6-1980

Prehistoric Soapstone Procurement in Northwestern South Carolina

Terry Andrew Ferguson
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Terry Andrew Ferguson entitled "Prehistoric Soapstone Procurement in Northwestern South Carolina." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Gerald F. Schroedl, Major Professor

We have read this thesis and recommend its acceptance:

Charles H. Faulkner, Jeff Chapman

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

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

PREHISTORIC SOAPSTONE PROCUREMENT IN NORTHWESTERN SOUTH CAROLINA

A Thesis

Presented for the

Master of Arts

Degree

The University of Tennessee, Knoxville

Terry Andrew Ferguson

June 1980

Charlie:
Many thanks
for your assistance
and support
throughout the
project.
Sincerely,
Terry A.
Ferguson

ACKNOWLEDGEMENTS

Completion of this thesis was made possible by the combined efforts of archeologists, government officials, geologists and the citizens of Spartanburg and Cherokee Counties. First and foremost I would like to extend my appreciation to the members of my committee: Dr. Gerald Schroedl, Chairman, Dr. Jefferson Chapman and Dr. Charles Faulkner. Several other professional archeologists and geologists supplied assistance during this project. I would like to thank the staff of the Institute of Archeology and Anthropology, specifically the director, Dr. Robert L. Stephenson for his support, comments and encouragement. I would also like to thank Dr. Bruce Smith and the staff of the United States Museum of Natural History for their assistance. Dr. Walter Klippel, Mr. Gerald Kline and Mr. Quentin Bass of the Department of Anthropology of the University of Tennessee supplied much needed criticism during the course of the project. Dr. Stephen Yurkovich supplied valuable geologic interpretations. Finally I would especially like to thank Dr. John Harrington of the Wofford College Geology Department for a multitude of services too long to mention but most of all for his perpetual insights and encouragment.

I would like to extend my appreciation to the South Carolina Department of Archives and History for funding this thesis. Specifically I would like to thank Mr. Charles Lee, Ms. Christie Fant, Mr. Stuart Johnson, Ms. Mary Ann Eddy and Dr. Donald Sutherland for their patience and assistance.

I would like to thank the field crews who performed heroically both in the face of blistering summer heat and freezing winter cold. They are also to be commended for their perseverence in spite of rough terrain and dense vegetation. Members of the field crew were: Lee Altman, James Bates, Napoleon Blakney, John Byars, John Camby, Ashley Carder, Judy Chiapella, Con Childress, George Contis, Peter Cooper, Bruce Eastes, Simon Ferguson, Thad Franklin, Bruce Freyburger, Mark Funderburk, Katherine Higgins, Tom Lancaster, Ken Mallary, David Murr, Mark Olenki, Maz O'Neal, Tim Richards, Jim Switzer and Marvin Williams.

Other contributors to the project were Mr. and Ms. William A. Taylor and Ms. Pam Manning who supplied housing for field crew members during the study. A special thanks is extended to Dr. George Dean Johnson and the members of the Spartanburg Historical Society for their interest and financial assistance.

Several residents and site owners in the study area and elsewhere supplied useful information and allowed survey members to study their private collections. I would especially like to thank Mr. and Ms. Dexter Davidson, Mr. Tony Harper, Mr. and Ms. Max Oxford and Mr. Walter Upton for these considerations. In addition I extend my sincere thanks to the other landowners and lessees in the study area for their indulgence and interest.

Finally, several persons must be acknowledged for their assistance in preparing the following thesis. Photographic assistance was supplied by Mr. Harley Lanham, Mr. Miles Wright and Mr. Dwight Schmidt. Assistance in processing the artifacts and compilation of the field records was supplied by Mr. Dwight Schmidt. A special thanks is extended to Ms. Terry Faulkner who drafted the overwhelming numbers of line drawings. I am sincerely grateful for the myriad of services unselfishly given by all of the above and any which may have been omitted.

My deepest appreciation is extended to my parents, Mr. and Ms. Franklin N. Ferguson and Katherine F. Higgins without whose support and patience this thesis would not have been possible.

ABSTRACT

During 1978 and 1979 an archeological survey was conducted near Spartanburg, South Carolina in an area containing an extensive zone of soapstone deposits from which soapstone was prehistorically quarried. The study area encompassed approximately 16 km^2 east of the city of Spartanburg, north of the town of Pacolet and along the Pacolet River. The study located 18 prehistoric soapstone quarries and 17 non-quarry sites. Previous soapstone research has suggested several hypothetical quarrying procedures and reduction sequences. A generalized reduction sequence model for soapstone vessel manufacture based on these suggested procedures was utilized to evaluate the data recovered during the survey. Analysis utilizing this model indicates that a reduction sequence suggested by Putnam in 1878 is the most probable sequence used at site 38SP54 in the study area. The model allows for quantitative evaluation and comparison to be made of soapstone vessel production strategies within and between any soapstone quarries. Also utilizing information from the survey, an evaluation is made of linear patterning exhibited by the soapstone quarries due to regional geologic structure. The proposition states that due to the concordant occurrence of quarried soapstone outcrops along the strike or the structural trends of local and regional rock units high

probability predictions of additional quarried outcrops can be made. Finally, it is essential that in future research soapstone be treated as a linear rather than a point research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

This thesis presents the findings of an archeological survey of prehistoric soapstone procurement localities in Spartanburg and Cherokee counties, South Carolina. The purpose of this survey was to locate, record and evaluate the archeological resources relating to prehistoric soapstone quarrying activities in the vicinity of Spartanburg, South Carolina.

The study area is located east of Spartanburg along the Pacolet River (Figure 1). Eighteen quarries were identified within a 16 km^2 area which extends from along Highway 176 approximately 10.6 km east-southeast of the center of Spartanburg in a northeasterly direction to approximately 0.8 km northeast of the Spartanburg-Cherokee County line approximately 6 km north of the town of Pacolet, South Carolina (Figure 2).

Prehistoric soapstone quarries near Spartanburg, South Carolina were first reported by Overton (1969) and later by Loman and Wheatley (1970). Overton (1969) reported four soapstone quarries: 38SP11, 38SP12, 38SP13 and 38SP14. Loman and Wheatley (1970) reported five additional sites: 38SP17, 38SP18, 38SP19, 38SP20 and 38CK1. Finally, Edens (1971) reported one additional site: 38SP21. These sites were delineated based on the occurrence of worked soapstone

