absence of more concrete information on the occurrence of this material in the environment, any inference of site function from these archeological data would be inevitably circular.

In contrast to the above categories, a number of the lithic raw materials at Windy Ridge seem clearly to have been derived from remote locales. The similarities between the thin sectioned Carolina slate (Banded) specimens from Windy Ridge and Powell Shoals (38FA121) in South Carolina to specimens from the aboriginal quarry site at Morrow Mountain in North Carolina has been noted in Chapter VIII. The Coastal Plain chert at Windy Ridge was most likely derived from sources roughly 100 miles to the south. Specimens lumped in the "other" raw material category because of their very infrequent occurrence at the site include a single flake of "Ridge and Valley" chert thought to have originated beyond the Blue Ridge over 200 miles to the west and a few pieces of Coastal Plain quartzite thought to have originated in the Santee River area in the middle Coastal Plain.

Even, the "other" and "unidentified" raw material categories employed in the description of the Windy Ridge materials may not be without analytical usefulness. Many of the "unidentified" raw materials have a pattern of occurrence similar to the "other" raw materials. About half the category is composed of pieces of a speckled chert-like material which perhaps could have been lumped with opaque grey chert. The remainder, however, is comprised of a great many distinctive raw materials, each represented by only a few flakes and perhaps a single biface fragment. This pattern is consistent with our expectations for the outcome of use and minor modification of a stone tool element of an exotic raw material during the course of extractive activities at an ephemerally-occupied locus.

Bifacial Reduction Processes at Windy Ridge

The reduction of a piece of stone to fashion a biface tool generates quantities of chipped stone debitage. The form that the debitage takes, though partially dependent on the technique used for detachment of flakes, is primarily controlled by the morphology of the core being reduced. As the core morphology changes through the process of reduction, so will the morphology of the resulting debitage. Some correlates between debitage types and bifacial reduction stages are presented in Chapter VIII. One of the major concerns here, however, is the fact that bifacial reduction may occur at two functionally-distinct stages in the behavioral chain of a biface tool: (1) during manufacture, and (2) during use as dulled and damaged edges are resharpened by detachment of flakes from the edges.

One of the writers (House) and Albert C. Goodyear have for some time been attempting to develop quantitative debitage analysis into an analytical tool for measuring past systemic variables and observation of functionally-meaningful contrastive variation among artifact assemblages on an intersite level. The major proposition under consideration is that biface thinning flakes found in archeological contexts represent the two functionally-distinct reduction processes named above and that these processes might have tended to occur differentially in the context of different functional poses within a settlement system.
The proposition, in its initial form (House and Ballenger 1976: 94) states: Manufacture of biface tools would be initiated at quarry/workshops but would, in the majority of cases, be completed at base camps or settlements. Resharpening of dulled biface tool edges would, on the other hand, take place primarily at loci of the use of the tools. Manufacture of bifaces would result in assemblages with a comparatively high mean and Coefficient of Variation (C.V.) (McMillen 1952: 297-302) for the length, width and thickness of biface thinning flakes, while resharpening would generate assemblages in which the values for both mean and C.V. for these variables were comparatively low. This might seem to archaeologically distinguish sites of certain extractive activities, involving only use and resharpening of biface tools. This proposition, referred to as the Biface Thinning Flake Model, will form the basis of the synthesis of the chipped stone debitage data from Windy Ridge.

Since the Biface Thinning Flake Model was initially formulated, however, we have become increasingly aware of the extent to which numerous contingencies, other than stage of reduction, affect the values of each of the artifactual variables identified by the model. These systemic variables may act on many levels including: (1) the detachment of individual flakes, (2) the formation of assemblages by the outcome of many successive enactments of flake detachment, and (3) differential patterns of flow of different raw materials within a settlement system.

(1) The length of flakes detached from a bifacial core form, though in part dependent on reduction stage, is also related to the size of the tool being manufactured or modified. Resharpening flakes from a Savannah River point blade 40 mm wide, for instance, might be frequently longer than manufacturing flakes from a Morrow Mountain point blade only 25 mm wide. It has also been observed that the absolute length of a flake detached during whatever reduction stage is in part controlled by the technological properties of the raw material being knapped. Given a sufficiently fine-grained and isotropic raw material, it is possible to detach long, very thin biface thinning flakes extending past the center of the blade of a tool. In fact, it would be desirable to do so, since this practice would maximize the uselife of the tool by replicating a certain blade edge morphology over many successive resharpenings while minimizing the rate of waste of the mass of the tool. It was found by House and Ballenger (1976: 132) that biface thinning flakes of Carolina slate from the Interstate 77 corridor averaged nearly twice as long in relation to thickness as did the quartz and "tuffaceous" (andesite) biface thinning flakes collected by the survey.

(2) The flow rates (c.f. Schiffer 1976: 58-61) of biface reduction debris into the archeological record probably contrast greatly between stages of reduction. The effect of this contingency on the composition of an archeological assemblage can be seen as even more marked after the further transformation of the assemblage by archeological recovery techniques is taken into consideration. Manufacture of a single biface tool may generate over a hundred comparatively large biface thinning flakes while subsequent resharpening of the same tool may generate only
a few thinning flakes large enough to be retained by \( 1/4" \) (6mm) mesh screen or be seen on the surface and collected during a survey. A structural pose which, in systemic context was dominated by use and re-sharpening vs. manufacture of tools may nonetheless generate an archeological assemblage which, after recovery, is dominated by the outputs of the comparatively infrequent episodes of manufacture (cf. House and Ballenger 1976: 99-100).

(3) The multivariate causality of statistical parameters of debitage assemblages becomes even more apparent when the possibility of differential patterns of flow of raw materials in a settlement system is considered. Gould (1974), citing ethnographic data from the Western Desert of Australia, proposes as a general principle that manufacture of tools of nonlocal, "expensive" vs. locally available "non-quarried" raw materials usually takes place at base camps but, in contrast, manufacture of tools of "non-quarried" materials widely available in the environment usually takes place when and where tools are needed, at extractive loci as well as base camps. The results of the Interstate 77 survey indicated that vein quartz should, in Gould's terminology, be considered a "non-quarried" resource. Quartz biface blanks from quarry/workshops collected by the Interstate 77 survey were typically very thick, crude and irregular suggesting that blanks were usually exported from these loci in very early stages of manufacture. Blanks from the numerous low-density lithic scatters in the corridor area were often more finished-looking than those at the quarries, suggesting that some further reduction had taken place prior to their rejection and discard on the former sites. Given this pattern of procurement, early stage manufacture debitage—of locally available raw materials—may be expected at many sites of extractive loci.

Though these sources of variability in the formation of debitage assemblages could be considered "analytical noise" detracting from the applicability of the Biface Thinning Flake Model, they can perhaps be controlled for, given adequate information on the availability and technological properties of raw materials and more refined quantitative methods. These added dimensions of debitage variability then could, in their own right, be considered sources of information on the systemic context of biface reduction processes.

Following the Biface Thinning Flake Model and Gould's (1974) suggested general principle cited above, it is proposed that if Windy Ridge was an ephemerally-occupied extractive locus, then comparatively little manufacture of biface tools of exotic raw materials should ever have taken place there. It should be emphasized at this point, however, that the data requirements of the Biface Thinning Flake Model cannot be completely fulfilled within the context of investigations at a single site. It is not sufficient merely to demonstrate that little or no early stage reduction of exotic raw materials occurred at a given site. It is necessary also to demonstrate that significantly more early stage reduction of exotic raw materials took place at other sites in the same settlement system. The present analysis will merely attempt to fulfill part of the data requirements of the Biface Thinning Flake Model. Hopefully, these Windy Ridge data will soon be complemented by comparable data from sites of hypothetical contemporary settlements in the region.
In order to archeologically evaluate the proposition that comparatively little manufacture of biface tools from exotic raw materials ever took place at Windy Ridge, the artifacts from the site in each raw material category will be compared to determine whether or not the tools and debitage of local raw materials do indeed represent earlier stages of biface reduction than do the tools and debitage of nonlocal raw materials. Three partially independent sets of artifactual variables were selected for examination to test this proposition.

(1) **Metric attributes of biface thinning flakes.** Frequency histograms for the distribution of the variables flake length, flake thickness and platform width (see Chapter VIII) are presented in Figures 14 through 16. These three raw materials—quartz, grey andesite and Carolina slate (Banded)—were chosen for this intensive analysis because they represent sufficient sample sizes and, as a set, they encompass the range of raw material availability, local to exotic, within the Windy Ridge assemblage. These histograms are derived from measurements of these attributes in a random sample of whole biface thinning flakes in each raw material category from all Stage I proveniences. The hypothesized relevance of flake length and thickness to reduction stage is stated above. The third variable, platform width, was selected to provide some information on the extent of technological variability—as opposed to variability in reduction stage—between raw material categories.

It is predicted by the Biface Thinning Flake Model that the length and thickness of thinning flakes of the local raw materials, quartz and andesite, should be greater than the corresponding dimensions of the flakes of nonlocal banded Carolina slate. The histograms and associated means indicate, however, that the situation is more complex. The "local" andesite flakes are indeed longer than the "nonlocal" Carolina slate flakes but the "local" quartz flakes are shorter than the slate flakes. The thickness data from the sample, however, are much more consistent than expectations derived from the model; the exotic Carolina slate thinning flakes are thinnest, followed by quartz, with grey andesite the thickest. The banded Carolina slate and quartz platform widths in the sample have a very similar distribution with much smaller values than the platform width of the grey andesite flakes.

It is desirable at this point to evaluate these sample differences between flakes in different raw material categories by statistically testing the null hypothesis that each possible pair of samples could have been drawn from populations with essentially identical distributions for these variables. The Kolmogorov-Smirnov two sample test for agreement between cumulative distributions (Siegel 1956: 127-136) was employed to test this null hypothesis. The Kolmogorov-Smirnov test was considered most appropriate in this case since, unlike a difference of means test, it does not assume a normally distributed population being sampled and/or large sample sizes. The results of pairwise comparison of the sample distribution for each raw material category are presented in Table 5.

The test results indicate significant differences between:
1. The thicknesses of andesite and banded Carolina slate thinning flakes.
2. The platform widths of both banded Carolina slate and quartz thinning flakes on the one hand and the andesite thinning flakes on the other.
FIGURE 14. Frequency distribution of biface thinning flake lengths for three raw materials, random sample from Stage I proveniences.
FIGURE 15. Frequency distribution of biface thinning flake thickness for three raw materials, random sample from Stage I proveniences.
FIGURE 16. Frequency distribution of biface thinning flake platform widths for three raw materials, random sample from Stage I proveniences.
TABLE 5
RESULTS OF KOLMOGOROV-SMIRNOV TEST FOR COMPARISON OF METRIC ATTRIBUTES
OF BIFACE THINNING FLAKES OF THREE RAW MATERIALS,
STAGE I PROVENIENCES, WINDY RIDGE, 38FA118

FLAKE LENGTH

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<thead>
<tr>
<th></th>
<th>Quartz</th>
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<td></td>
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<td>p &gt; .05</td>
</tr>
<tr>
<td>Banded</td>
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FLAKE THICKNESS

<table>
<thead>
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PLATFORM WIDTH

<table>
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<td>Quartz</td>
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<td>D = .38</td>
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<td>p &lt; .005</td>
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<td>p &lt; .001</td>
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<td>Banded</td>
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<tr>
<td>Slate</td>
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</table>
Extrapolating from these sample data, it may be summarized at Windy Ridge, there are no significant differences among the lengths of the biface thinning flakes in any raw material category. The Carolina slate thinning flakes are, however, much thinner than the andesite thinning flakes.

The markedly different length/thickness ratio between the banded Carolina slate flakes and the quartz and andesite flakes from the site corresponds to the significantly greater length/thickness ratio for Carolina slate thinning flakes in the Interstate 77 survey collections. As noted above, the detachment of long, very thin biface thinning flakes during resharpening might be a strategy for extending the usefulness of a biface tool. Indeed, it is likely that of all the metric attributes examined here, flake thickness should be most directly dependent on stage of reduction. During manufacture, rapid reduction in the thickness of a bifacial core would be desirable; during resharpening, in contrast, it would be optimum to minimize reduction of the thickness of a tool.

The great similarity in the distribution of platform width between the banded Carolina slate and quartz flakes suggests that a very similar knapping technology was used in their detachment. The wide platforms of the andesite flakes and the presence of numerous lipped platforms observed during analysis suggest that much of the reduction of andesite at Windy Ridge was accomplished with the use of a soft hammer, a technique that allows removal of comparatively large masses from biface cores while minimizing the risk of breakage of the core.

Though the data presented above suggest that some of the difference between quartz and banded Carolina slate thinning flakes and andesite thinning flakes represents a difference in reduction stage, it should also be borne in mind that the andesite flakes are probably by-products of the production of a rather different tool than are the flakes in the other two raw material categories. Both Kelly's (1972) survey data from this region and the Windy Ridge data (see below) suggest that andesite was used largely for the manufacture of Savannah River points, a hafted biface type which has a much greater blade width than any other biface tool form represented at Windy Ridge.

An unanswered question in any attempt to identify outputs of resharpening vs. manufacture of biface tools is the nature of the resharpening technique(s) employed. Removal of pressure flakes from biface edges would seem to be the technique that would allow maximum control and the lowest breakage rate. If this were the major resharpening technique, the resulting pressure flakes might be typically below the 6 mm threshold for archeological recovery by standard techniques. Two factors, however, would probably preclude total reliance on pressure flaking for resharpening. First, it would be desirable to detach flakes long enough to extend past the center of the blade, thereby reproducing a given edge angle through successive resharpenings. This could be accomplished by pressure flaking on some materials but, in these cases, the resulting flakes should be archeologically recoverable by standard techniques. Second, cursory experimentation by the writers (not on quartz, it must be admitted!)
suggests that dulled and rounded blade edges, such as were observed on many Windy Ridge hafted biface specimens and attributed to functional wear, present an "over-strengthened platform" from which it is extremely difficult to press flakes. Pressure flaking could, however, be partially relied upon even in this case, if it were augmented by hard-hammer percussion whenever over-strengthened platforms were encountered.

2. **Debitage weight.** One artifactual variable that may directly reflect the rate of reduction of masses of pieces of raw material—and indirectly reflect such factors as transportation costs—is the weight of debitage. Table 6 presents the mean weight of all pieces of debitage in all three morphological classes (chunks/other flakes/thinning flakes) in each raw material category from Stage I proveniences at Windy Ridge. A breakdown of the debitage in each raw material category by morphological class is also presented in Table 6.