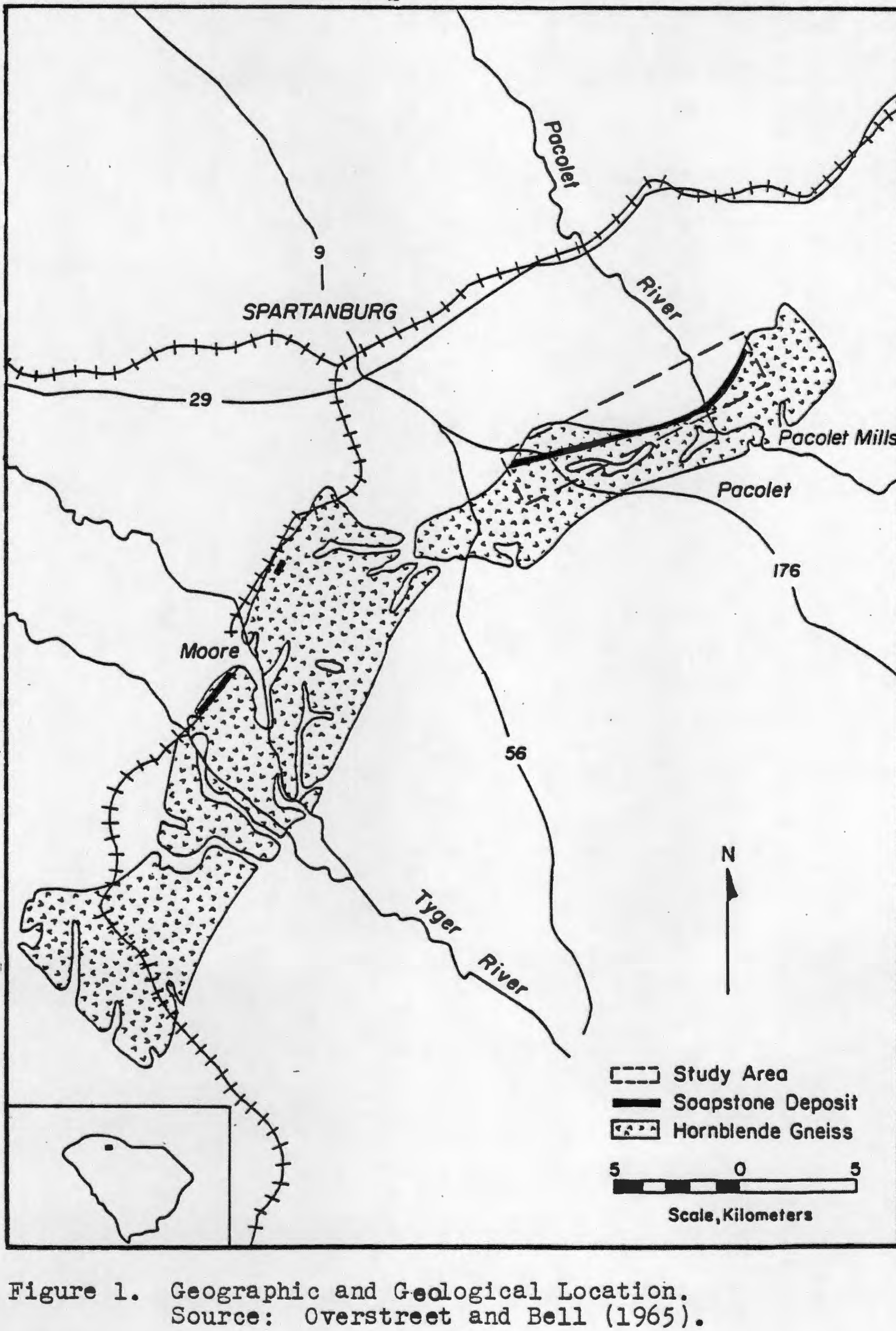


Figure 1. Geographic and Geological Location.
Source: Overstreet and Bell (1965).

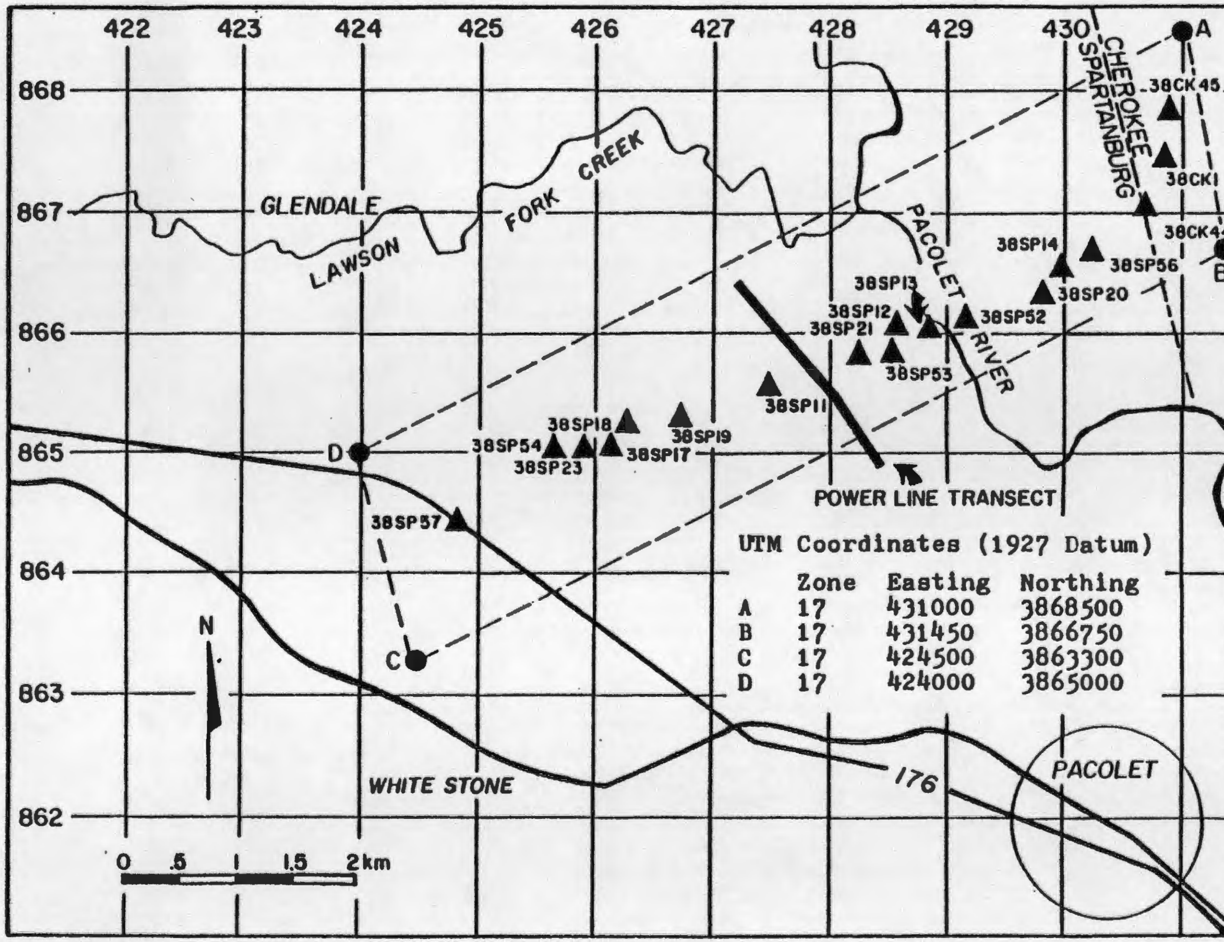


Figure 2. Study Area and Quarry Site Locations.

outcrops and quarry implements. Ferguson (1976) summarized the knowledge relating to these quarries and outlined research needs for the area. This summary included one unreported quarry (31SP23) located by Dr. Robert L. Stephenson in 1973.

Based on information from previous research in the study area and in similar quarry areas elsewhere in the eastern United States, three research objectives were formulated for this study. The first objective is to describe the nature and extent of the archeological resources relating to the full range of soapstone procurement activities in quarry localities near Spartanburg, South Carolina.