<table>
<thead>
<tr>
<th>Raw material</th>
<th>No. of pieces</th>
<th>X wt. per pc.</th>
<th>Chunk Count %</th>
<th>Other Count %</th>
<th>Thinning Count %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey andesite</td>
<td>163</td>
<td>2.1</td>
<td>9%</td>
<td>91%</td>
<td>26%</td>
</tr>
<tr>
<td>Quartz</td>
<td>709</td>
<td>1.2</td>
<td>4%</td>
<td>28%</td>
<td>90%</td>
</tr>
<tr>
<td>Amphibolite (LG)</td>
<td>80</td>
<td>3.7</td>
<td>1%</td>
<td>62%</td>
<td>32%</td>
</tr>
<tr>
<td>Amphibolite (HG)</td>
<td>49</td>
<td>6.6</td>
<td>16%</td>
<td>61%</td>
<td>70%</td>
</tr>
<tr>
<td>Opaque grey chert</td>
<td>162</td>
<td>1.1</td>
<td>16%</td>
<td>21%</td>
<td>78%</td>
</tr>
<tr>
<td>Carolina slate (B)</td>
<td>89</td>
<td>.5</td>
<td>7%</td>
<td>93%</td>
<td>8%</td>
</tr>
<tr>
<td>Carolina slate (U)</td>
<td>84</td>
<td>.6</td>
<td>4%</td>
<td>96%</td>
<td>4%</td>
</tr>
<tr>
<td>Quartz porphory</td>
<td>34</td>
<td>.8</td>
<td>1%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>C.P. chert</td>
<td>11</td>
<td>.4</td>
<td>1%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Argillite</td>
<td>4</td>
<td>1.0</td>
<td>1%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Diabase</td>
<td>2</td>
<td>15.0</td>
<td>2%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Other &amp; Unident.</td>
<td>170</td>
<td>1.5</td>
<td>2%</td>
<td>13%</td>
<td>85%</td>
</tr>
</tbody>
</table>

If tools of local raw material were manufactured at Windy Ridge and tools of nonlocal raw material were only resharpened or modified in other relatively minor ways, then the debitage in the former raw material categories should exhibit a higher mean weight per piece, reflecting the more rapid reduction of the mass of a piece of stone entailed by manufacture vs. resharpening. Examination of Table 6 indeed reveals a considerable disparity in the mean weight per piece of debitage among various raw material categories. These data in general agree with our expectation that the debitage of local raw materials should be characterized by a higher mean weight per piece than the debitage of nonlocal raw materials. Conspicuously high values are indicated for the local materials grey andesite.
andesite, low grade amphibolite and high grade amphibolite. The exotic raw materials, banded Carolina slate and Coastal Plain chert, on the other hand have comparatively low mean weights. Interpretation of the values for the other raw materials is less clear-cut. The mean weight of quartz debitage seems to be quite low considering its well-demonstrated status as a local raw material. The unbanded Carolina slate flakes have a mean weight similar to the nonlocal raw materials as does the quartz porphyry in the sample—even though conspicuous amounts of early stage debitage in this raw material have been observed at some sites in the immediate vicinity of Windy Ridge. The values for opaque grey chert and other and unidentified raw materials in the sample are approximately in the middle of the range of this variable. The small sample sizes for argillite and diabase debitage preclude any meaningful generalization about the value of debitage in these categories at Windy Ridge.

In summary, comparison of debitage weight among raw material categories at Windy Ridge suggests that early stages in the manufacture of at least some raw materials did take place at Windy Ridge. Other perhaps equally available raw materials, however, were reduced at a slower rate characterized by the entry of typically smaller pieces of debitage into the archeological record.

The size distribution of quartz debitage is particularly intriguing. From the data presented in Table 6 a mean weight of 0.6 g for quartz biface thinning flakes can be derived, a value in close agreement with the mean weight of banded Carolina slate and Coastal Plain chert thinning flakes but contrasting markedly with the 1.7 g mean weight of the grey andesite biface thinning flakes. Conspicuous quantities of early stage debitage are present in the quartz sample; however, chunks and other flakes comprise 32% of the sample by count. It seems likely that if continuous reduction from unmodified tabular blocks or rough blanks typified the reduction of this raw material at Windy Ridge, then the thinning flakes in the sample would include many large early stage specimens. This seeming paradox might be explained if it were postulated that very late stages in bifacial reduction, perhaps mostly resharpening, dominated in systemic context with infrequent episodes of reduction of large amorphous masses of quartz generating brief but copious flows of early stage knapping debris into the archeological record. This hypothesis is consistent with the presence of minor amounts of river cobble quartz in the assemblage indicating that a significant amount of the quartz reduced at Windy Ridge originated not at sources in the immediate locality but rather from stream gravels many kilometers distant.

Though differential availability and differential procurement patterns are undoubtedly major factors affecting the characteristics of debitage among different raw materials at Windy Ridge, other potential sources of variability, as well, should be considered. It will be argued below that diachronic variability in the aboriginal use of Windy Ridge seems also to be a major factor producing different patterns of occurrence among different lithic raw materials in the archeological assemblage at the site.
(3) Proportional frequencies of discrete artifact classes. It was postulated in Chapter VIII that the series of morphological debitage types employed in the Windy Ridge artifact analysis—chunks, other flakes, and thinning flakes—corresponds to the outputs of the sequence of early to late stages in the reduction of a piece of stone to fashion a biface tool. Given this assumption, the proportional frequencies of each debitage type in an assemblage should provide a measure of the relative amount of early or late stage bifacial reduction represented by that assemblage. Accordingly, within a single assemblage, comparison of raw materials in terms of proportional frequencies of discrete debitage types should provide yet a third measure of the earlier vs. later stage reduction represented by the artifacts in each raw material in that assemblage.

During the analysis of the Interstate 77 survey data, two indexes using discrete artifact class frequency data were set up in order to distinguish assemblages representing primarily manufacture of bifaces from those representing mainly use (and breakage, exhaustion and discard, etc.) of bifaces. These indexes are the Index of Early Stage Reduction (ER) and the Index of Biface Discard (BD). A high value of BD would suggest a high degree of biface tool use, breakage and discard vs. biface tool manufacture in the assemblage. A high value of ER would indicate the opposite. Values for ER and BD for the intensively collected prehistoric sites in the I-77 corridor are presented in Tables 6 and 7 of the Interstate 77 survey report (House and Ballenger 1976).

In order to compare the different raw materials at Windy Ridge in terms of the relative amounts of biface manufacture vs. biface use represented by the samples, Indexes of Early Stage Reduction and Biface Discard were calculated from the proportional frequencies of discrete artifact classes in each raw material category from the Stage I proveniences. The values of ER and BD for these samples are presented in Table 7. In comparing these values with the corresponding values for surface samples from the Interstate 77 survey, it should be borne in mind that the sample sizes in many cases in both data sets are small and the degree of comparability between proportional frequencies of various artifact classes between surface and screened excavated samples has yet to be determined.

The data presented in Table 7 contrast in some ways with the patterns indicated by the analysis of the two previous sets of artifactual variables. Grey andesite has a conspicuously high value for BD while quartz exhibits the highest value of ER and a comparatively low value for BD. The values of both Indexes for low grade amphibolite, high grade amphibolite and opaque grey chert suggest considerable early stage manufacture but such a comparatively low rate of use that exhausted and broken tools of these materials entered the archaeological record too infrequently to find their way into the Stage I sample. In contrast, the two varieties of Carolina slate show extremely low values for ER and high values for BD, consistent with our expectation that tools in these materials were used, but not manufactured, at Windy Ridge. The index values for Coastal Plain chert, quartz porphyry, argillite, and diabase are presented in

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Table 7 should perhaps be totally disregarded as the sample sizes are extremely small. It should be noted that some of the values for both indexes—but especially BD—are quite subject to nonrepresentativeness due to small numbers and sampling error.

### TABLE 7

INDEXES OF EARLY STAGE REDUCTION (ER) AND BIFACE DISCARD (BD)
BY RAW MATERIAL
STAGE I PROVENIENCES, WINDY RIDGE, 38FA118

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>ER</th>
<th>BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey andesite</td>
<td>.10</td>
<td>.13</td>
</tr>
<tr>
<td>Quartz</td>
<td>.47</td>
<td>.07</td>
</tr>
<tr>
<td>Amphibolite (Low grade)</td>
<td>.11</td>
<td>0</td>
</tr>
<tr>
<td>Amphibolite (High grade)</td>
<td>.64</td>
<td>0</td>
</tr>
<tr>
<td>Opaque grey chert</td>
<td>.28</td>
<td>0</td>
</tr>
<tr>
<td>Carolina slate (Banded)</td>
<td>.08</td>
<td>.17</td>
</tr>
<tr>
<td>Carolina slate (Unbanded)</td>
<td>.04</td>
<td>.34</td>
</tr>
<tr>
<td>Quartz porphyry</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Coastal Plain chert</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Argillite</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Diabase</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other and unidentified</td>
<td>.18</td>
<td>.18</td>
</tr>
</tbody>
</table>

Notes: (1) ER = No. of chunks and other flakes
       No. of thinning flakes
(2) BD = No. of finished bifaces including fragments
       No. of other flakes
(3) A value of "0" indicates that no members of the classes specified in the numerator were present in the sample; a value of "i" indicates that no members of the classes specified in the denominator were present in the sample.

Before leaving the discussion of these variables, it may be useful to suggest some reasons for the seemingly anomalous values of the indexes for grey andesite and quartz. The two grey andesite Savannah River point fragments from N92R132 (N1/2), though classified as fragments of finished tools and postulated to have entered the archeological record through breakage in use and subsequent discard, may in actuality be almost completed preforms broken during manufacture. The larger specimen (Fig. 11a) exhibits no sign of blade edge wear; the other (Fig. 11b) was broken just above the shoulder, precluding observation of this attribute.
The close association of these two tool fragments of virtually identical raw material with each other and with a dense concentration of early stage bifacial reduction debris of the same raw material further supports the hypothesis that they were broken during manufacture. If these artifacts are deleted from the calculation of BD for grey andesite, the resulting value of this index would be "0", corresponding to the values for high and low grade amphibolite.

It was noted in the preceding section that, though the small size of the quartz biface thinning flakes suggests predominantly very late stages in bifacial reduction, chunks and other flakes are also numerous in the sample, suggesting a significant amount of very early stage reduction of this material. It may also be significant that, though the value of ER for quartz is the highest of any raw material in the Stage I sample from Windy Ridge, it is conspicuously low compared with the ER values for most of the surface collections--representing mostly quartz artifacts--from the Interstate 77 survey.

**Tool-Debitage Correlations**

If carried to a successful conclusion, bifacial reduction results in the production of functional tools as well as debitage. At this point in the analysis it is desirable to examine the raw material composition of the tools and tool fragments that were recovered at Windy Ridge and attempt to infer patterns of systemic relationship between the tools at the site and the debitage associated with them in archeological context. This analysis is focused on two aspects of this systemic relationship: (1) which portions of the debitage, by raw material, can be attributed to various cultural stages in the 8000 year span of human utilization of Windy Ridge, and (2) the extent to which the bifacial tools manufactured at Windy Ridge were subsequently used, exhausted, broken and discarded at the site.

Cultural identification of the debitage at Windy Ridge will be extrapolated from two sources of information on the association of lithic raw materials with diagnostic hafted biface forms in that part of the South Carolina Piedmont: (1) the Windy Ridge hafted biface data presented in Appendix E of this report, (both Stage I and Stage II data will be employed in this endeavor), and (2) data on the association of raw material categories and point types derived from Kelly's (1972: 79) analysis of materials from his survey in this region.

**Palmer.** The three Palmer points recovered were of three different raw materials: quartz, unbanded Carolina slate and Coastal Plain chert. All of these materials were used by later occupations of the site and the region.

**Stanly.** The single Stanly point was made of an unidentified raw material.
Morrow Mountain. Eighty-five percent of the Morrow Mountain points excavated at Windy Ridge were made of quartz. Likewise, the majority of the quartz chipped stone tools at the site were Morrow Mountain points. As will be discussed below, the occurrence of Morrow Mountain points in the site seems to correlate spatially with the highest densities of quartz debitage in the site. It can probably be inferred that most of the quartz debitage at Windy Ridge is a by-product of stone tool manufacture and modification by the Morrow Mountain people. The strong association of quartz with Morrow Mountain points at Windy Ridge agrees with the pattern revealed by Kelly's survey in this region. Seventy-five percent of the Morrow Mountain points in Kelly's sample were made of quartz.

Guilford. Of the two Guilford points recovered from the excavations, one was made of unbanded Carolina slate and the other of an unidentified raw material.

Savannah River. The raw materials of the eight Savannah River point fragments recovered at Windy Ridge are: grey andesite (2), quartz (1), argillite (3), and unidentified (2). Kelly's (1972: 79) data indicate a strong association between "quartzite", "granodiorite", "slate" (probably our argillite, see Chapter VIII, "schist" and "andesite" and Savannah River points. In Chapter VIII, it is postulated that both low grade and high grade amphibolite debitage at Windy Ridge are by-products of Savannah River point manufacture since, extrapolating from Kelly's data, such coarse-textured raw materials seem to have been used almost exclusively for Savannah River point manufacture in this region.

Given these point type-raw material correlations and, given the assumption that high debitage weight per piece is indicative of early reduction stages, then it may be inferred that a disproportionate amount of the bifacial reduction that occurred in the past at Windy Ridge is attributable to the Savannah River occupation. The raw material categories grey andesite, low grade amphibolite and argillite comprise 39% of the debitage by weight from Stage I proveniences while Savannah River points comprise only 24% of the chronologically-identified hafted biface fragments in this sample. As noted above, there is reason to consider the two andesite Savannah River points from N92R134 (N1/2) as actually outputs of biface manufacture rather than use. If these specimens are deleted from the tabulation, then the two remaining Savannah River points comprise only 13% of the Stage I hafted bifaces, further emphasizing the disproportionate amount of Savannah River point manufacture represented by the sample.

Otarre. Of the three points tentatively identified with the Otarre Stemmed type, two are made of quartz and one is made of an unidentified raw material.

Unclassified stemmed. The four possible Woodland stemmed points from the Windy Ridge excavations include two specimens of banded Carolina slate, one of unbanded Carolina slate and one of an unidentified material.
As these two unclassified stemmed points of banded Carolina slate compromise the only hafted biface specimens in this material from the excavation, it might be suggested that most of the banded Carolina slate debitage at the site is attributable to this tool system. Both Kelly's (1972) data and the Interstate 77 survey data, however, indicate that the use of banded Carolina slate spans the whole prehistoric sequence in this part of the South Carolina Piedmont.

To address the question of whether or not the hafted bifaces made at Windy Ridge were indeed the same ones that entered the archeological record at the site and were recovered by the excavation, we must return to consideration of the postulated behavioral chain of this cultural element. Use of a biface tool typically follows its manufacture. It will be assumed that since exhaustion and breakage of finished biface tools occurs during use, it follows that discard of the exhausted biface tool and tool fragments should also occur in the context of use. Though the magnitude of the spatial transformations (Schiffer 1976: 67) involved in discard are difficult to predict in this context, such small and inoffensive items as biface tools and tool fragments are likely to have been discarded when and where they ceased to be functional. In any event, the location of discard was probably in very close proximity to the location of last use.

Since hafted biface tool elements presumably had a use-life of some duration, involving many successive enactments of the task(s) for which they were intended, the probability that a tool manufactured at a given locus would end its use-life and be discarded at the same locus would be contingent on the duration of its owner's stay on that locus. If the occupation span was typically long, then there would be a high probability of a worn-out or broken tool being discarded at the locus of its manufacture. If the occupation span were short, there would then be a high probability that the tool would end its use-life and be discarded at another locus in the settlement system.

The archeological implications of these alternatives are as follows:

(1) If tools of a certain raw material were made and ended their use-lives on the location of a given site, then the percentage of the total discarded tools in that material at the site should be approximately equal to the proportion of the total debitage in that material.

(2) If the tools of a certain raw material were made at a site but typically ended their use-lives elsewhere in the settlement system, then the percentage of the total debitage represented by that raw material at the site should exceed the percentage of discarded tools of that material.

(3) If tools of a certain raw material were typically manufactured elsewhere in a settlement system but were used, exhausted, broken and discarded at the location of a given site, then the percentage of the discarded tools in that raw material at the site should exceed the percentage of the debitage in that raw material.
The data specified by the above model are presented in Table 8. Though the patterning is not unambiguous, the inverse correlation between percentages of biface tool fragments and debitage by raw material predicted by the hypothesis of a short occupation span seems to obtain for some raw material categories. The occurrence pattern for low grade amphibolite, high grade amphibolite, and opaque grey chert corresponds to Implication 2 above while the occurrence pattern for argillite and, to a lesser degree "other and unidentified," corresponds with Implication 3. If the two grey andesite Savannah River fragments from N92R134 (N1/2) are deleted from the tabulation, then the occurrence pattern for this raw material as well, corresponds to Implication 2.

Table 8

Comparison of raw material frequency between biface tool and debitage classes,
Stage I proveniences, Windy Ridge, 38FA118

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Biface tools</th>
<th>Debitage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>% by count</td>
</tr>
<tr>
<td>Grey andesite</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Quartz</td>
<td>14</td>
<td>56</td>
</tr>
<tr>
<td>Amphibolite (Low grade)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Amphibolite (High grade)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Opaque grey chert</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Carolina slate (Banded)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Carolina slate (Unbanded)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Quartz porphyry</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Coastal plain chert</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Argillite</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Diabase</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other and unidentified</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Totals</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes: (a) See Table 6 for raw count and weight data for debitage. (b) "Biface tools" includes all whole or fragmentary hafted bifaces plus other bifaces. (c) "Debitage" includes chunks, other flakes and biface thinning flakes. (d) Percentages are rounded-off to the nearest whole percent.

It is interesting that the raw material categories involved in these patterns of inverse correlation between discarded tool and debitage frequencies are chiefly those most closely associated with Savannah River points. This suggests the possibility that the Savannah River points...
manufactured at Windy Ridge were replacements for the Savannah River points which were exhausted, broken, discarded and subsequently recovered by us. If this were the case, we may speculate that the manufacturing debitage from the latter Savannah River points is still lying in archeological context at various other, yet unrecorded sites, while broken and exhausted Savannah River points which were originally fashioned from andesite and amphibolite at Windy Ridge are lying undiscovered on some other ridge top or stream terrace somewhere in the region.

Biface Reduction and Site Function: A Summary

The analysis of the Windy Ridge lithic artifacts has indicated that almost all of the chipped stone debitage at the site can be readily attributed to biface reduction. In an effort to determine whether or not the debitage of exotic, nonlocal raw materials—as opposed to locally-available raw materials—tends to represent only latter stages of bifacial reduction, the specimens in each raw material category were compared in terms of three different sets of artifactual variables: (1) modal biface thinning flake dimensions, (2) mean weight of debitage per piece, and (3) proportional frequencies of debitage and tool classes in the sample. These analyses revealed dramatic differences in the utilization of different raw materials at Windy Ridge, generally supporting the proposition under consideration. Some of the observed variability among raw material categories, however, seems attributable to differences in the fracturing properties of different raw materials, differences in techniques and strategies of reduction, and diachronic variability in the use of the site location by prehistoric peoples.

Further analysis revealed that the relative percentages of debitage and tool classes in certain raw materials departs from what we would expect if the tools made at the site location were subsequently used over a prolonged period and worn-out or broken and discarded at the same location. It was suggested that the Savannah River points manufactured at the site were replacements for Savannah River points that were previously manufactured elsewhere in the settlement system and ended their use-lives at Windy Ridge, where they were discarded and subsequently recovered by us.

It should be re-emphasized in this final comment on biface reduction at Windy Ridge that the model of differential flow of raw materials within a settlement system characterized by a strong maintenance/extractive dichotomy (cf. Binford and Binford 1966) has by no means been verified in this case. Indeed such a model cannot be confined within the context of a single site.

Though the quantified, probabilistically-sampled, regionally-extensive data required for confirmation or disconfirmation of the model are not available at this time, a few comments on impressionistically-observed variability among Archaic components in the region may be in order. Cursory observation of banded Carolina slate debitage from the Powell Shoals site (38FA121) on the Broad River in Fairfield County
(see Brockington 1977) suggests that considerable early stage reduction of bifacial cores of this material took place at some locations within the site, even though the site is 35 km further west of the postulated source of this material than is Windy Ridge. Banded Carolina slate biface thinning flakes on the order of 40 mm long are frequently observed. Compared with the Windy Ridge and Interstate 77 survey data, these impressionistic observations agree with our expectations for the pattern of occurrence of an "exotic" or "quarried" raw material in the archeological record of a cultural system regularly importing such a material in an unfinished state and subsequently completing tool manufacture in the context of a set of settlement-associated maintenance tasks. Local collectors have reported finding caches of early stage biface blanks of banded Carolina slate at riverine sites in the region, lending further support to this model.

Biface Tool Use at Windy Ridge

Introduction to Functional Analysis

Inference of the function of biface tool systems represented at Windy Ridge is relevant to both of the sets of alternative site function hypotheses presented in Chapter II. Implication of the structural pose hypothesis set states that only a comparatively narrow range of tool functions should be represented by the assemblage at Windy Ridge if the site represents a work camp occupied for extraction of a specific resource from the environment. Implication 1 of the hunting and butchering camp hypothesis states that the tools recovered should primarily be attributable to possible butchering functions.

Inference of tool function from archeological data is often difficult to accomplish with any degree of certainty but the present analysis will attempt to establish some functional possibilities, for the hafted biface systems represented at Windy Ridge. The postulate that the majority of the hafted bifaces forms recovered at Windy Ridge actually functioned as cutting tools—as opposed to spear or dart points—has been implicit throughout the preceding discussion but it will be evaluated explicitly here.

Dimensions of artifact variability under consideration here include: (1) the presence and nature of functional damage on working edges, (2) edge angles, and (3) breakage patterns. The relevance of these dimensions to the systemic phenomena of interest are outlined in Chapter VIII.

This analysis will concentrate on Morrow Mountain points since this tool system is the best represented of any at the site. Specimens from both Stage I and Stage II proveniences will be lumped to provide a sufficiently large data set for this analysis.
A few comments on the shortcomings of this analysis are in order. First the analysis is comparatively superficial. The attributes under consideration do not exhaust our understanding of functionally meaningful attributes of hafted bifaces and, as noted in Chapter VIII, the scaling of the attribute states employed is rather crude. Second, though generalizations based on experiments reported in the literature are employed here, no systematic replicative experiments specifically addressing any of the tool systems or lithic raw materials represented at Windy Ridge have been carried out.

**Functional Blade Edge Damage**

The major form of functional edge damage observed on Windy Ridge hafted biface specimens was rounding and smoothing of blade edges. This attribute state is defined in Chapter VIII and, as may be seen from Appendix E, was observed on a presence-or-absence basis. Only cursory microscopic examination was carried out. In conjunction with rounding and smoothing of blade edges, evidence of resharpening, in the form of discontinuous prominent areas of blade edge dulling over-ridden by subsequent flake scars, was observed on some specimens.

From data presented in Appendix E it can be seen that functional blade edge damage was present on 8 of the 11 Morrow Mountain points on which this attribute was observable. This pattern strongly supports the hypothesized cutting function for Morrow Mountain points—though it does not preclude the possibility of additional functions which would not leave functional damage.

It remains to ask what cutting functions would produce such a wear pattern. Experiments by Tringham, et al. (1974) indicated that severe edge damage is typically associated only with the use of stone tools on durable materials such as bone or wood rather than meat, leahter, etc. Butchering experiments by Ahler (1974: 83-84) using hafted biface forms with blades similar to Morrow Mountain points indicated that similar wear patterns can result from dismembering the carcasses of large animals. Ahler hypothesizes that in these instances, the wear actually derives from contact of the tool with bone rather than with softer tissues.

Though these data tend to confirm the hypothetical cutting function for Morrow Mountain points and suggest the probability that butchering, especially jointing and dismembering, would produce the observed edge damage patterns, it seems likely that the hafted Morrow Mountain points were actually multi-functional tools much as are our own pocket knives. More intensive analysis of larger samples would probably indicate considerable variability in functional damage patterns, suggesting a wide range of at least occasional uses for this tool form.

Edge damage data for other hafted biface systems generally parallels the patterns observed for the Morrow Mountain points. Especially, the blade edge dulling on the four Unclassified Stemmed points resembles that of the Morrow Mountain points from the site. One of these stemmed points (Fig. 12d) exhibits distinct rotary wear on the tip strongly suggestive of a drill function.

**Edge Angles**

A hafted biface edge is a complexly-shaped entity that does not lend itself to precise measurement of edge angles. Particularly, it was noted that most of the specimens exhibited a continuous increase in the edge angle from the shoulder to the tip. The edge angle values
given in Appendix E are the average of the edge angles which seemed to
best typify the morphology of each of the two edges of the blade of a piece.

Edge angles were measured on 12 of the 19 Morrow Mountain points
recovered at Windy Ridge. Edge angles were tabulated separately for
the whole specimens and for those that were transversely broken across
either the blade or the stem.

For the seven complete Morrow Mountain points, the mean edge angle
was 55° with a standard deviation of 14°. For the six transversely
broken specimens with measurable blade edges, the mean edge angle was
45° with a standard deviation of 7°. This difference between the edge
angles of the two groups seems significant but no statistical test of
the significance of these differences was carried out since the sample
sizes are small and the initial measurement of this attribute was very
imprecise. The possible functional significance of this observed
difference in edge angles will be discussed below.

Wilmsen (1974: 91) suggests that edge angles on the order of 35-45°
are highly efficient for butchering. Likewise, butchering experiments by
Ahler (1971: 84) suggest that angles on the order of 40° are best for
dismemberment of carcasses. Lower angled edges are too weak and higher
angled edges tend not to penetrate joints effectively.

Given these functional parameters, it can be stated that the edge
angles of the transversely broken Morrow Mountain points tend to fall
within the optimum range for butchering and dismembering of large
animal carcasses. The edge angles of the complete specimens, however,
include many very high values which, though they might correspond to
the extreme upper limit for butchering functions, perhaps rather represent
use in tasks involving modification of hard materials such as wood or bone.

The edge angle values for representatives of other hafted biface
systems at Windy Ridge tend to show a similar pattern. Particularly,
the high edge angles of the complete Unclassified Stemmed points
correspond well with the modal values for the complete Morrow Mountain points.

Breakage Patterns

Consideration of the behavioral chain of a biface tool suggests
three points at which breakage may occur resulting in discard of the
tool: (1) manufacture, (2) use, and (3) resharpening. To these three
activities in systemic context, a fourth potential source of breakage
in archeologically recovered specimens must be added. Plowing and other
recent cultural activity may break specimens. We deem breakage from this
last source, however, as probably infrequent due to the durablé nature
of these cultural elements and the loose sandy nature of the upper
soil strata at Windy Ridge. The first three potential sources of
breakage, however, are relevant to the transformation of the tool from
systemic to archeological context and are hence relevant to inference
of the systemic context of a tool recovered from a site.
The Morrow Mountain points recovered from the excavations at Windy Ridge included 7 complete specimens, 3 specimens broken across the blade, and 9 specimens broken across the stem. The last category includes both stem fragments and blade and shoulder fragments, which, in some cases, may comprise fragments of the same tool. No intensive effort at finding cross-mends, however, was undertaken.

From these data it appears that breakage across the stem was probably more frequent than breakage across the blade. During use, the latter breakage mode could result from excessive stress during use or from resharpening. Breakage across the stem, however, would probably result only from excessive stress during use—especially stress in a direction perpendicular to the blade. Such a stress pattern would be involved if the hafted Morrow Mountain point were used in a prying motion. If it can be assumed that the breakage point roughly coincides with a pivot point in the application of force to a hafted tool, then it can be inferred that the haft of a Morrow Mountain II point was probably a socket extending to just below the shoulder of the point. The prying motion suggested by this breakage pattern would not be inconsistent with forcing the blade of such a tool into the connective tissue of joints during the process of dismembering a large animal carcass.

If the edge angle of a cutting tool steadily increased over many successive episodes of resharpening, then the specimens which left systemic context in earlier resharpening stages should exhibit lower edge angle values than those which left systemic context at later resharpening stages. The noted disparity between edge angles of complete and transversely broken Morrow Mountain points becomes relevant in the context of this assumption. Tools broken in use would tend to be discarded at all resharpening stages between initial use and exhaustion while complete specimens would end their use-lives only after the upper limit of functional edge angle magnitude had been reached.

To further test the hypothesis that the transversely broken Morrow Mountain points represent earlier stages in resharpening than do the whole examples, the edge angles of the 9 quartz tip fragments of hafted bifaces were tabulated and their mean and standard deviation were calculated. (This makes the simplifying assumption that the majority of the specimens are tips of Morrow Mountain points.) The mean edge angle for these specimens was $48^\circ$ with a standard deviation of $9^\circ$, agreeing with our expectation if these tip fragments, too, represent earlier stages of resharpening than do the whole specimens.

Examination of the edge angle and breakage pattern data for the other hafted bifaces at Windy Ridge suggests patterning similar to that described for the Morrow Mountain points. As noted earlier in this Chapter, edge wear data and contextual associations suggest that the 2 grey andesite Savannah River points from N92R134 (M1/2) may have been discarded because of breakage during manufacture.
The breakage characteristics of the Stanly point from N90R116(N1/2) (Fig. 8d) are particularly interesting, the face of the break seems to exhibit a negative bulb of force on one side (on the left in Figure 8) and the adjacent area of the blade edge is retouched from one face to prepare what seems to be a platform for detachment of a thinning flake from that face. These characteristics suggest that this tool element was broken and discarded during an abortive attempt at re-sharpening by percussion flaking.