The second objective is to define the various techniques and procedures used in the production of soapstone vessels and to generate a reduction sequence model based on these techniques and procedures. Since most previous soapstone research has been concerned with little more than description of cultural materials, this thesis attempts a systematic evaluation of prehistoric behavior associated with the quarrying of soapstone vessels near Spartanburg, South Carolina with specific emphasis upon the delineation of production sequences and associated production technology. Early studies by Holmes (1897, 1919), Bushnell (1939), Kengla (1883) and Reynolds (1878) along with a recent study by Dickens and Carnes (1976) discuss various hypothetical quarrying procedures and associated reduction sequences. Using these studies and comparative materials observed at the National Museum of Natural History from the Rose Hill Quarry (Holmes 1897) in conjunction with information recovered from the study area quarries, specifically 38SP54, an attempt has been made to generate a generalized behavioral model of reduction sequences.

Similar models have been developed for other lithic reduction sequences by Collins (1975), House (1975) and Schiffer (1976). Such models allow for systematic presentation of the stages of production and various behavioral pathways into and out of these stages. Such models also allow the researcher to deal with variability manifested by qualitative and quantitative artifact variability. Finally the generation of models of this kind allow for greater ease and specificity in empirical testing and in the design of future research.

The third research objective of this study is to evaluate the patterning of quarry locations based on geologic factors and to assess the potential of this patterning for predicting additional quarry locations and to evaluate the significance of such patterning for future research. During the course of previous research in the study area by Overton (1969), Loman and Wheatley (1970), Edens (1971) and Ferguson (1976) the existence of a linear patterning in the quarries of the study area became increasingly apparent. It was noted that if consistent patterning occurred, the extension of the linear alignment of quarry localities yielded additional quarries. In this thesis an attempt has been made to evaluate the underlying geologic factors involved in the patterning and to determine the presence and importance of similar patterning in other areas.

In addition, a secondary objective was to determine the significance and consequent eligibility of the archeological resources associated with soapstone procurement activities for inclusion on the National Register of Historic Places. Accordingly a Thematic National Register Nomination has been made for the quarries discussed in this thesis.

CHAPTER II

ENVIRONMENTAL SUMMARY

The following is a brief description of the environmental setting of the study area. More detailed and thorough discussions are found in House and Ballenger (1976), House and Wogaman (1978) and Taylor and Smith (1978). Emphasized here are the geologic factors since they are vital to understanding prehistoric soapstone procurement.

Geology

The natural occurrence of soapstone in eastern North America is geographically restricted to the Piedmont and Eastern Appalachian Mountains from Newfoundland to Alabama. Geologically, these areas are composed primarily of low to high rank metamorphic rocks. These metamorphic rocks include Pre-Cambrian and Paleozoic gneisses, schists and quartzites, which generally exhibit great deformation resulting from regional tectonic activity. This deformation is exhibited in the northeast-southwest orientation of the structural trends of these rocks and in the orientation of the Appalachian Mountains themselves.

The study area is located geologically in the Inner Piedmont belt. The Inner Piedmont belt (Overstreet and Bell 1965: 54) is a zone of high grade metamorphism consisting of plutonic schists and gneisses that are intruded by concordant and discordant igneous rocks of gabbroic to granitic characters. Igneous intrusives include basalts, granites, gabbro, norites, pyroxenites and peridotites (Overstreet and Bell 1965).

Soapstone, a hydrous magnesium silicate, is formed geologically by the alteration of certain ultramafic igneous intrusives, generally peridotites, that occur within the metamorphic rocks. Ultramafic bodies occur in two chains or belts extending from Alabama to Newfoundland, one in the eastern Appalachian Highlands, the other in the Piedmont (Misra and Keller 1978). The lenticular soapstone deposits of the northwestern Piedmont of South Carolina occur in the Piedmont belt. These lenses occur as small circular to irregularly shaped bodies and dikes within and generally indistinguishable from hornblende gneiss units. The soapstone lenses in Spartanburg and Cherokee counties of South Carolina are composed of varying amounts of talc, tremolite-actinolite, chlorite, biotite, magnetite and hematite (Bohanan 1975: 96-98). These lenses occur primarily along the northwestern margin of a zone of interrelated facies of hornblende gneiss and schist (Figure 1).

Physiography

The study area is located in the Piedmont upland of northwestern South Carolina. The Piedmont Physiographic Province (Fenneman 1938) is a dissected peneplain characterized by gently rolling hills with elevations ranging from 200 to 300 meters above mean sea level. The Piedmont extends from Newfoundland to Alabama and divides the Coastal Plain Province from the Appalachian Highlands. House and Ballenger (1976) define two distinct topographic-environmental zones within the Piedmont: an inter-riverine zone and a riverine zone. The inter-riverine zone has extensive areas which range in relief from gently rolling to almost flat as well as areas consisting of relatively parallel steep-sloping ridges separated by ravines up to 200 feet in depth. The inter-riverine zone is characterized by a dendritic drainage pattern. The study area is within an inter-riverine zone. The riverine zone is defined as an area characterized by alluvial landforms such as active floodplains, levees, knolls and terraces. The study area is drained by the Pacolet River. The primary tributaries are Lawsons Fork Creek and Richland Creek. Neither the Pacolet River nor its tributaries have any appreciable floodplain development. Topographically the soapstone quarries occur along ridges. These ridges blend in as characteristic features with the rolling hills of the Piedmont.

Soils

The soils of the study area result from the in place weathering of metamorphic and igneous rocks of the region and the erosion, transportation and subsequent deposition of weathered particles of these rocks. The primary soil types occurring in the quarry areas are the Cecil series and Wilkes series (Camp 1968; Jones 1962). The Cecil series soils are deep, well drained, friable soils that occur on gently to steeply sloping landforms. The upland Cecil soils are derived from the weathering of gneiss and schist and are medium acid. The Cecil series soils occur under mixed hardwoods except in those areas which have been cultivated and are covered with pines. The Wilkes series soils are shallow, moderately well drained to excessively drained and occur in gently sloping to steep upland areas. These soils are derived from dark-colored, mixed basic and acidic rocks and are medium acid (Camp 1968; Jones 1962).

Climate

The study area today is within the humid subtropical climatic province, which is characterized by hot summers, mild winters and adequate rainfall well distributed throughout the year. The average annual precipitation is 116.3 cm with 9.1 cm occurring as snow. The average annual relative humidity is approximately 70 percent. Summer temperatures range from 59° to 96° F. Winter temperatures range from 13° to 70° F (Kronberg 1968: 76-78).

Flora and Fauna

The Piedmont of South Carolina according to Dice (1943: 16-17) lies within the Carolinian biotic province, a section of the deciduous forests of the North American Atlantic Coast. The Carolinian biotic province is primarily an oak climax community possessing a pine sub-climax community with an eastward trend toward the Fall Line. The oak climax community once contained the now near extinct chestnut. According to Braun (1950: 259-267) the Piedmont of South Carolina lies within the Oak-Pine forest region. The fauna and flora of such forests coupled with aquatic resources presumably provided a broad and abundant subsistence base for the prehistoric inhabitants. The area today bears little resemblance biotically to its conditions in prehistoric times. Oosting (1942) indicates the lack of virgin forest conditions in the Piedmont are due to extensive clearing and poor cultivation practices on the part of early settlers.