Technology and Function in Other Tool Systems at Windy Ridge

Unifaces

Descriptive data for the 10 unifaces recovered from the excavations at Windy Ridge are presented in Appendix F. Examples of these specimens are illustrated in Figure 17.

Six of these specimens can be categorized as endscrapers as they have steeply retouched transverse working edges. Three can be categorized as sidescrapers with lateral working edges. The remaining specimen has both a lateral and a transverse working edge. The raw materials of these tools are rather diverse, paralleling the raw material diversity of the hafted bifaces from the excavations. In the previous chapter, all of these specimens are attributed to the Palmer component at the site. This assignment, however, may need to be re-evaluated when better control is achieved over chronological variability in uniface form in the region.

Little can be inferred about the technology of the unifaces at Windy Ridge. It is probable that the Coastal Plain quartzite uniface example from N88R132 (N1/2) and the smoky quartz example from N92R134 (N1/2) were not manufactured at the location investigated at Windy Ridge since no manufacturing debitage in these materials was recovered. It does appear that the smoky quartz endscraper was extensively re-sharpened or otherwise modified while in use at Windy Ridge since 10 tiny flakes of identical smoky quartz with a combined weight of 5.5 g were recovered from the Stage II excavation units surrounding the provenience of this tool. Though these tiny flakes were classified as biface thinning flakes in accordance with the operational definition of this class in the typology being employed (see Chapter VIII) some of these flakes exhibited the ca. 90° platform angle expected on unifacial rejuvenation flakes.

The edge angles of the endscrapers are typically very high, averaging 80° with a standard deviation of 10°. Such high edge angles are hypothesized by Wilmsen (1970: 70-73) to reflect use of such a tool in modifying hard materials such as wood or bone rather than use in hide preparation. The occurrence of this number of uniface tools in the excavation units at the site suggests that a significant amount of maintenance activity was associated with the Palmer occupation at Windy Ridge. Though the articulation of Palmer occupation of inter-
FIGURE 17. Unifaces and bipolar core from 38FA118. a. endscraper N92R134(N1/2); b. endscraper N88R132(N1/2); c. endscraper N88R132 (S1/2); d. endscraper N86R126(S1/2); e. endscraper N82R116(N1/2); f. sidescraper N90R120(N1/2); g. sidescraper N86R126(N1/2); h. bipolar core N80R116(N1/2).
FIGURE 18. Pitted cobble and hammerstones from 38FA118. a. pitted cobble N98R120(N1/2); b. hammerstone on quartz core N90R136(N1/2); c. hammerstone on river cobble N90R136(N1/2).
riverine zone ridge tops with a total settlement system remains obscure, a high frequency of occurrence of uniface tools with Palmer components in this zone is revealed by both Kelly's (1972: 85-89) survey and the Laurens-Anderson Connector route survey (Goodyear, Ackerly and House n.d.).

Core and Flake Industries

The extremely low frequency of utilized flake tools in the excavation units (see Appendix D) corresponds with their low frequency in the Interstate 77 survey collections. This contrasts with assemblages typical of some areas in the Southeast in which marginal edge modification occurs on as many as 50% of the flakes over about 10 mm in length (e.g. Schiffer and House 1975, Appendix E).

These low flake tool frequencies at Piedmont prehistoric sites may reflect the difficulty of recognizing edge damage on the raw materials involved—and the fact that use of flake tools on soft materials produces relatively little edge damage (cf. Tringham et al. 1974) rather than the lack of flake tool utilization in systemic context. If appreciable numbers of flakes were used as expedient cutting and scraping tools at Windy Ridge, however, the flakes used must have been by-products of biface manufacture rather than flakes intentionally produced for this purpose. With one exception, none of the cores recovered from the site seem to represent deliberate production of flakes; they seem rather to be amorphous early stage biface blank fragments or pieces of prospective raw material from which a few test flakes had been removed prior to rejection of the piece.

The only exception is the bipolar core of quartz crystal recovered from N80R116 (N1/2) (Figure 17h). The piece is probably too blocky to be a functional pièce esquilleé but does exhibit distinct bipolar battering and columnar fractures and may be a by-product of pièce esquilleé production. McDonald (1968: 88-90) suggests that pièces esquilleé were used as wedges or slotting tools for splitting long bones into tool blanks. This artifact is attributed to the Palmer component since bipolar industries are conspicuous in some early Archaic assemblages in the Southeast (Goodyear 1974; Chapman 1975). The pitted cobbles anvil recovered from N98R120(N1/2) (Figure 18a) would be appropriate for use in bipolar reduction but pitted cobbles, unlike pièces esquilleé and other distinctive components of bipolar industries, seem to be well represented throughout the prehistoric sequence in the Southeast. The example illustrated has a depressed zone of battering on both faces.

Hammerstones

Hammerstones are presumably fabricators which may have functioned in a variety of activity systems. Only 3 hammerstones were recovered from the excavations at Windy Ridge. Two examples, from N90R136 (N1/2) and N96R134 (S1/2), are on large solid pieces of quartz and would have been suitable for use in early stage knapping involving reduction.
of large pieces of stone. The specimens weigh 445g and 383g respectively. The former specimen (Fig. 18d), is of particularly high quality quartz and shows evidence of intensive use.

The remaining hammerstone fragment, from N90R136 (N1/2) (Fig. 18c) is on an extremely weathered, comparatively soft, river cobble. It probably would have had a very short use-life if used for knapping, but might have been suitable for smashing bones during butchering, to name only one of many possibilities.

Other Tool Systems in Summary

The archaeological assemblage at Windy Ridge is dominated by outputs of the manufacture and use of hafted biface tools. Even the two hammerstones of hard material can be attributed to biface manufacturing activity. After artifacts associated with biface systems, unifaces are well represented and probably played a prominent role in the activities of the Palmer people at the site location. Evidence in the assemblage of any other tools systems, however, is extremely sparse. The assemblage can, on the whole then, be characterized as representing only a very narrow range of tool manufacture and use.

Outputs of Habitation

Archaeological Implications of Settlement

Any human settlement system must include locations where whole kin groups, consumers as well as producers, are co-resident and where the activities involved in the maintenance and reproduction of the population, its social structure, and ideology are concentrated. It is presumably at such loci that day-to-day food processing is most prevalent and construction and use of permanent facilities takes place, if the society constructs such facilities at all.

The ethnographic record indicates that the specific activities involved in this structural pose vary greatly among contemporary hunter-gatherers and the archaeological record suggests even greater diversity in the prehistoric past (cf. Yellen 1977: 3-4). Since it is impossible, given our current understanding of general principles of hunter-gatherer behavior, to model a priori, any useful set of implications for archeological sites representing this structural pose, a set of implications has been induced from data on the contents of various Archaic middens reported in the literature from throughout the Southeast. These data are reviewed by House and Ballenger (1976: 29-39).
Artifact classes deemed indicative of cooking include fire-cracked rock, steatite vessel sherds or "netsinkers" (cf. Stoltman 1972: 46) and ceramic vessel sherds. Plant processing tools such as mortars and pestles might also be expected at sites of habitation. Artifacts indicating construction of facilities—especially of houses and wooden containers—might include heavy-duty woodworking tools such as chipped or ground stone axes, adzes, or celts or perhaps more expedient chipped stone core tools as scraper planes. (Data pertaining to possible direct evidence of subsurface features are reviewed in Chapter VII). The range of processes involved in the entry of atlatl weights into the archaeological record remains obscure but broken or unfinished atlatl weights (or finished, intact examples placed in graves) might also be expected at sites of settlements. Cultural elements pertaining to the maintenance and reproduction of social structure and ideology might include pigment minerals, tubular stone beads, and articles of copper or other very exotic materials. The Windy Ridge data, positive and negative, pertaining to each of these categories will be discussed in turn.

**Cooking**

As noted in Chapter VIII, some material classifiable as fire-cracked rock was observed in excavation units at Windy Ridge. Though this variable could not be quantified reliably because of the difficulty of distinguishing fire-cracked rock from natural weathered rock fragments in the soil, we feel confident that this artifact class was represented by only very small quantities at the site.

Provenience data for one subclass of fire-cracked rock, heated quartz, are presented in Appendix D. This artifact class may be an output of cooking but, for reasons stated in Chapter VIII, this seems unlikely.

No steatite artifacts were recovered at Windy Ridge. A tiny piece of unmodified steatite recovered from one excavation unit, however, may be a manuport.

The nine ceramic sherds recovered from the excavation units are described in Chapter VIII. The sherds bear two distinct modes of decoration, cord impression and punctation, suggesting that two vessels are present. All sherds, however, exhibit identical paste characteristics and were recovered from the same portion of the site. Since there is nothing to prevent placement of two distinctly different modes of decoration on different portions of a single vessel, the sherds may represent a discrete event, the breakage of a single pot on Windy Ridge some time during the Woodland period. It is possible that ceramic vessels were sometimes used in extractive activity away from settlements or that a single vessel might be broken while being transported between settlements.

**Plant Processing**

No mortars or pestles or any other recognizable plant processing tools were recovered from the excavations at Windy Ridge.
Heavy Duty Woodworking

The excavations at Windy Ridge yielded no chipped or ground stone axes, adzes or celts nor any chips with polished exterior surfaces such as might have been detached during either use or repair of such tools. Nor were any scraper planes or other large, heavy, crudely-fashioned core tools found (cf. House and Ballenger 1976, Figure 18). The specimen from the survey surface collection at Windy Ridge, identified as a "probable heavy-duty woodworking tool" in the I-77 report (House and Ballenger, Figure 17a) on re-examination appears to be a preform with battering on a transverse end, attributable to attempted platform shaping.

Ceremonial Activities

Though the artifacts known as bannerstones or atlatl weights were apparently components of functioning atlatls (Webb 1974: 319-333), the variety in their forms and the effort expended in their manufacture suggests that they served ideotechnic (Binford 1962) or symbolic functions as well. In any event they are frequently found in Archaic graves and, in a finished or unfinished state, in Archaic middens. No atlatl weights, whole or fragmentary, finished or unfinished, however, were found at Windy Ridge.

Two fragments of a single piece of unidentified hematite-rich rock were found in N88R134 (S1/2). This rock type does not seem to be naturally occurring on Windy Ridge and the specimens seem to faintly exhibit abraded facets. Such a piece of material could have been a source of red pigment and thus considered a cultural element serving an ideotechnic function.

Interpreting Negative Evidence

The Windy Ridge data relevant to our expectations for sites of settlements are mostly negative. Artifact classes postulated as correlated with activities in this structural pose were recovered in very low frequencies or not at all.

Inference from negative evidence is always a risky proposition. If certain assumptions are made, however, analysis of the proportional frequencies of relevant artifact classes recovered from riverine middens in the Carolina Piedmont may provide some useful quantitative expectations against which to evaluate the significance of these negative Windy Ridge data. These assumptions are: (1) that the systemic material inventory and cultural formation processes of the Archaic and early Woodland societies represented at Doerschuk, Gaston (Coe 1964) and Windy Ridge are roughly comparable, and (2) that the archeologically recovered samples from all three sites are adequately representative of the outputs, in archeological context, of the three societies at these particular loci.
One artifact class recovered in quantity at all three sites is hafted bifaces ("projectile points"). Forty examples were recovered from excavation units at Windy Ridge; 348 points were recovered from undisturbed excavation units at Doerschuk, and 176 were recovered from Gaston (Coe 1964: 34, 107). The ratio of recovered hafted bifaces between these two sites and Windy Ridge are 8.7 and 4.4, respectively. Given the assumptions stated above and discounting the chronological variability within the samples, the relative frequency of mortars, atlatl weights and steatite sherds, etc., between these two sites, on the one hand, and Windy Ridge, on the other, should also fall into the range of these intersite hafted biface ratios—if all three sites represent the same structural pose of past societies. For example, 3 mortars were found in excavation units at Doerschuk, therefore $3 + 8.7 \times 0.35$ mortars should be expected in the sample from Windy Ridge. 35 steatite vessel sherds were recovered from excavation units at Gaston, therefore $35 + 4.4 \times 8.0$ steatite sherds should be expected at Windy Ridge. Applying this admittedly tenuous logic to each of the additional relevant artifact classes named above, expected frequencies on the order of 1.0 specimens are generated for atlatl weights, chipped stone axes, ground stone axes, and engraved slate artifacts. With the implied frequencies in the underlying artifact population at Windy Ridge, the presence or absence of each of these artifact classes in our archeologically recovered sample could be dramatically affected by sampling error. The fact that all of the relevant artifact classes were absent from the sample, however, implies that these negative Windy Ridge data may be quantitatively meaningful.

The above exercise is based on a great many unexamined assumptions and cannot be considered a basis for any but the most tentative of inferences. It does, however, suggest that it may be valuable to rigorously quantify these variables in a wide variety of archeological contexts and to attempt to control some of the processes governing the entry of these cultural elements into the archeological record.
CHAPTER XI

INTRASITE SPATIAL ANALYSIS

Spatial Structure and Behavioral Structure

It is widely agreed that it is in the horizontal spatial structure of the archeological record that the organization of past behavioral variability is most directly reflected (cf. Binford 1964; Binford et al. 1970; Whallon 1973; Goodyear 1975a: 24; Yellen 1977). In the sense used here, spatial structure can be defined as patterning in the distribution of artifact categories about the site and the pattern of association in space of one artifact category with another.

Elucidation of the spatial structure of the archeological record at Windy Ridge is one of the major goals embodied in the excavation design employed in this research. The dispersion of the Stage I sampling units was intended to provide roughly uniform coverage of the area under investigation. The point-provenience mapping of certain artifact classes in the Stage II block excavation was intended to reveal any patterning in the association of tool classes with each other on the level of a localized portion of the site.

Two dimensions of past behavioral variability, chronology and function, are of interest here.

(1) Chronology. It was hoped that non-uniform, clustered distributions of artifacts could be related to synchronic episodes of deposition, thereby approximating some of the cultural information usually derived from "pure" components and stratified sites. The pitfalls of using surface (or, in our case, stratigraphically-mixed) data for this purpose have been candidly discussed by Coe (1964: 6, 8). In the present research, however, we have attempted to compensate for these difficulties by employing very fine-grained spatial controls, given the assumption that the outputs of a finite number of discrete, systemically-unrelated episodes of occupation should exhibit at least some degree of horizontal discreteness on a landform as large as Windy Ridge.

(2) Function. We hoped to derive functionally-meaningful patterns of artifact association from the spatial distribution of artifact classes at Windy Ridge. These hopes proceeded from the same logic as our hopes for deriving chronologically-meaningful associations.

The present analysis makes the assumption that the magnitude of the spatial transformations intervening between the last use and the discard of cultural elements in the past at Windy Ridge was typically very minor. By this assumption, all of the materials recovered can be treated analytically as primary refuse (cf. Schiffer 1976: 67-68).
An additional assumption is that the depositional context of the artifacts at Windy Ridge has not been badly disturbed (horizontally) either by pedoturbation in prehistoric times (see Chapter VI) or by cultivation in historic times. Current experiments on the effect of cultivation on artifact proveniences suggest that, even cumulatively, the effect of cultivation on horizontal artifact provenience is not significant on the level of the site as a whole. Two inferences about historic land use at Windy Ridge (see Chapter IV) are relevant to this point: all of the cultivation of the site appears to have taken place many years ago and, hence, probably involved one-row equipment drawn by mules or perhaps small tractors, and (2) the presence of an intact sandy loam horizon over most of the site suggests minimal disturbance and perhaps infrequent cultivation in historic times in comparison with most locations in the southern Piedmont.

**Debitage Distribution By Raw Material:**

**Stage I Sample**

The computer graphics program SYMAP was used to prepare isopleth maps of the density by weight of debitage in 6 raw material categories: grey andesite, quartz, low grade amphibolite, high grade amphibolite, opaque grey chert, and banded Carolina slate. These maps are presented in Figure 19 through 24.

The data used in preparing these maps are the debitage weights by raw material in Stage I proveniences presented in Appendix C. The outline and data points of the SYMAPs are congruent with the sampling boundary and Stage I excavation unit locations illustrated in Figure 2. Six density classes were used in preparing each of these maps. The interval selection function employed in each case was geometric or logarithmic; the interval between zero and the maximum weight value for each raw material category was divided into 6 intervals by generating a geometric progression for this range. The sets of data intervals for different raw material categories accordingly represent different absolute densities. In the absence of evidence to the contrary, it was assumed that the deposition of the debitage in each raw material category was an event or set of events independent of the deposition of the debitage in other raw material categories.

In examining these maps it should be borne in mind that like all maps, they are descriptive models derived from data and not exact representations of reality (cf. Board 1967). In these cases they represent interpolations made by the SYMAP program from 22 spatially dispersed sample values. Experience has shown that the interpolations made by SYMAP are not particularly accurate predictors of the actual values of archeological variables but are probably nonetheless good representations of general trends of varying density.
FIGURE 19. SYMAP of Grey Andesite Debitage Weight, Stage I Proveniences.
SYMAP of Quartz Debitage Weight, Stage I proveniences.

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**FIGURE 20.** SYMAP of Quartz Debitage Weight, Stage I proveniences.
FIGURE 21. SYMAP of Low Grade Amphibolite Debitage Weight, Stage I proveniences.
FIGURE 22. SYMAP of High Grade Amphibolite Debitage Weight, Stage I proveniences.
FIGURE 23. SYMAP OF Opaque Grey Chert Debitage Weight, Stage I proveniences.
HIDWAY PROJECT
38FAILB + CANO-SLATE=H + WT HY G = GEOMETRIC RANKING
STAGE 1

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FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

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FIGURE 24. SYMAP of Banded Carolina Slate Debitage Weight, Stage I proveniences.
The first generalization one can derive from these maps is that the density of debitage in each raw material category is quite non-uniform within the site. The sample data suggest that much of the debitage occurs in roughly circular clusters or "hot spots" which might represent the outputs of reduction of a few cores. Indeed, examination of Appendix C suggests that proveniences characterized by a high total debitage weight for a given raw material are also characterized by a high weight per piece, highly suggestive of early stage reduction (see Chapter 10). Exceptions to this general pattern are quartz, opaque grey chert and banded Carolina slate.

Quartz debitage seems to be very generally distributed throughout the site with high concentrations in the extreme eastern and extreme northwestern portions of the site. It will be noted below that these high quartz debitage density areas coincide roughly with the proveniences of Morrow Mountain points in the Stage I sample.

Opaque grey chert seems widely distributed about the site with a high concentration in a broad area in the north central portion of the site. Banded Carolina slate seems to occur in very low density in various portions of the site with a relative concentration in the extreme eastern portion.

Tool Distribution: Stage I

Only Morrow Mountain points, of all hafted biface forms, occurred in sufficient number in the Stage I sample to permit even tentative generalizations about their distribution within the site. Seven Morrow Mountain points were found in 6 Stage I proveniences. Three of these were in the extreme western portion of the site: N96106(N1/2), N92R106 (N1/2) and N90R116(N1/2). The remaining 4 examples were found in proveniences in the extreme eastern portion of the site: N98R140 (N1/2), N98R148(N1/2) (2 examples) and N90R150(N1/2). By comparing the location of these proveniences with Figure 20, it will be noted that the distribution of Morrow Mountain points in the Stage I sample co-varies with the highest densities of quartz debitage in the site. The possible significance of this pattern will be discussed below.

Five unifaces, attributed to the Palmer component at Windy Ridge, were recovered from Stage I proveniences (see Appendix F). While this is not a sufficiently large number for reliable generalizations about the distribution of unifaces in the underlying artifact population at the site, it is interesting to note that all of the specimens were found toward the south-central portion of the site.
FIGURE 25.
Tool Proveniences in the Block Excavation

Proveniences of all tools, cores and prehistoric sherds recovered from the Stage II block excavations are mapped in Figure 25. These data indicate complex, overlapping distributions of artifacts representing diverse cultural periods and, presumably, diverse functions. The clear-cut readily interpretable patterns we had hoped for simply did not emerge at this level of observation.

The twelve Morrow Mountain points recovered from the block excavations seem to be generally distributed throughout this area. It is interesting that such a high density of Morrow Mountain points was encountered in a portion of the site which yielded no Morrow Mountain points in the Stage I sample. The density of Morrow Mountain points in the block is 0.24 points per m\(^2\) as opposed to the estimate of 0.16 points per m\(^2\) for the site as a whole based on the Stage I sample. The seemingly clustered occurrence of the Morrow Mountain points in the Stage I sample then, is perhaps the "tip of the iceberg" in terms of the distribution of this tool class within the site. Assuming that these clusterings are not a product of sampling error, then the block may represent the low density periphery of an area of much higher Morrow Mountain point density to the east.

A possibly significant pattern of association is suggested by the proveniences of the five unifaces recovered from the block area. Two examples are from adjacent excavation units N92R132(N1/2) and N92R134(N1/2). As noted in the preceding chapter, the scatter of tiny smoky quartz flakes in the excavation units surrounding the latter specimen (Figure 17a) suggests that it was intensively used and re-sharpened in this location. A second concentration of 3 unifaces was in adjacent excavation units N88R132(N1/2) and N88R132(S1/2). It may be no coincidence that both concentrations are in close proximity to each other and to the two Palmer points found in the block excavation.

A second possibly significant association is the presence of two Guilford points in adjacent squares N92R134(S1/2) and N90R134(N1/2). These two specimens are the only two Guilford points recovered from any of the excavation units at Windy Ridge.

In the preceding chapter it was hypothesized that Feature 7, the association of 2 grey andesite Savannah River points and grey andesite debitage in N92R134(N1/2) is a result of the breakage during manufacture of two almost completed preforms. From data presented in Appendix C, it can be seen that large amounts of manufacturing debris of andesite are present in this and surrounding units in the block.

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Implication 7 of the Structural Poses hypothesis set under consideration (see Chapter 2) states that areas of intensive habitation should be represented by high densities of diverse tools and debitage whereas such clusterings should be absent if the site represents only many sporadic episodes of extractive activity. This pair of alternative expectations will be further explicated at this time.

(1) The former archeological pattern is the predicted result of the occurrence of many enactments of an activity (or set of activities) whose location of occurrence is constrained by the presence of a facility of some duration. For instance, activities occurring over several weeks or months in close proximity to a house or group of houses should result in a concentration of the outputs of those activities in the proximity of the structure(s). The size of this area of concentration would depend on many factors but 10 to 30 meters in diameter would probably be a good order-of-magnitude estimated, given our present understanding of hunter-gatherer social group sizes.

(2) If on the other hand, the same number of episodes of activity enactment occurred over many centuries—with each episode totally unrelated to all of the others—a more-or-less uniform distribution of outputs of these activities over an area, such as a ridge top, meeting the locational requirements of that activity should result. Any clustering in this case should consist of the outputs of a single enactment, perhaps 1 or 2 tools and related debitage, in an area only a few meters across.

In this section, the data pertaining to the degree of clustering of tools and debitage attributable to each component will be reviewed:

**Palmer.** The Windy Ridge data pertinent to the Palmer occupation are quite few and equivocal as to the degree of clustering of outputs of this occupation. It was noted above that the unifaces recovered by the Stage I excavation seem to be concentrated toward the south central part of the site and, within the block, the two Palmer points seem to be associated with unifaces. If any clusterings of Palmer artifacts are present, however, they are probably small and of low density, consistent with the hypothesis of temporary extractive use of this location.

**Stanly.** The data indicate a very low density of Stanly points in the site and imply very minimal utilization of Windy Ridge, for whatever purpose, by the makers of this tool form.

**Morrow Mountain.** The most intriguing spatial pattern revealed by the Windy Ridge research is the apparent presence of two large clusters of Morrow Mountain points and quartz debitage, representing primarily late manufacturing stages or resharpening, within the site. Extrapolating (rather loosely) from the sample data, these clusters may be 10 to 20 (or more) meters in diameter and include 50 to 150 Morrow Mountain
points and 5 to 15 kg of quartz debitage. There is little evidence that any other tools' systems besides hafted bifaces, in this case Morrow Mountain points, are represented by these clusters of artifacts. While the content of each cluster represents a very narrow range of technology and function, consistent with the extractive locus hypothesis, the level of clustering indicated—if the data are to be taken at face value—is more consistent with our expectations for intensive habitation.

Before this archeological pattern is taken at face value, however, two alternatives to the interpretation that it represents synchronic units of deposition need to be considered: (1) the apparent clustering may be a result of sampling error, and (2) the clustering may represent diachronic accumulations of outputs of activities whose location of occurrence was determined by the microtopography of the site; it will be noted (see Figure 2) that the extreme western and eastern portions of the area investigated are slightly more level than the intervening area.

(1) The writers know of no way to objectively assess the probability that the clustering indicated is due to sampling error. Given the disparity between the size of the sampling units (2 m²) and the size of the hypothetical clusters (75-300 m²) the distribution of sample values should not be expected to depart significantly from a Poisson distribution even if the hypothetical clustering existed in the underlying population (cf. Kershaw 1973: 128-134, 136-137). No attempt to apply any statistical test for nonrandom distribution to the quartz debitage data was made because of the complexity implied by our model of clustering derived from two different levels of systemic phenomena; i.e., reduction of individual pieces of stone and the clustering of such episodes of reduction within the site location. In any event, the evidence for clustering primarily consists not of the variance of sample values but in the juxtaposition of units with high values for both Morrow Mountain points and quartz debitage within certain areas of the site.

(2) If these two clusterings of Morrow Mountain points and quartz debitage are taken as "real", then it must be asked whether or not their rough correlation with slightly more level areas of the site is meaningful. Two observations are relevant here. First, the distribution of other tool and debitage classes does not seem to decrease in the central portion of the site. Second, the location of maintenance activities and the microtopography of a locality are not necessarily independent variables (cf. Binford and Binford 1966: 291, see Implication 9 of the Structural Poses hypothesis set). If habitation and facility construction took place on Windy Ridge during Middle Archaic times, the most level areas would probably have been chosen for this purpose.

Accepting for the time being the conclusion that these clusters are real and represent synchronic units of deposition within spaces circumscribed by proximity to substantial facilities, it remains to ask what possible structural poses of a hunting and gathering society might result in deposition of 50 to 150 worn out or broken hafted cutting tools and associated manufacturing and maintenance debris concentrated in an area 10 to 20 m in diameter. (1) In spite of the narrow range of
technology and function represented, the clusters may reflect some type of whole kin group habitation of substantial structures that was sufficiently prolonged to have considerable outputs, but was perhaps nonetheless sufficiently brief or seasonally specialized to involve only a limited range of lithic tool technology and function. (2) The behavior that took place at the site might yet be a specialized extractive activity carried out by a minimal social segment that nonetheless involved construction and annual reuse of facilities. To speculate, a lean-to, a group of tent poles, or a butchering rack might have been left at a hunting camp and re-used for periods going on a week or so every year or every other year. Though the outputs per episode of such use might be minimal, maintenance and reuse of such facilities over a generation or so might generate the archeological pattern suggested by the data under consideration. This hypothetical systemic pattern is similar to the ethnographically-documented pattern of Ainu hunting camps (Watanabe 1972: 473).

A comment on methodology is relevant here. Had the Stage I sample data been analyzed prior to initiation of Stage II of the excavations at Windy Ridge, we would undoubtedly have chosen to locate the block in the extreme eastern portion of the site in order to investigate a concentrated area of Morrow Mountain occupation. A stage of analysis between Stage I and Stage II of the data recovery was recommended by House and Ballenger (1976: 156) in the original Interstate 77 mitigation proposal but it could not be carried out because of logistical problems.

Gulf. The close spatial association within the block of the only two Guilford points recovered from the Windy Ridge excavation is strongly suggestive that these two artifacts were deposited at the same time. This pattern is quite consistent with our predictions for the results of a single brief episode of specialized activity at the site.

Savannah River. The sample data suggest that Savannah River points are widely distributed throughout the site in a pattern consistent with the hypothesis of many discrete, unrelated episodes of deposition. The debitage attributed to Savannah River point manufacture (see Chapter 10) is spatially concentrated but the absolute amount of debitage represented by each cluster, less than 1 or 2 kg, is consistent with our expectations for the outputs of manufacture of a few Savannah River points from a few large, thick biface blanks. Such an episode—including procurement of raw material in the vicinity—could probably take place in a few hours during the course of a brief occupation of Windy Ridge by a few individuals.

Otarre. The three hafted bifaces tentatively identified with the Otarre type are all from the central portion of the site but no inferences about the spatial distribution of this tool class in the underlying artifact population at the site are justified at this time.

Woodland. The 9 prehistoric ceramic sherds recovered at Windy Ridge perhaps represent a single vessel and, if so, their entry into the archeological record would have been a discrete event which, by definition, is not amenable to elucidation of pattern (Wilcox 1975: 126). The Unclassified Stemmed points attributed to Woodland occupation are from proveniences throughout the site.
Chapter XII
HYPOTHESIS EVALUATION

Introduction

The excavation at Windy Ridge, 38FA118, in the Interstate 77 corridor in the South Carolina Piedmont was an attempt to operationalize, in a single case, the hypothesis, originally proposed by Dickens (1964) that the numerous low density artifact scatters on upland land surfaces in the Southern Piedmont represent ephemerally-occupied hunting camps. In order to focus this research and guide the selection of a sampling strategy, data recovery techniques and analytical methods, 2 sets of alternative hypotheses about the function of the site location in prehistoric settlement/subsistence systems were formulated and a set of archeological test implications for each hypothesis was deduced (see Chapter 2). These hypotheses and test implications are basically those operationalized by the Interstate 77 survey (House and Ballenger 1976) but they were reformulated to address a single site data base. In this chapter, these hypotheses and test implications will be re­capitulated and the Windy Ridge data pertinent to each hypothesis will be briefly summarized.