CHAPTER III

ARCHEOLOGICAL OVERVIEW AND BACKGROUND

The study area near Spartanburg, South Carolina, like much of the South Carolina Piedmont, is archeologically *terra incognita*. The distinct lack of prehistoric research in the Piedmont of South Carolina was made obvious in a summary of archeological research in South Carolina by Stephenson (1975). The primary sources of information concerning the prehistory of the Piedmont come primarily from studies in North Carolina and Georgia. The most notable study is that of Coe (1964) in which the most comprehensive temporal-stylistic sequence for the Piedmont is developed. Other studies of note include Claflin (1931), Kelly (1938), Ingmanson (1964), Caldwell and Miller (1948), Caldwell (1954), Michie (1969), Kelly (1972), House and Ballenger (1976), Taylor and Smith (1978) and Goodyear et al. (n.d.). Based in part on these studies, the prehistoric and historic culture history of the southeastern Piedmont may be divided into eight major cultural periods: Paleo-Indian (10,000-8000 B.C.), Early Archaic (8000-6000 B.C.), Middle Archaic (6000-3000 B.C.), Late Archaic (3000-800 B.C.), Early Woodland (500-200 B.C.), Middle Woodland (200 B.C.-A.D. 400), Late Woodland-Mississippian (A.D. 400-1500) and Proto-Historic to Historic. The eight major cultural periods represent a continuous occupation of the region for a time span of approximately 12,000 years.

The earliest utilization of soapstone is dated to the Middle Archaic Period (6000-3000 B.C.). During this period, archeological evidence suggests that soapstone was used infrequently except for the manufacture of atlatl weights such as those recovered from the Howard Site (40MR66) (Cridelbaugh 1977). In contrast, extensive exploitation of soapstone and the manufacture of soapstone vessels took place during the Late and Terminal Archaic Periods (approximately 2000-800 B.C.). Ford (1974) proposes that the florescence of soapstone utilization in eastern North America occurred by 1000 B.C. In the eastern United States soapstone vessels are frequently associated with a variety of broad-stemmed projectile points which make up what has become known as the broad-stemmed or broad-point tradition (Dragoo 1976).

Specifically in the southeastern United States, the earliest manifestation of the broad-point technological tradition appears to be in the Savannah River Phase of North Carolina, South Carolina and Georgia. The Savannah River Phase was originally defined by Claflin (1931). Since that time Fairbanks (1942), Coe (1964) and others have developed and expanded the application of the term. Coe (1964) considers Savannah River to be the final phase of the Archaic in North Carolina. Coe views the Savannah River Phase as a continuation and elaboration of the Middle Archaic Stanly Phase. In general, the Savannah River Phase is characterized by ground and polished stone artifacts, soapstone vessels and broad-stemmed points. Fiber-tempered ceramics are also associated in some contexts with the Savannah River Phase.

The Savannah River stemmed projectile points are the primary diagnostic artifacts of the Savannah River Phase. In the Southeast, Keel (1976) points out that the Savannah River stemmed point type is synonymous with such regional names as: Appalachian Stemmed (Harwood 1959), Benton Stemmed (Kneberg 1956) and Kays Stemmed (Kneberg 1956). In the Northeast, Ritchie (1969) indicates that such northeastern point types as Long, Lehigh, Snook Hill, Parkloma, Perkiomen and Susquehanna points are "genetically" related to Savannah River points.

Due to these similarities a well developed, relatively homogeneous and inter-related lifeway has been proposed for most of the eastern United States during the Late Archaic Period (Dragoo 1976; Cook 1976; Ford 1974; Ritchie 1959, 1969; Turnbaugh 1975; and Witthoff 1959). This lifeway is generally called the broad-point "cultural" tradition (Dragoo 1976). In this context technological tradition is a more accurate term since this supposed homogeneous lifeway is based on little more than projectile points with similarities in morphology and techniques of production. As used here, the broad-point tradition is considered a technological rather than cultural tradition.

According to Dragoo (1976) and Ford (1974) the broad-point technological tradition developed in the Southeast and spread northward. Soapstone thus diffused accordingly with the broad-point technological tradition. Evidence supporting diffusion of soapstone from the Southeastern Piedmont and Appalachian Highlands can be seen in a comparison of radiocarbon dates for the Late Archaic Period from the southeastern United States (Table 1). The earliest dated occurrences of soapstone are from North Carolina, Georgia and east Tennessee. The earliest dates in this area are around 3500 B.C. The latest dates are around 1500 B.C. Dated occurrences from southeast and central Tennessee are markedly later, ranging from around 1300 B.C. to around 900 B.C.

The differences in the dates from sites near soapstone sources in the Piedmont and Appalachian Highlands and those sites farther from the source areas indicates that diffusion of some type has taken place. The determination of the type of diffusion and the mechanisms involved are beyond the scope of this thesis.

Due to their geographic position and similarities between the temporal-stylistic artifacts from the study area and from dated sites in North Carolina and Georgia, a

TABLE 1. Radiocarbon Dates Associated with Soapstone for the Late Archaic Period.

Site/Sample Number	Uncorrected	Corrected *	Reference
Warren Wilson (31Bn29) (GX-2274)	4865 ± 280 B.P.** (2915 B.C.)	5616 ± 294 B.P. (3666 B.C.)	Keel 1975: 242
Stallings Island (M-1279)	4700 ± 150 B.P. (2750 B.C.)	5421 ± 176 B.P. (3471 B.C.)	Bullen and Green 1970: 11
Stallings Island (M-1277)	4450 ± 150 B.P. (2500 B.C.)	5116 ± 190 B.P. (3166 B.C.)	Crane and Griffin 1965: 134
Bacon Bend (40MR25) (GX-5043)	4390 ± 155 B.P. (2440 B.C.)	5042 ± 194 B.P. (3092 B.C.)	Chapman and Shea 1978: 7
Patrick (40MR40) (GX-5244)	4210 ± 160 B.P. (2260 B.C.)	4817 ± 190 B.P. (2867 B.C.)	Schroedl 1978: 190
Bacon Bend (40MR25) (UGa-1879)	4070 ± 70 B.P. (2120 B.C.)	4637 ± 124 B.P. (2687 B.C.)	Chapman and Shea 1978: 7
Gaston (31Hx17) (M-524)	3894 ± 250 B.P.** (1944 B.C.)	4411 ± 267 B.P. (2461 B.C.)	Coe 1964: 118
Stallings Island (M-1278)	3730 ± 150 B.P. (1780 B.C.)	4196 ± 198 B.P. (2245 B.C.)	Bullen and Green 1970: 12
Iddins (40LD38) (GX-4705)	3655 ± 135 B.P. (1705 B.C.)	4099 ± 187 B.P. (2149 B.C.)	Chapman and Shea 1978: 8
Bacon Bend (40MR25) (GX-5044)	3580 ± 225 B.P. (1630 B.C.)	4000 ± 260 B.P. (2050 B.C.)	Chapman and Shea 1978: 7

TABLE 1. (continued)