Structural Poses and Site Variability

Hypothesis 1. The area investigated at Windy Ridge was the location of intensive habitation.

Hypothesis 2. The area investigated at Windy Ridge was the scene only of procurement and preliminary processing of a specific biotic resource.

Implication 1. If the area investigated was a settlement, expect midden staining in the soil; if the area was the scene only of extractive activities, expect no midden staining.

No midden staining was observed in the soil in any part of the area investigated at Windy Ridge. Except for the presence of scattered prehistoric artifacts, the upper soil horizons at the site were not noticeably different from corresponding soil horizons elsewhere in this locality.

Implication 2. If the area investigated was a settlement (during late Archaic or Woodland times) expect sherds from steatite and ceramic vessels; if the area was the scene only of extractive activities, expect few if any steatite or ceramic sherds.
No steatite sherds were recovered from any of the excavation units even though a significant late Archaic component was present. A few probable Woodland ceramic sherds were found but, since there is a strong likelihood that they represent breakage of a single vessel, it cannot be inferred that use of ceramic vessels ever typified the structural pose represented at Windy Ridge.

Implication 3. If the area investigated was a settlement, expect abundant fire-cracked rock; if the area was the scene only of extractive activities, expect little if any fire-cracked rock.

The excavations revealed the presence of small amounts of material corresponding to the operational definition of fire-cracked rock but this material could not be consistently recovered or its presence quantified. It was concluded that such material was present in only very small quantities. Its presence in such small quantities may be attributable to prehistoric forest fires or burning during historic times rather than aboriginal "hot rock" cooking.

Implication 4. If the area investigated was a settlement, expect a wide variety of tool forms representing a wide variety of functions, especially maintenance tasks; if the area was the scene only of extractive activities, expect only a narrow, functionally-specialized range of tool forms.

The contents of the site are, on the whole, consistent with the latter expectation. The predominant tool form recovered was hafted bifaces. Edge angle and edge damage analysis, however, suggest the possibility that these tool forms encompass some diversity of function. The debitage recovered at the site seems to be largely attributable to biface manufacture and modification and the two hammerstones of quartz could easily have functioned in a biface manufacture subsystem. A greater degree of functional diversity is suggested by the artifacts attributed to the Palmer component. In addition to Palmer points, these include end scrapers and sidescrapers and a small bipolar core which might reflect manufacture of pieces esquillee. A pitted cobbble found in one excavation unit might have been part of a bipolar reduction industry. A single hammerstone of fairly soft material does not seem attributable to a knapping function. Very few utilized flakes were recognized and, with the exception of the bipolar core mentioned above, no cores specialized for flake production were recovered. Other tool forms conspicuous by their absence were atlatl weights, ground or chipped stone axes, scraper planes, mortars and pestles.

Implication 5. If the area investigated was a settlement, expect a wide variety of types of debitage, representing manufacture and modification of a wide variety of tool forms; if the area was the scene only of extractive activities, only a narrow range of debitage types will be present.
Virtually all of the debitage recovered at Windy Ridge seems attributable to biface tool manufacture and modification. The postulated "early stage" debitage, chunks and other flakes, of course, is somewhat amorphous reflecting detachment from somewhat amorphous core forms so it cannot be inferred with certainty that they represent a biface tool manufacturing trajectory. A small amount of unifacial resharpening debitage of smoky quartz was recognized in materials from excavation units surrounding the provenience of a smoky quartz endscraper and it is possible that a small amount of unifacial resharpening debris in other raw materials went unrecognized in the analysis.

Implication 6. If the area investigated was a settlement, expect debitage indicating early stages in the manufacture of tools from exotic as well as local raw materials; if the area was the scene only of extractive activities, expect any manufacturing debris present to be only of materials available in the local environment.

This dichotomous archeological variable was suggested by Gould's (1974) proposition, based on ethnographic data from the Western Desert of Australia, that manufacture of tools of nonlocal raw materials usually takes place in the context of habitation while manufacture of tools of materials widespread in the environment may take place on an ad hoc basis wherever such a tool is needed in the course of either maintenance or extractive activities. This variable, however, is rather difficult to operationalize. Not only is it difficult to reliably distinguish local raw materials from exotic raw materials, given our present state of knowledge (or ignorance) of lithic resources in the Piedmont, but it is also difficult to distinguish resharpening debris (predicted to occur at sites of extractive loci in exotic as well as local raw materials) from manufacturing debris. Furthermore, a divergence between the characteristics of exotic and local debitage at a hypothesized extractive locus becomes meaningful only if the manufacture of tools of exotic, extra-regional raw materials can be demonstrated elsewhere in the settlement system.

The lithic raw material categories represented at the site were divided into local and non-local groups, based partly on the results of a petrological analysis of selected specimens. Given this categorization, it appeared that the exotic debitage at Windy Ridge consists mostly of biface thinning flakes rather than outputs of earlier stages of reduction and has a comparatively low mean weight per piece. The biface thinning flakes of one of the exotic materials, banded Carolina slate, tended to be much thinner, though not necessarily shorter, than the biface thinning flakes in two of the local raw material categories, a contrast which may be related to resharpening vs. manufacture. Analysis of debitage suggests, however, that a significant amount of variability in debitage between raw material categories may be derived from technology as well as reduction stage. The presence of probable resharpening debris and tool fragments of exotic raw materials indicates that tools in these materials were present in systemic context at Windy Ridge, even if the debitage representing their manufacture was not present.
in archeological context. Though quantified data are not yet available, impressionistic observation suggests that early stage manufacture of tools of at least one extra-regional raw material, banded Carolina slate, may have occurred at some riverine Archaic site locations in the region.

Implication 7. If the area investigated was a settlement, expect a high density of diverse tools and debitage within some portions of the site; if the area was the scene only of extractive activities, then there should be no dense concentrations of diverse artifacts.

One of the most interesting results of the present research is the apparent discovery of 2 spatial clusterings of Morrow Mountain points and quartz debitage in the extreme eastern and extreme northwestern portions, respectively, of the area investigated. The possibility that these clusters could be spurious and a result of sampling error should be borne in mind but is not considered likely. Based on sample data, these clusters may be 20 m in diameter and may consist of 50-150 Morrow Mountain points and several kg of quartz debitage. Though these clusters seem to be relatively dense, they are not particularly diverse; they contain little besides worn out and broken Morrow Mountain points and quartz debitage. This quartz debitage consists mostly of small biface thinning flakes but minor quantities of early stage reduction debris of quartz were present also.

No other component at Windy Ridge seemed to exhibit this type of large-scale aggregation of artifacts within the site. Some indications of clustering on a much smaller scale were more consistent with our expectations for the outputs of a single brief episode of extractive activity.

Implication 8. If the area investigated was a settlement, expect archeological features representing portions of aboriginal subsurface features; if the area was the scene only of extractive activities, expect no evidence of subsurface facilities.

No archeological features attributable to aboriginal subsurface facility construction were observed in any of the excavation units at Windy Ridge. Evaluation of these negative data, however, requires knowledge of whether or not such evidence would be preserved over thousands of years in shallow soil horizons under a forest floor. The occurrence of prehistoric artifacts representing diverse cultural periods throughout the upper 30 to 40 cm of soil suggests that these upper strata are quite biologically active and have undergone considerable pedoturbation. The soil horizons below 30-40 cm below surface, on the other hand, appear to be quite stable and it seems likely that any features ever extending into these strata should still be discernible, given the excavation techniques employed at Windy Ridge. A brief review of relevant archeological literature for the Southeast indicates that some kinds of late Archaic features frequently extend well below this 40 cm threshold but other classes of archeological
features and the most frequently-observed classes of early Archaic features in some sites do not extend much deeper than 40 cm below the surface at which they originated. This question would be best resolved empirically, by excavation at a series of additional, functionally diverse sites in the upland Piedmont and documenting whether or not evidence of subsurface facilities is ever observed in such contexts.

Implication 9. If the area investigated was a settlement, it would be in a favored location, one with adequate fairly level living space and close proximity to water; if the area was the scene only of extractive activities, it might or might not be in such a favored location.

The area investigated at Windy Ridge is located on a topographic feature which, prior to construction on nineteenth and twentieth century roads, would have had sufficient fairly level land surface to meet the living space requirements of a band or other fairly large co-resident group of hunter-gatherers. It was initially thought that the site was rather remote from a reliable water source but an early twentieth century plat map examined by the writer indicated a spring in close proximity to the area investigated.

**Identification of Specific Biotic Resources Extracted**

**Hypothesis 1.** The area investigated at Windy Ridge was a gathering processing station for acorns and hickory nuts.

Implication 1. Expect stone plant processing tools.

No stone artifacts interpretable as plant processing tools were recovered from the excavations at Windy Ridge.

Implication 2. If wooden, rather than stone, mortars and pestles were used, expect numbers of broken or exhausted heavy duty woodworking tools.

The excavation yielded no ground or chipped stone axes, adzes, or celts or any other tool suitable for manufacture and maintenance of wooden mortars and pestles nor any chips which might have been detached during the use or repair of such heavy duty woodworking tools. More expedient core tools such as scraper planes were also absent from the recovered artifact assemblage.

**Hypothesis 2.** The area investigated at Windy Ridge was the location of hunting-butchering camps for procurement of game animals, especially white-tailed deer.
Implication 1. Expect an artifact assemblage dominated by the outputs of manufacture (of locally-available raw materials), use, resharpening, breakage and discard of stone butchering tools.

The artifact assemblage at Windy Ridge can indeed be characterized as dominated by the outputs of the manufacture, use, resharpening, breakage and discard of hafted bifaces ("projectile points"). As noted above, most of the debitage readily attributable to manufacture vs. resharpening of such tool forms is of raw materials thought to be available in the local environment. Inference of the function of these tool forms was approached in three ways: (1) examination of blade edge damage, (2) examination of blade edge angles, and (3) analysis of breakage patterns. Consideration of cultural formation processes of the archeological record in particularly important in this kind of analysis since a set of discarded tools in archeological context cannot be assumed to correspond exactly to a "tool kit" in systemic context (cf. Schiffer 1976: 44-45). Examination of blade edges indicated that the majority of the hafted bifaces in every category exhibited edge dulling and rounding indicative of a knife or cutting tool function as opposed to a projectile point function. Experiments have shown that similar edge damage on hafted biface blade edges can result from dismembering the carcasses of large animals. Analysis of the bladed edge angles revealed a considerable range of variability. The lower part of the range corresponded roughly with the 40° value which experiments have shown to be optimum for butchering. Many very high edge angle values were observed also, however. When the edge angle data for one category of hafted bifaces, Morrow Mountain points, were tabulated separately for whole and transversely broken specimens, it was revealed that the transversely broken specimens tended to have much sharper edges than the complete specimens. This pattern suggested that the broken specimens had been discarded, by fact of their breakage in use, at all stages of resharpening while the complete specimens were discarded after they could no longer be resharpened. If so, the lower edge angle range of the specimens may best represent the optimum functional edge angle of the tools system. Articulation of breakage pattern data with edge damage and edge angle data suggests that discard of hafted cutting tool blades after (1) breakage during manufacture, (2) breakage during resharpening, (3) breakage due to excessive stress in use, and (4) exhaustion of still complete specimens, all played a role in the formation of the assemblage. Though these data do not demonstrate that the hafted bifaces at Windy Ridge were actually butchering tools, they demonstrate the possibility that they could have functioned in this manner.

Other Observations

A few other observations derived from the present research do not pertain directly to the test implications outlined above but are nonetheless relevant to inference of the function of Windy Ridge in prehistoric settlement systems:
(1) A review of the catchment data for Windy Ridge compiled during the Interstate 77 survey (see Chapter IV) emphasizes the fact that the site is relatively remote from any major streams or floodplains and is in the heart of as uniform an environmental zone as may be found anywhere in the South Carolina Piedmont. This type of location, as opposed to location in close proximity to the boundary of 2 or more diverse microenvironments, is postulated to be an attribute of extractive loci as opposed to habitational loci (cf. Hill 1972: 90-92).

(2) A not anticipated pattern lending support to the extractive locus hypothesis emerged when the data pertaining to the use vs. manufacture of Savannah River points at Windy Ridge were analyzed. Given postulated associations between certain raw material categories and the technological requirements of Savannah River points, it appears that the Savannah River points manufactured at Windy Ridge were not the same Savannah River points that were used, broken and discarded at the site location and subsequently recovered by the excavation; the former are represented only by manufacturing debitage and perhaps aborted preforms while the latter are represented by tool fragments but no manufacturing debitage. It is hypothesized that the Savannah River points manufactured at Windy Ridge were replacements for the Savannah River points which were broken in use and discarded. The apparent fact that the Savannah River points manufactured at the site location did not end their uselives and enter the archaeological record there implies that their makers occupied the locus for spans of only short duration.

(3) One artifact recovered from the excavations at Windy Ridge seems most readily attributable to an ideotechnic or symbolic function rather than a function directly related to subsistence. A single abraded piece of unidentified hematite-rich rock, recovered from an excavation unit in the block, would probably have been suitable for preparation of red pigment.

**Conclusions**

The data on the whole, favor Hypothesis 2 of the "Structural Poses and Site Variability" hypothesis set and Hypothesis 2 of the "Specific Biotic Resources Extracted" hypothesis set. They suggest that over centuries, Windy Ridge functioned as a camp occupied for hunting and butchering of white-tailed deer. The occurrence of some specific artifact classes implying the contrary; i.e., ceramic sherds and a single piece of abraded hematite-rich rock, are readily interpretable as the outputs of discrete events rather than modal patterns of past behavior at the site location. The set of artifacts attributable to the Palmer components, however, may be more functionally diverse than those attributable to later components. One structural pattern, the apparent presence of 2 extensive high density clusters of Middle Archaic points and quartz debitage within the area investigated, implies larger units of synchronic deposition of artifacts than were anticipated by our models of extractive activity in the inter-riverine zone.

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In the largest sense, however, the testing of the hypotheses outlined in Chapter 2 remains incomplete. The data set is diachronically diverse in the extreme and we were not always able to control for diachronic variability while exploring technological and functional variability in the assemblage. Many of the behavioral-material correlates used in the synthesis of the Windy Ridge data are very poorly established and are subject to further evaluation and perhaps disconfirmation. Many of the archeological patterns predicted by the model require quantitative analysis of regional vs. single site data sets. Considerations of sampling—and the confidence intervals of the parameter estimates upon which some structural patterns have been synthesized—have not been carefully examined in this report. Perhaps the most serious shortcomings of the present research, however, are theoretical. The concepts of structural poses and cultural ecology embodied by the hypotheses under consideration may be of limited usefulness and may be addressing the articulation of human beings, resources, technology and scheduling in quite simplistic and inappropriate ways. Our archeological attempts to answer anthropological questions can hardly be very successful if the questions themselves do not make anthropological sense (cf. Yellen 1977: 86).