Site/Sample Number	Uncorrected	Corrected *	Reference
Warren Wilson (31Bn29) (GX-2275)	3455 ± 140 B.P. (1505 B.C.)	3836 ± 146 B.P. (1886 B.C.)	Keel 1976: 242
Iddins (40LD38) (GX-4706)	3205 ±145 B.P. (1255 B.C.)	3509 ± 155 B.P. (1559 B.C.)	Chapman and Shea 1978: 8
Ice House Bottom (40MR23) (GX-2155)	3120 ± 140 B.P. (1170 B.C.)	3397 ± 150 B.P. (1447 B.C.)	Glesson 1970: 132-133
Nowlin II (40CF35) (UGa-999)	3025 ± 75 B.P. (1075 B.C.)	3275 ± 93 B.P. (1325 B.C.)	Keel 1978: 156
Higgs (40LD45) (UGa-547)	2970 ± 155 B.P. (1020 B.C.)	3203 ± 158 B.P. (1253 B.C.)	Brandau and Noakes 1975: 110
Banks III(40CF108) (UGa-569)	2960 ± 135 B.P. (1010 B.C.)	3189 ± 144 B.P. (1239 B.C.)	Faulkner and McCollough 1974: 294
Nowlin II (40CF35) (UGa-935)	2920 ± 215 B.P. (970 B.C.)	3140 ± 217 B.P. (1190 B.C.)	Keel 1978: 150
Higgs (40LD45) (UGa-517)	2850 ± 85 B.P. (900 B.C.)	3050 ± 90 B.P. (1100 B.C.)	McCollough and Faulkner 1973: 55
Higgs (40LD45) (CWRU-27)	2730 ± 220 B.P. (780 B.C.)	2898 ± 226 B.P. (948 B.C.)	McCollough and Faulkner 1973: 55

TABLE 1. (continued)

Site/Sample Number	Uncorrected	Corrected *	Reference
Westmoreland-Barber (40MI11) (GX-572)	2705 $\pm$ 155 B.P. (775 B.C.)	2866 $\pm$ 217 B.P. (910 B.C.)	Faulkner and Graham 1966: 113

NOTE: * Corrected dates were interpolated from tables provided by Damon et al. (1974).

** Indicates 2 σ.

temporal estimate of from 2000 to 3500 B.C. can be made for the quarries discussed in this thesis. It should be noted that the dates from North Carolina, Georgia and some from east Tennessee indicate that the florescence of soapstone utilization in parts of the Southeast was considerably earlier than 1000 B.C. as suggested by Ford (1974).

Coe (1952) and Manson (1948) suggest that a developmental interaction existed between soapstone use and the use of ceramics during the transitional period between the Archaic and Woodland Periods. Evidence for this is the similarities exhibited between soapstone vessels and ceramic vessels with regard to general morphology and surface treatment. Soapstone was also utilized as a tempering agent in early Woodland Period ceramic types such as Marcey Creek or Seldon Island types (Manson 1948) and similar pottery reported by South (1953).

During the preceding discussion certain tentative conclusions have been indicated concerning the use and distribution of soapstone and the Late-Transitional Archaic of the Southeast. These tentative conclusions suggested by previous research can be summarized as follows:

1. Soapstone was used as early as the Middle Archaic Period but the florescence of soapstone utilization occurred during the Late-Terminal Archaic.

2. Widespread soapstone use developed in conjunction with the broad-point technological tradition in the southeastern United States.
3. Current radiocarbon dates indicate the earliest development of soapstone vessel utilization occurred with the Savannah River Phase in North Carolina, South Carolina and Georgia between 2000 and 3500 B.C.
4. Soapstone vessel utilization probably spread from a hearth area in North Carolina, South Carolina and Georgia along with the spread of the broad-point technological tradition.

CHAPTER IV

PREVIOUS SOAPSTONE RESEARCH

The earliest scientific research dealing specifically with prehistoric soapstone quarrying was conducted by Putnam (1878) in Rhode Island, Reynolds (1878) in the District of Columbia, Schumacher (1878) in California, Cushing (Baird 1879) in Virginia and by Kengla (1883) also in the District of Columbia. Later, Holmes (1890, 1897) reported on soapstone quarries in the Potomac-Chesapeake region, Finally, in the earliest part of this century excavations were conducted by Bushnell (1926) in Virginia and by Bullen (1940a,b) in Massachusetts on soapstone quarry sites. Although subsequent research has revised some of the interpretations made by the investigators, the reports contain detailed descriptions, particularly of subsurface materials and their context.

These descriptions are valuable due to the fact that since these studies were made no large scale excavations of soapstone quarries have been carried out. Notable exceptions to the descriptive nature of the early reports are the studies by Holmes (1897, 1919), Bushnell (1939), Kengla (1883) and Reynolds (1878). These studies also present in addition to quarry descriptions, comprehensive summaries of previous research and site distributions. Of greater importance, these studies along with those of Kengla (1883) and Reynolds (1878) present the best available discussions of the techniques and procedures possibly employed in prehistoric soapstone procurement. These studies also present the best available descriptions of quarrying implements and quarry products. Other descriptions of quarrying implements and quarry products are found in recent studies by Fowler (1963, 1966, 1969) in Massachusetts and by Neshko (1970) in Rhode Island.

Most investigations of prehistoric quarries have taken place in the Northeast and research has only recently begun on quarries in the Southeast. The earliest studies in the Southeast were by South (1953) in western North Carolina and by Wauchope (1966) in Georgia. Since then three additional studies have been conducted in Georgia by Watley (1968), Sheldon (1976) and Dickens and Carnes (1976). In eastern Alabama quarries have been reported by Wright (1971). The only other investigations conducted in the Southeast are by Overton (1969), Loman and Wheatley (1970), Edens (1971) and Ferguson (1976), all in South Carolina.

Like earlier investigations, most recent studies have been primarily descriptive. These studies in addition have been concerned primarily with archeological survey and little or no subsurface excavations have been carried out. The study by Dickens and Carnes (1976) is the best attempt to date to describe several quarries and associated sites within a given area. This study, like several earlier studies previously mentioned, contains testable assumptions concerning prehistoric production technology.

A final area of research relating to prehistoric soapstone procurement includes efforts by Luckenbach (1974a,b), Allen et al. (1974, 1975a,b,c), Bohanan (1975) and Becker (1976) to correlate soapstone artifacts found on prehistoric habitation sites with source areas by means of physical and chemical examination such as instrumental neutron-activation, petrographic and spectrographic analysis. The goal of these studies was to produce models of local and regional distribution and exchange systems. Samples of soapstone from quarry localities in the study area have been analyzed by Allen, Holland and Luckenbach at the University of Virginia by means of instrumental neutron-activation but substantive information concerning their distribution has yet to be forthcoming. Bohanan (1975) performed a petrographic and spectrographic analysis on two of the known quarries in the study area, 38SP13 and 38SP20 in an attempt to determine source areas for soapstone artifacts in Tennessee. Bohanan found no correlation between these quarries and the Tennessee material. The lack of correlation is probably a result of poor sampling strategy. If the analytical methods employed by Bohanan were applied to sites in North and South Carolina more relevant information might be obtained. All correlation studies employing trace element analysis of soapstone need more comprehensive and intensive investigation of the variability within and between source areas. As yet none of the studies mentioned above have been able to define confidence limits on the reliability of the techniques utilized. Until such limits are determined the results of these studies should be viewed with caution.