On the positive side, it should be noted that the recovery and analysis of the data specified by the hypotheses did reveal a number of intriguing patterns in the archeological record at Windy Ridge. Perhaps most importantly, the question of the prehistoric utilization of the inter-riverine Piedmont still seems interesting and relevant after this effort. We hope that in spite of all of the shortcomings of the present research, its modest accomplishments will facilitate the formulation of better hypotheses and test implications and will soon lead to further insights into the evolution of human cultural behavior over thousands of years in the South Carolina Piedmont.
Appendix A

Results of Preliminary Shovel Testing at Windy Ridge, Early Spring, 1977

As part of the process of revising the Interstate 77 mitigation proposal and making a final assessment of the research potential of Windy Ridge, the site was visited on two separate occasions in February and March, 1977. On these occasions, four shovel tests were made across the length of the site to acquire information on the overall artifact density at the site and information on stratigraphy and preservation of the site. These shovel tests were about 40 cm in diameter and excavated to the depth at which compact reddish sandy clay was encountered. A few shovelfuls of soil from each hole were screened through 1/4" mesh for recovery of artifacts.

Comparison of the results of this shovel testing with the stratigraphic and artifactual data from the subsequent full-scale excavations at Windy Ridge may be useful in evaluating the shovel test method as a means of exploring the research potential of a site in a wooded environment. The data from the shovel tests are presented below.

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<td>near N88R130</td>
<td>ca. 30cm of sandy loam</td>
<td>1 quartz flake</td>
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<td></td>
<td></td>
<td></td>
<td>1 andesite flake</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 C. slate (unbanded) flake</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 C.P. chert biface fragment</td>
</tr>
<tr>
<td>2</td>
<td>near N90R115</td>
<td>ca. 30cm of sandy loam</td>
<td>2 quartz flakes</td>
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<td></td>
<td></td>
<td></td>
<td>1 gr. opaque ch. flake</td>
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<td></td>
<td></td>
<td>1 amphibolite (low grade) flake</td>
</tr>
<tr>
<td>3</td>
<td>near N88R100</td>
<td>less than 10cm of loam</td>
<td>2 quartz flakes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 quartz chunk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 C. slate (unbanded) flake</td>
</tr>
<tr>
<td>4</td>
<td>within N98R148</td>
<td>ca. 40cm of sandy loam</td>
<td>3 quartz flakes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 gr. opaque ch. flake</td>
</tr>
</tbody>
</table>
APPENDIX B

PETROLOGICAL ANALYSIS OF CHIPPED STONE RAW MATERIALS

by

Gerald Weisenfluh

RAW MATERIAL CATEGORY: CAROLINA SLATE (BANDED)

PROVENIENCE: 38FA118, surface

MINERAL COMPOSITION: Quartz, plagioclase feldspar, actinolite, chlorite, biotite, sphene, opaque oxides.

This rock type is characterized by fine, evenly spaced laminations comprised of opaque oxides, chlorite and sphene. Broken surfaces are dark grey and sugary, while weathered surfaces are buff to light grey and emphasize the laminations. The majority of the matrix minerals are too small to identify. They are probably comprised mostly of quartz. In some of these fine-grained layers, the minerals appear to be aligned parallel to one another. These zones are separated either by the dark laminations or by layers of coarser grained quartz and plagioclase. Occasional grains of radiating Chalcedony are observed in the coarse layers. Fibrous actinolite and tabular chlorite and biotite have grown with random orientation and are metamorphic in origin.

This rock is probably derived from one of the sedimentary sequences of the Carolina slate belt. The laminations appear to be the result of sedimentary layering.

ROCK NAME: laminated metasiltstone

RAW MATERIAL CATEGORY: CAROLINA SLATE (BANDED)

PROVENIENCE: Powell Shoals (38FA121), Fairfield County, South Carolina

MINERAL COMPOSITION: Quartz, plagioclase feldspar, biotite, chlorite, sphene, opaque oxides, chalcedony.

Fresh surfaces are dark grey and have a distinct sugary texture. Weathered surfaces emphasize the banded character of the rock.

The matrix is comprised of an indistinct network of quartz, plagioclase, sphene and opaque oxides. Brown biotite and green chlorite (and possibly green hornblende) also occur in the matrix. Occasionally larger grains of quartz and plagioclase can be identified. As in the sample from Morrow Mountain, North Carolina (31ST18), cavities of radiating chalcedony are present.
The delicate laminations in this rock appear to be the result of sedimentary working following deposition. It probably represents a pyroclastic eruption which was deposited in a shallow water environment. It is also weakly metamorphosed and characteristic of the Carolina slate belt.

ROCK NAME: Metafelsite

RAW MATERIAL CATEGORY: CAROLINA SLATE (BANDED)

PROVENIENCE: aboriginal quarry/workshop (31ST18) on Morrow Mountain, Stanly County, North Carolina.

MINERAL COMPOSITION: plagioclase feldspar, quartz, chalcedony (hydrated quartz), hornblende, actinolite, chlorite, biotite, muscovite, sphene, and opaque oxides.

The groundmass consists predominantly of anhedral (no crystal faces developed) quartz and subhedral (some crystal faces developed) plagioclase feldspar. Small grains of green hornblende, actinolite, chlorite, biotite, and muscovite with granular aggregates of sphene and opaque oxides also occur in the matrix. Larger cavities (1 mm radius) are filled with spherulitic chalcedony (SiO₂). These patches of radiating fibers can be observed in hand specimen. They probably originated as gas vesicles which were later filled with silica. Their occurrence is indicative of volcanic lithologies.

The mineral assemblage indicates the rock has been metamorphosed to the upper greenschist to lower amphibolite grade. This lithology also is a typical constituent of the Carolina slate belt.

ROCK NAME: felsic tuff

RAW MATERIAL CATEGORY: CAROLINA SLATE (UNBANDED)

PROVENIENCE: 38FA118, N90 R116 (North 1/2)

MINERAL COMPOSITION: plagioclase feldspar, quartz, biotite, chlorite, sericite (fine-grained muscovite), sphene, and opaque oxides.

Groundmass is extremely fine-grained and is comprised of indistinct aggregates of all of the above minerals. The mafic minerals (biotite, chlorite, and sphene) occur as small granular grains and as patchy overgrowths. Microscopic phenocrysts are present and are comprised predominantly of euhedral plagioclase. Subordinate phenocrysts of quartz are present.
The absence of amphibole suggests this rock has undergone greenschist facies metamorphism. Texturally and compositionally this rock is identical to "grey andesite," although it is finer grained. It is not impossible that the two specimens could have been derived from the same area of lithologic unit.

ROCK NAME: porphyritic metadacite or metafelsite

RAW MATERIAL CATEGORY: GREY ANDESITE

PROVENIENCE: 38FA118, N92 R134 (North 1/2); Feature 7

MINERAL COMPOSITION: plagioclase feldspar, biotite, chlorite, quartz?, opaque oxides, sphene, epidote, and garnet?.

The groundmass is very fine-grained and is comprised predominantly of euhedral (well formed crystal faces) to subhedral plagioclase crystals, tabular biotite and chlorite crystals, and granular opaque oxides, epidote, and sphene. Quartz may occur in the groundmass, but is too fine-grained to distinguish from plagioclase. Larger crystals (phenocrysts) of plagioclase (1 mm) are present and are characterized by well-developed oscillatory zoning (compositional oscillations from center of crystal to exterior) and complex twinning (structural defects). These phenomena are characteristic of shallow level and extrusive volcanic rocks.

The igneous textures of this rock are excellently preserved and indicate the unit has undergone little regional metamorphism (low greenschist facies). Probably derived from the Carolina slate belt.

ROCK NAME: Andesite or dacite porphyry (porphyry refers to a rock which has two distinct grainsizes--fine-grained matrix and larger phenocrysts).

RAW MATERIAL CATEGORY: GREY ANDESITE

PROVENIENCE: 38FA118, N86 R134 (North 1/2)

MINERAL COMPOSITION: plagioclase feldspar, biotite, chlorite, quartz, opaque oxides, sphene, epidote, muscovite.

Freshly broken surface is dark grey to black with chalky white plagioclase phenocrysts. Weathered surfaces are buff colored with flesh-colored phenocrysts. The groundmass is fine-grained and phenocrysts are up to 1 mm in size.

The matrix is composed of small (.1 mm) anhedral quartz and subhedral plagioclase grains with small sheaths of brown biotite, green chlorite, clear muscovite along with granular opaque oxides, sphene and epidote. All phenocrysts are composed of twinned or oscillatory-zoned euhedral plagioclase.

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For interpretation and further description of this material, see discussion of "grey andesite" specimen above.

ROCK NAME: andesite or dacite porphyry

RAW MATERIAL CATEGORY: GREY OPAQUE CHERT

PROVENIENCE: 38FA118, N92 R134 (North 1/2); Feature 7

MINERAL COMPOSITION: SiO₂, sericite (fine-grained muscovite), and minute quantities of opaque oxides.

Extremely fine-grained rock with no significant textural features. SiO₂ occurs in the forms of quartz, opal, and chalcedony. Small veinlets of hematite-stained quartz are observed. No relict fossil structures are present, so that it is difficult to determine the environment of deposition of the chert.

It appears to be a fairly young geologic deposit and probably was derived from outside the Piedmont province. Similar lithologies occur in the sedimentary sequences of both the Coastal Plain and the Valley and Ridge provinces.

ROCK NAME: chert

RAW MATERIAL CATEGORY: QUARTZ PORPHYRY

PROVENIENCE: 38FA118, surface

MINERAL COMPOSITION: Quartz, plagioclase feldspar, potassium feldspar, muscovite, chlorite, and opaque oxides.

Fresh surfaces are light grey while weathered surfaces are buff colored with glassy quartz and feldspar phenocrysts.

This rock has an extremely fine-grained matrix of quartz and feldspar minerals. These grains are too small to be identified. Slightly larger crystals of subhedral plagioclase and potassium feldspar along with anhedral quartz also constitute the groundmass. Minor amounts of patchy muscovite, chlorite, and granular opaque oxides are also present. Distinctly larger phenocrysts of embayed quartz with subordinate amounts of plagioclase and potassium feldspar phenocrysts imbue the material with the characteristic porphyritic texture.

The rock is a weakly metamorphosed volcanic lithology derived from the Carolina slate belt.

ROCK NAME: quartz porphyry
RAW MATERIAL CATEGORY: AMPHIBOLITE (LOW GRADE)

PROVENIENCE: 38FA118 N90 R116 (North 1/2)

MINERAL COMPOSITION: plagioclase feldspar, quartz, green hornblende (possibly ferroactinolite), epidote, clinozoisite, and opaque oxides.

Quartz and feldspar constitute most of the groundmass (matrix) and occur as small (less than .1mm) polygonal grains. Fine-grained opaque oxides (predominantly magnetite) also occur in the matrix. The hornblende and/or actinolite occurs as acicular (needle-like) crystals and aggregates of crystals, and are typically aligned parallel to one another. This mineral is larger (up to 1mm) and is the black fibrous mineral visible in hand specimen. Epidote and clinozoisite (iron poor epidote) occur as alteration products of hornblende, and magnetite is commonly altered to epidote or sphene.

The texture, fine grain size, and the presence of epidote and hornblende/actinolite suggest this rock has undergone low-grade regional metamorphism (greenschist to epidote amphibolite). It is probably locally derived from Carolina slate belt or similar lithologic units in the Carolina Piedmont.

ROCK NAME: andesite tuff or intermediate tuff

RAW MATERIAL CATEGORY: DIABASE

PROVENIENCE: 38FA118, N98 R148 (North 1/2), Level I

MINERAL COMPOSITION: Calcium rich plagioclase feldspar, olivine, clinopyroxene, chlorite, talc, opaque oxides, serpentine.

Fresh surfaces of this rock type are dark black to grey while weathered surfaces are earthy brown. Olivine-bearing diabases commonly show a pitted texture on weathered surfaces.

Sixty to seventy percent of the rock is comprised of euhedral (well-formed) laths of plagioclase feldspar. These grains are characteristically twinned and interfere with each other's growth. The plagioclase crystals are sometimes intergrown with each other and also enclose small grains of pyroxene and olivine. Most of the olivine and pyroxene occur in the interstices between plagioclase grains creating an intergranular texture. Olivine is clear, anhedral (rounded) and is usually altered to small amounts of chlorite, talc and serpentine. The pyroxene (augite and/or pigeonite) is brown to green in color and has a well-developed cleavage. Small granules of opaque oxides seem to be associated with the pyroxene crystals.

This rock is unmetamorphosed and is characteristic of the Mesozoic diabase dikes. These dikes are ubiquitous in the Piedmont province but are not found in the Coastal Plain or west of the Blue Ridge.

ROCK NAME: Olivine diabase.
## APPENDIX C.