CHAPTER V

SUMMARY OF FIELD INVESTIGATIONS

Methodology

The field investigations of soapstone quarries in Spartanburg and Cherokee counties, South Carolina were conducted in two parts. An archeological field school in conjunction with the 1978 Wofford College Interim Program was conducted in January 1978 with additional investigations conducted between June 1978 and January 1979. The field investigations involved three phases of research:

Phase 1. Systematic Survey. This phase involved the relocation and re-evaluation of previously recorded sites and a search for new quarries and non-quarry sites within the study area.

Phase 2. Controlled surface collection and testing of quarry locality 38SP54. This phase involved the implementation of a controlled random sampling procedure on a well preserved quarry locality. This phase also involved limited testing of selected areas of the same quarry locality.

Phase 3. Geologic investigations. This phase involved an attempt to determine the geologic variability and extent of individual quarry deposits and areal occurrences of soapstone deposits in general and their relationships with the local metamorphic rocks. Such information was essential for understanding quarry context and assessing the predictive capability of the quarry patterning elsewhere in the study area and the southeastern Piedmont.

Phase 1

The purpose of the first phase of research was to eliminate inconsistencies in the previously recorded data. This was done to insure a complete and unbiased evaluation of the final corpus of data and to delineate the range of archeological resources in the study area.

Pedestrian reconnaissance was employed during Phase 1. Originally a statistical sampling procedure had been considered to allow for concise probabilistic inferences. However, due to the size, topography and vegetation of the study area, along with limited funding and resources, a non-statistical approach was employed to maximize information recovery. From previous research it was noted that the quarries were oriented linearly in a northeast-southwest fashion, therefore a transect survey following this orientation was implemented. The area covered in the transect was approximately 100 m wide and extended the length of the study area. This area included previously recorded quarry localities and areas in between.

To test for bias in the methods employed to locate quarries and to provide non-quarry site and geologic data, a second transect survey was implemented perpendicular to the first transect. Due to the heavily vegetated conditions in the project area, it had been initially proposed that the second set of perpendicular transects be walked and cleared at a set interval. However, this method proved to be too labor intensive. Thus, when a powerline clearing project was carried out in the project area, the opportunity was taken to alter the proposed research design. It was felt that a pedestrian reconnaissance of cleared areas along the powerline right-of-way fulfilled all the desired conditions of the survey. The powerline clearing allowed for greater visibility and improved accuracy in identification of rock and soil exposures and artifact recovery.

Previous investigations in the study area and elsewhere in the Piedmont indicate that severe soil erosion over most of the upland areas and a concomitant increase in deposition in low lying areas has occurred due to intensive agricultural activity from the mid-1800's to the early 1900's. In some cases, from six to eight feet of deposition has occurred on some Piedmont floodplains within the past 200 years (Trimble 1974). Due to agriculturally induced erosion, soil development in the uplands has been greatly disturbed. In many areas erosion has removed the A Horizon or topsoil and much of the B Horizon. Consequently the sites which occur in the uplands are generally deflated with extremely disturbed archeological contexts. Therefore, when the opportunity to survey the powerline cut presented itself it was acknowledged that the artifact context would be disturbed but it was felt that such disturbance would be no greater than the existing widepsread disturbance due to agricultural practices and related erosion.

The cleared area of the powerline cut extended from UTM: Zn. 17; N3866400; E427200 to UTM: Zn. 17; N3864400; E428050 and was approximately 2.5 km in length by approximately 25 m in width (Figure 2, p. 3). Visual reconnaissance of the area thus included approximately 62,500 m^2.

All quarry and non-quarry sites encountered during Phase 1 were plotted on aerial photographs (Scale 1":400') and USGS quadrangles. Sketch maps were drawn and South Carolina site survey forms were completed for each site. When possible, limited surface collections were made in an attempt to determine cultural affiliation and range of lithic raw material utilized.

Phase 2

The purposes of the second phase of field research involving the controlled collection of quarry site 38SP54 were:

1. To determine the nature and types of surface materials.
2. To obtain a representative collection of surface materials for analysis.
3. To delineate areas for subsurface testing from which to determine the presence or absence of vertical integrity.
4. To obtain precise artifact locations for subsequent studies of possible patterning in the surface materials.

From a datum point located along a fence row at the southeast corner of the site, a rectangular grid of 10 x 10 m collection squares was established over the site area (Figure 3). A 3200 m^2 area located across the approximate center of the site and containing most of the prominent quarry features and densest artifact concentrations was chosen for study. Thirteen random collection squares from this portion of the site constituting 1300 m^2 were chosen from a table of random numbers. The 13 squares represented a 30% random sample of the selected stratum. The 13 selected squares were cleared of underbrush and systematically collected.

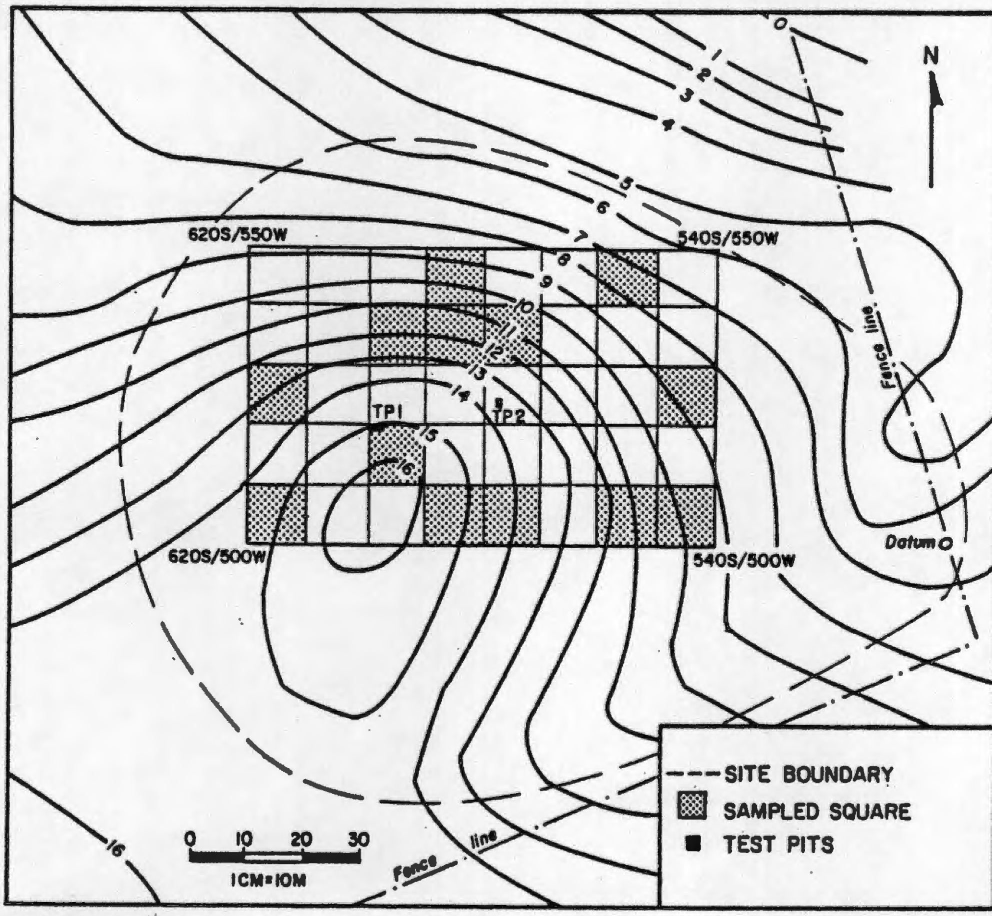


Figure 3. Site Map: 38SP54.

Based on the controlled surface collection and feature locations, two small test pits were excavated at the site. The test pits, 1 x 3 m and 1 x 1.5 m respectively, were placed so as to yield information concerning the two most prominent quarry features: large depressions and worked outcrops. Accordingly, Test Pit 1 was excavated across the edge and into the center of a major depression. Test Pit 2 was excavated adjacent to the base of a large outcropping boulder exhibiting partially buried evidence of quarrying activity.

Phase 3

The third phase of the field research involved geologic investigations which consisted of several interrelated studies. To determine the nature and extent of the apparent lenticular deposits of soapstone in which the outcrops exhibiting quarrying activity occur, a procedure was developed in which shovel testing of soil was employed in an attempt to determine the boundary at which soapstone soils turned to gneissic soils. The area chosen for testing was between Gold Mine Road and the Pacolet River. This area includes four quarry localities: 38SP12, 38SP13, 38SP21 and 38SP53. A base line approximately 950 m long was established extending from Gold Mine Road to the Pacolet River along an old roadbed. Perpendicular testing transects were run due north and south at 100 m intervals along the base line with shovel tests being made approximately every 25 m until soapstone soil was no longer encountered. A total of ten transects were walked. Also during Phase 3 outcropping boulders were inspected to determine mineralogical composition and lithological variability. This inspection was also made to acquire data from which structural relationships between the soapstone outcrops and the local metamorphic rocks could be inferred.

Results of Field Investigations

Phase 1

During the first phase of the field investigations 10 previously identified sites and eight additional sites were recorded (Figures 4-7 and Table 2). Low density non-quarry artifact scatters were recorded at six distinct loci along the powerline cut (Figures 5 and 6). Eleven additional non-quarry loci were also located elsewhere in the study area. The materials recovered from the 17 non-quarry loci are summarized in Tables 3 and 4 and Figures 8 and 9. Originally it was anticipated that the materials recovered from non-quarry loci would allow inferences concerning variability in settlement related activities and relative chronologic positions of the quarries with respect to temporal-stylistic artifacts. Unfortunately the

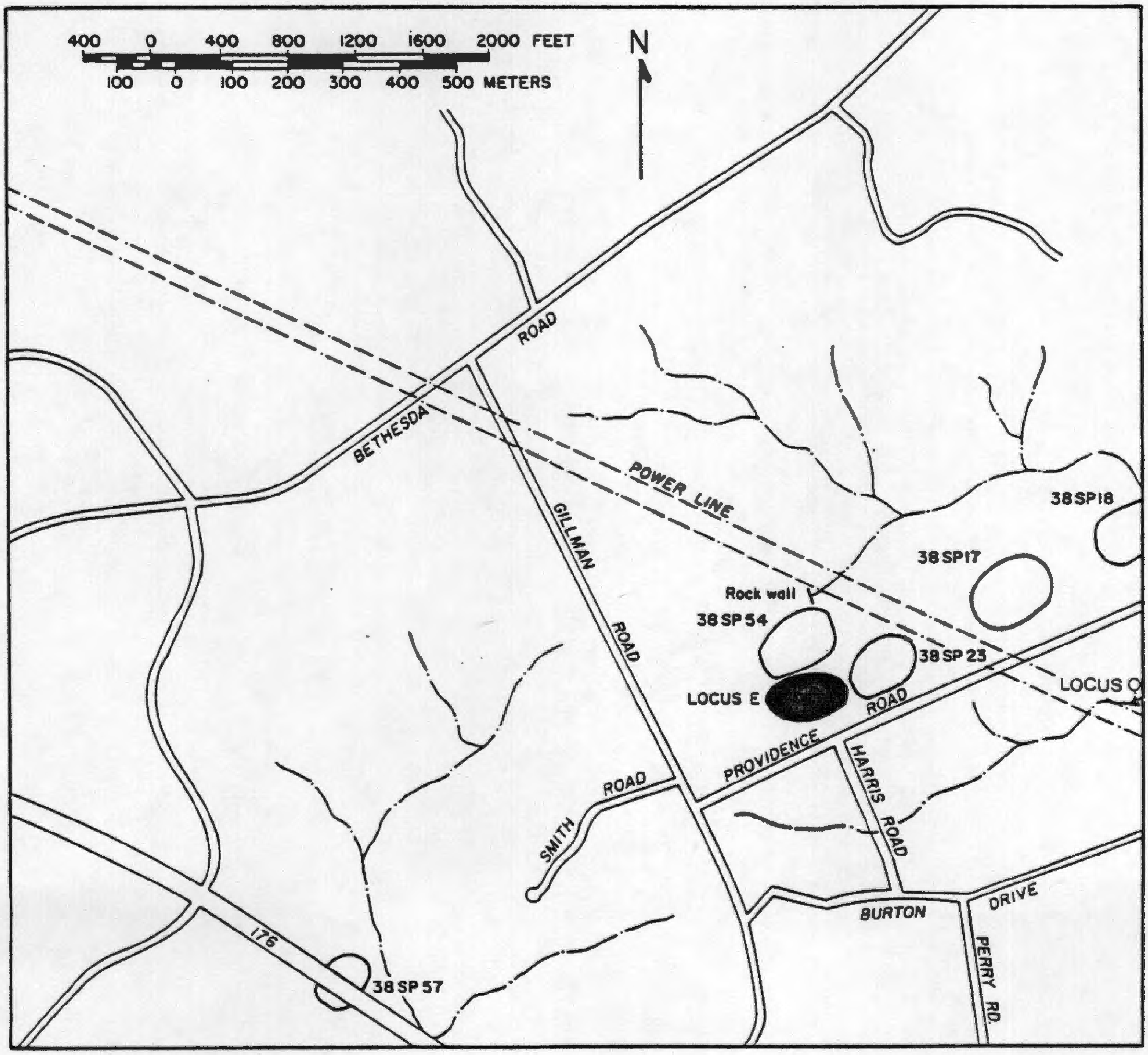


Figure 4. Site Locations: 38SP17, 38SP18, 38SP23, 38SP54, 38SP57, Locus E, and Locus Q.