**DEBITAGE BY RAW MATERIALS, EXCAVATION UNITS AT WINDY RIDGE, 38FA118**

Sum of chunks plus other flakes plus biface thinning flakes  
(number of pieces/weight in grams)

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Grey (LG)</th>
<th>Andesite</th>
<th>Quartz (LG)</th>
<th>Quartz (HG)</th>
<th>Amph (DG)</th>
<th>Amph (HG)</th>
<th>Opaque Grey ch</th>
<th>Car Sl (B)</th>
<th>Car Sl (U)</th>
<th>Quartz</th>
<th>CP Chert</th>
<th>Arg</th>
<th>Dia &amp; Unid</th>
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</table>
### DEBITAGE BY RAW MATERIALS, EXCAVATION UNITS AT WINDY RIDGE, 38PA118

Sum of chunks plus other flakes plus biface thinning flakes  
(number of pieces/weight in grams)

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Grey Andesite</th>
<th>Quartz (LG)</th>
<th>Amph (HG)</th>
<th>Opaque Grey ch</th>
<th>Car Sl (B)</th>
<th>Car Sl (U)</th>
<th>Quartz Porph</th>
<th>CP Chert</th>
<th>Arg</th>
<th>Dia</th>
<th>Other &amp; Unid</th>
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*Also a Stage I provenience.
### APPENDIX D

**PREHISTORIC STONE TOOL AND CORE PROVENIENCES**

**WINDY RIDGE, 38FA118**

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<th>Points</th>
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<th>Cores (# wt. in grams)</th>
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Notes:
- a One pitted cobble anvil
- b Probable Morrow Mountain preform
- c Hammerstone made on quartz core, hammerstone made on river cobble
PREHISTORIC STONE TOOL AND CORE PROVENIENCES 
WINDY RIDGE, 38FA118

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STAGE II

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Note:  
ᵃBipolar core, quartz crystal  
bBipolar core, quartz crystal  
cAlso a Stage I provenience  
ᵈHammerstone
# Prehistoric Stone Tool and Core Proveniences

## Windy Ridge, 38PA118

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<td>0</td>
</tr>
<tr>
<td>N90R134 (N&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1 Morrow Mountain</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>N90R134 (S&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 Morrow Mountain</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N90R134 (S&lt;sub&gt;2&lt;/sub&gt;)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 Morrow Mountain</td>
<td>1</td>
<td>0</td>
<td>1/1.5g</td>
</tr>
<tr>
<td>N88R132 (N&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>1/1</td>
<td>1</td>
<td>1</td>
<td>2 Savannah River tip fragments</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N88R132 (S&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>1/1</td>
<td>2</td>
<td>0</td>
<td>1 Palmer</td>
<td>0</td>
<td>1</td>
<td>1/60g</td>
</tr>
<tr>
<td>N88R134 (N&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>1/1</td>
<td>0</td>
<td>2</td>
<td>1 Morrow Mountain tip fragment</td>
<td>1</td>
<td>1</td>
<td>2/153g</td>
</tr>
<tr>
<td>N88R134 (S&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2 Morrow Mountain</td>
<td>0</td>
<td>0</td>
<td>1/51g</td>
</tr>
<tr>
<td>N86R134 (N&lt;sub&gt;2&lt;/sub&gt;)&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>0</td>
<td>0</td>
<td>1 Savannah River</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Notes:**

<sup>a</sup> Also a Stage I provenience

<sup>b</sup> Hammerstone made on a quartz core, hammerstone made on river cobble

<sup>c</sup> Pieces of hematite-rich rock with abraded facets, pigment material?
### APPENDIX E

**DESCRIPTION OF HAFTED BIFACES FROM EXCAVATION UNITS**

**WINDY RIDGE, 38FA118**

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Raw material</th>
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<th>Blade B. width (mm)</th>
<th>P.H.E. width (mm)</th>
<th>Max. thick (mm)</th>
<th>Weight (g)</th>
<th>Max. weight Angle</th>
<th>Edge damage Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N94R114(N2)</td>
<td>C. slate(U)</td>
<td>-</td>
<td>5</td>
<td>35</td>
<td>(19)</td>
<td>6</td>
<td>6</td>
<td>35°</td>
<td>yes</td>
</tr>
<tr>
<td>N92R130(N2)</td>
<td>C.P. chert</td>
<td>28</td>
<td>9</td>
<td>26</td>
<td>25</td>
<td>7</td>
<td>4</td>
<td>55°</td>
<td>no</td>
</tr>
<tr>
<td>N88R132(S2)</td>
<td>Quartz</td>
<td>-</td>
<td>12</td>
<td>19</td>
<td>24</td>
<td>9</td>
<td>5</td>
<td>75°</td>
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</tr>
<tr>
<td>N90R116(N2)</td>
<td>Unidentified</td>
<td>-</td>
<td>11</td>
<td>40</td>
<td>17</td>
<td>9</td>
<td>15</td>
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</table>

**PALMER**

**STANLY**

**MORROW MOUNTAIN**

<table>
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<th>Blade length (mm)</th>
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<th>Blade B. width (mm)</th>
<th>P.H.E. width (mm)</th>
<th>Max. thick (mm)</th>
<th>Weight (g)</th>
<th>Max. weight Angle</th>
<th>Edge damage Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N96R106(N2)</td>
<td>Quartz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>5</td>
<td>-</td>
<td>-</td>
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<tr>
<td>N98R140(N2)</td>
<td>C.P. chert</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N98R148(N2)</td>
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<td>(35)</td>
<td>17</td>
<td>35</td>
<td>0</td>
<td>10</td>
<td>13</td>
<td>50°</td>
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<td>N98R148(S2)</td>
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<td>22</td>
<td>23</td>
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<td>10</td>
<td>6</td>
<td>30°</td>
<td>no</td>
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<td>N92R106(N2)</td>
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<td>34</td>
<td>-</td>
<td>23</td>
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<td>9</td>
<td>9</td>
<td>45°</td>
<td>yes</td>
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<tr>
<td>N90R116(N2)</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>N90R150(N2)</td>
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<td>36</td>
<td>13</td>
<td>26</td>
<td>0</td>
<td>10</td>
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<tr>
<td>N94R134(N2)</td>
<td>Quartz</td>
<td>30</td>
<td>16</td>
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<td>9</td>
<td>8</td>
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<td>20</td>
<td>24</td>
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<td>6</td>
<td>45°</td>
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</tr>
<tr>
<td>N94R136(N2)</td>
<td>Quartz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N92R130(N2)</td>
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<td>-</td>
<td>12</td>
<td>29</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>35°</td>
<td>-</td>
</tr>
<tr>
<td>N92R136(S2)</td>
<td>Quartz</td>
<td>18</td>
<td>-</td>
<td>28</td>
<td>-</td>
<td>10</td>
<td>6</td>
<td>45°</td>
<td>yes</td>
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</table>
### DESCRIPTION OF HAFTED BIFACES FROM EXCAVATION UNITS.

**WINDY RIDGE, 38PA118**

<table>
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<tr>
<th>Provenience</th>
<th>Raw material</th>
<th>Blade length (mm)</th>
<th>H.E. length (mm)</th>
<th>Blade B. width (mm)</th>
<th>P.H.E. width (mm)</th>
<th>Max. thick (mm)</th>
<th>Weight (g)</th>
<th>Edge Angle</th>
<th>Edge damage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MORROW MOUNTAIN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N92R134(S2)</td>
<td>Quartz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Tiny stem fragment</td>
</tr>
<tr>
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<td>Quartz</td>
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<td>24</td>
<td>8</td>
<td>6</td>
<td>40°</td>
<td>yes</td>
<td>-</td>
<td>-</td>
<td>Broken across stem Fig. 10d</td>
</tr>
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<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>2</td>
<td>-</td>
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<td>Tiny stem fragment</td>
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<td>N88R132(S2)</td>
<td>O. gray chert</td>
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<td>12</td>
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<td>6</td>
<td>3</td>
<td>50°</td>
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<td>-</td>
<td>Broken across blade Fig. 10b</td>
</tr>
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<td>-</td>
<td>12</td>
<td>24</td>
<td>0</td>
<td>10</td>
<td>7</td>
<td>55°</td>
<td>-</td>
<td>Broken across blade Fig. 10c</td>
</tr>
<tr>
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<td>Quartz</td>
<td>28</td>
<td>12</td>
<td>23</td>
<td>0</td>
<td>8</td>
<td>7</td>
<td>60°</td>
<td>yes</td>
<td>Figure 10a</td>
</tr>
<tr>
<td><strong>GUILFORD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>-</td>
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<td>17</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Figure 10e</td>
</tr>
<tr>
<td>N90R134(N2)</td>
<td>C. slate(U)</td>
<td>-</td>
<td>21</td>
<td>25</td>
<td>10</td>
<td>10</td>
<td>13</td>
<td>50°</td>
<td>-</td>
<td>Figure 10f</td>
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<tr>
<td><strong>SAVANNAH RIVER</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>-</td>
<td>15</td>
<td>53</td>
<td>55°</td>
<td>yes</td>
<td>Blade fragment</td>
<td></td>
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<td>N90R106(N2)</td>
<td>Argillite</td>
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<td>-</td>
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<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>Stem fragment</td>
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<tr>
<td>N92R134(N2)</td>
<td>G. andesite</td>
<td>-</td>
<td>25</td>
<td>40</td>
<td>26</td>
<td>12</td>
<td>46</td>
<td>70°</td>
<td>no</td>
<td>Figure 11a</td>
</tr>
<tr>
<td>N92R134(N2)</td>
<td>G. andesite</td>
<td>-</td>
<td>21</td>
<td>49</td>
<td>23</td>
<td>12</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>Figure 11b</td>
</tr>
<tr>
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<td>Argillite</td>
<td>-</td>
<td>26</td>
<td>-</td>
<td>27</td>
<td>9</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>Stem fragment, Fig. 11c</td>
</tr>
<tr>
<td>N96R134(N2)</td>
<td>Argillite</td>
<td>39</td>
<td>32</td>
<td>38</td>
<td>21</td>
<td>11</td>
<td>33</td>
<td>80°</td>
<td>-</td>
<td>Weathered, Fig. 11d</td>
</tr>
<tr>
<td>N94R136(N2)</td>
<td>Quartz</td>
<td>-</td>
<td>17</td>
<td>-</td>
<td>22</td>
<td>10</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>B. across blade, Fig. 11e</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
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<td>-</td>
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<td>Blade fragment</td>
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</table>

**Notes:**

- **a** This provenience not part of random sample
- **b** These specimens from Feature 7
DESCRIPTION OF HAFTED BIFACES FROM EXCAVATION UNITS.
WINDY RIDGE, 38FA118

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<th>Raw material</th>
<th>Blade length</th>
<th>H.E. length</th>
<th>Blade B. width</th>
<th>P.H.E. width</th>
<th>Max. thick</th>
<th>Weight (g)</th>
<th>Edge Angle</th>
<th>Edge damage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Quartz</td>
<td>-</td>
<td>11</td>
<td>33</td>
<td>19</td>
<td>10</td>
<td>15</td>
<td>50°</td>
<td>no</td>
<td>Figure 12a</td>
</tr>
<tr>
<td>N92R124(NW)</td>
<td>Unidentified</td>
<td>38</td>
<td>15</td>
<td>24</td>
<td>14</td>
<td>8</td>
<td>14</td>
<td>50°</td>
<td>Weathered, Fig. 12b</td>
<td></td>
</tr>
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<td>N90R142(NW)</td>
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<td>(40)</td>
<td>14</td>
<td>33</td>
<td>(15)</td>
<td>10</td>
<td>15</td>
<td>60°</td>
<td>yes</td>
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UNCLASSIFIED STEMMED

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<th>P.H.E. width</th>
<th>Max. thick</th>
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<th>Edge Angle</th>
<th>Edge damage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N90R116(SW)</td>
<td>C. slate(B)</td>
<td>25</td>
<td>5</td>
<td>18</td>
<td>24</td>
<td>7</td>
<td>4</td>
<td>70°</td>
<td>yes</td>
<td>Figure 12d</td>
</tr>
<tr>
<td>N90R150(NW)</td>
<td>Unidentified</td>
<td>(40)</td>
<td>12</td>
<td>20</td>
<td>17</td>
<td>9</td>
<td>8</td>
<td>55°</td>
<td>yes</td>
<td>Figure 12e</td>
</tr>
<tr>
<td>N96R134(SW)</td>
<td>C. slate(U)</td>
<td>21</td>
<td>10</td>
<td>17</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>60°</td>
<td>yes</td>
<td>Figure 12f</td>
</tr>
<tr>
<td>N92R132(NW)</td>
<td>C. slate(B)</td>
<td>24</td>
<td>9</td>
<td>22</td>
<td>17</td>
<td>8</td>
<td>5</td>
<td>60°</td>
<td>yes</td>
<td>Figure 12g</td>
</tr>
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</table>

Notes:  
a This provenience is not part of random sample  
b Edge damage includes extremely heavy rotary wear on tip
## APPENDIX F

### DESCRIPTION OF STEEPLY-RETOUCHED UNIFACES FROM EXCAVATION UNITS,
WINDY RIDGE, 38FA118

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Raw material</th>
<th>Max. length</th>
<th>Max. width</th>
<th>Max. thick</th>
<th>Weight</th>
<th>Edge Angle</th>
<th>Side</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N92R134(N~)</td>
<td>Smokey Qtz.</td>
<td>23 mm</td>
<td>21 mm</td>
<td>8 mm</td>
<td>4 g</td>
<td>80°</td>
<td>-</td>
<td>See Figure 17a</td>
</tr>
<tr>
<td>N82R116(N~)</td>
<td>Quartz</td>
<td>39 mm</td>
<td>43 mm</td>
<td>19 mm</td>
<td>39 g</td>
<td>100°</td>
<td>-</td>
<td>questionable</td>
</tr>
<tr>
<td>N90R120(N~)</td>
<td>Quartz</td>
<td>49 mm</td>
<td>39 mm</td>
<td>17 mm</td>
<td>39 g</td>
<td>80°</td>
<td>-</td>
<td>See Figure 17f</td>
</tr>
<tr>
<td>N86R126(N~)</td>
<td>Quartz</td>
<td>53 mm</td>
<td>33 mm</td>
<td>12 mm</td>
<td>26 g</td>
<td>70°</td>
<td>-</td>
<td>Denticulate edge, Fig. 17g</td>
</tr>
<tr>
<td>N86R126(S~)</td>
<td>Quartz</td>
<td>43 mm</td>
<td>29 mm</td>
<td>11 mm</td>
<td>16 g</td>
<td>70°</td>
<td>-</td>
<td>Laterally ground, Fig. 17d</td>
</tr>
<tr>
<td>N92R132(N~)</td>
<td>Unidentified</td>
<td>38 mm</td>
<td>26 mm</td>
<td>10 mm</td>
<td>11 g</td>
<td>-</td>
<td>50°</td>
<td>Very crude and damaged</td>
</tr>
<tr>
<td>N88R132(N~)</td>
<td>Quartzite</td>
<td>22 mm</td>
<td>14 mm</td>
<td>9 mm</td>
<td>3 g</td>
<td>70°</td>
<td>-</td>
<td>See Figure 17b</td>
</tr>
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<td>N88R132(S~)</td>
<td>Quartz</td>
<td>1 mm</td>
<td>1 mm</td>
<td>8 mm</td>
<td>5 g</td>
<td>80°</td>
<td>-</td>
<td>A tiny fragment</td>
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<tr>
<td>N88R132(S~)</td>
<td>Quartz</td>
<td>14 mm</td>
<td>11 mm</td>
<td>10 mm</td>
<td>6 g</td>
<td>80°</td>
<td>90°</td>
<td>See Figure 17c</td>
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</table>

i - indeterminate

**Notes:**

- a See Goodyear, Ackerly and House n.d. for definition of attributes
- b Also a Stage II provenience
- c This provenience is not part of the random sample
REFERENCES

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BARTRAM, WILLIAM

BINFORD, LEWIS R.

BINFORD, LEWIS R. AND SALLY R. BINFORD

BINFORD, LEWIS R., SALLY R. BINFORD, ROBERT WHALLON, AND MARGARET ANN HARDIN

BIRDSSELL, JOSEPH B.

BOARD, C.

BOWEN, WILLIAM ROWE

BRAUN, E. LUCY

BROCKINGTON, PAUL E.
BROWN, DOUGLAS SUMMERS

BROYLES, BETTYE J.

BRYSON, REID A. AND WAYNE M. WENDLUND

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SOIL SURVEY STAFF

SPEARS, CAROL S.

SPECK, FRANK G.

STOLTMAN, JAMES B.


STRAHLER, A.N.

STUART, DAVID E.
STRUEVER, STUART

SWANTON, JOHN R. (EDITOR)

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