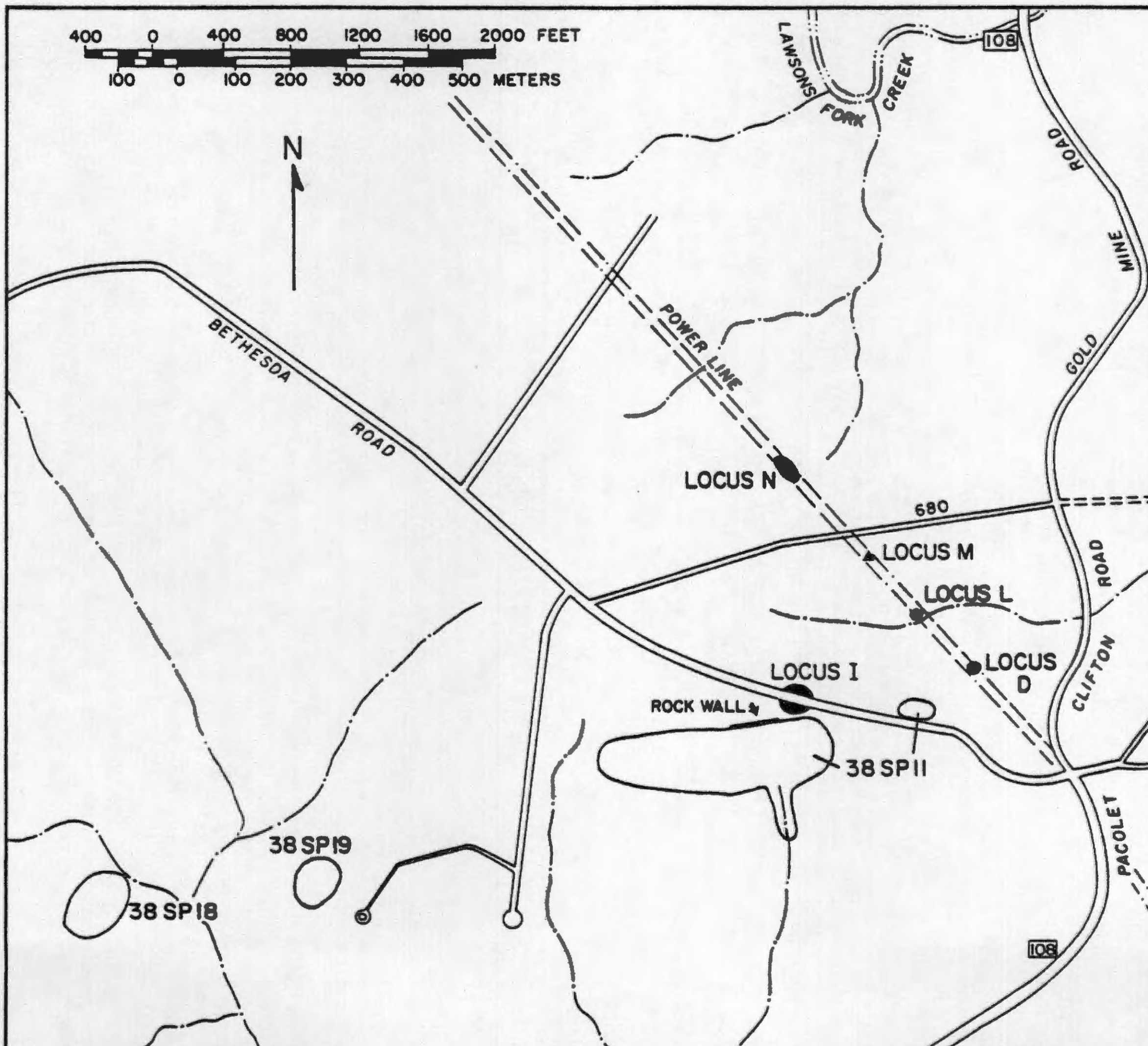


Figure 5. Site Locations: 38SP11, 38SP18, 38SP19, Locus D, Locus I, Locus L, Locus M, and Locus N.

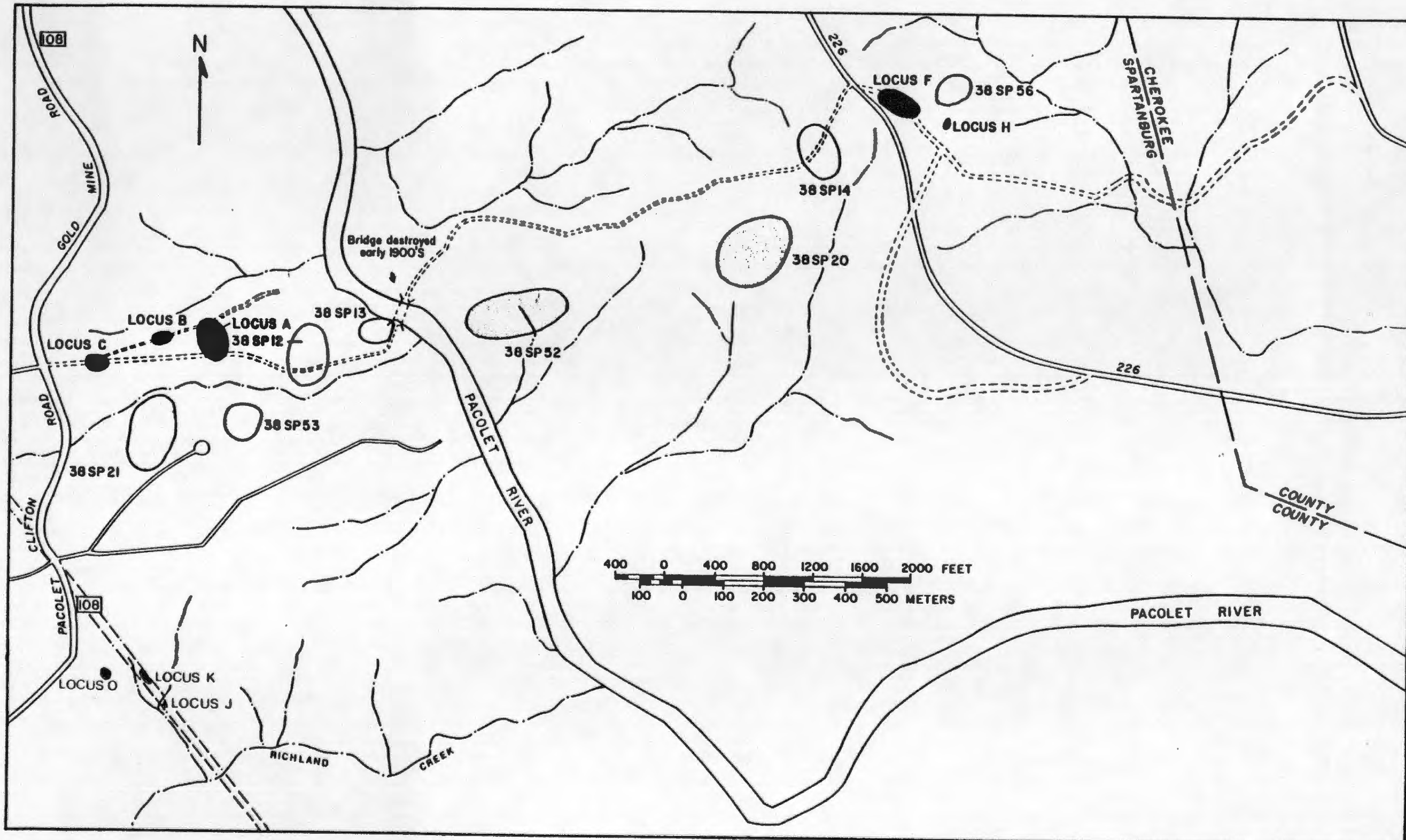


Figure 6. Site Locations: 38SP12, 38SP13, 38SP14, 38SP20, 38SP21, 38SP52, 38SP53, 38SP56, Locus A, LocusB, Locus C, Locus F, Locus H, Locus J, Locus K, and Locus O.

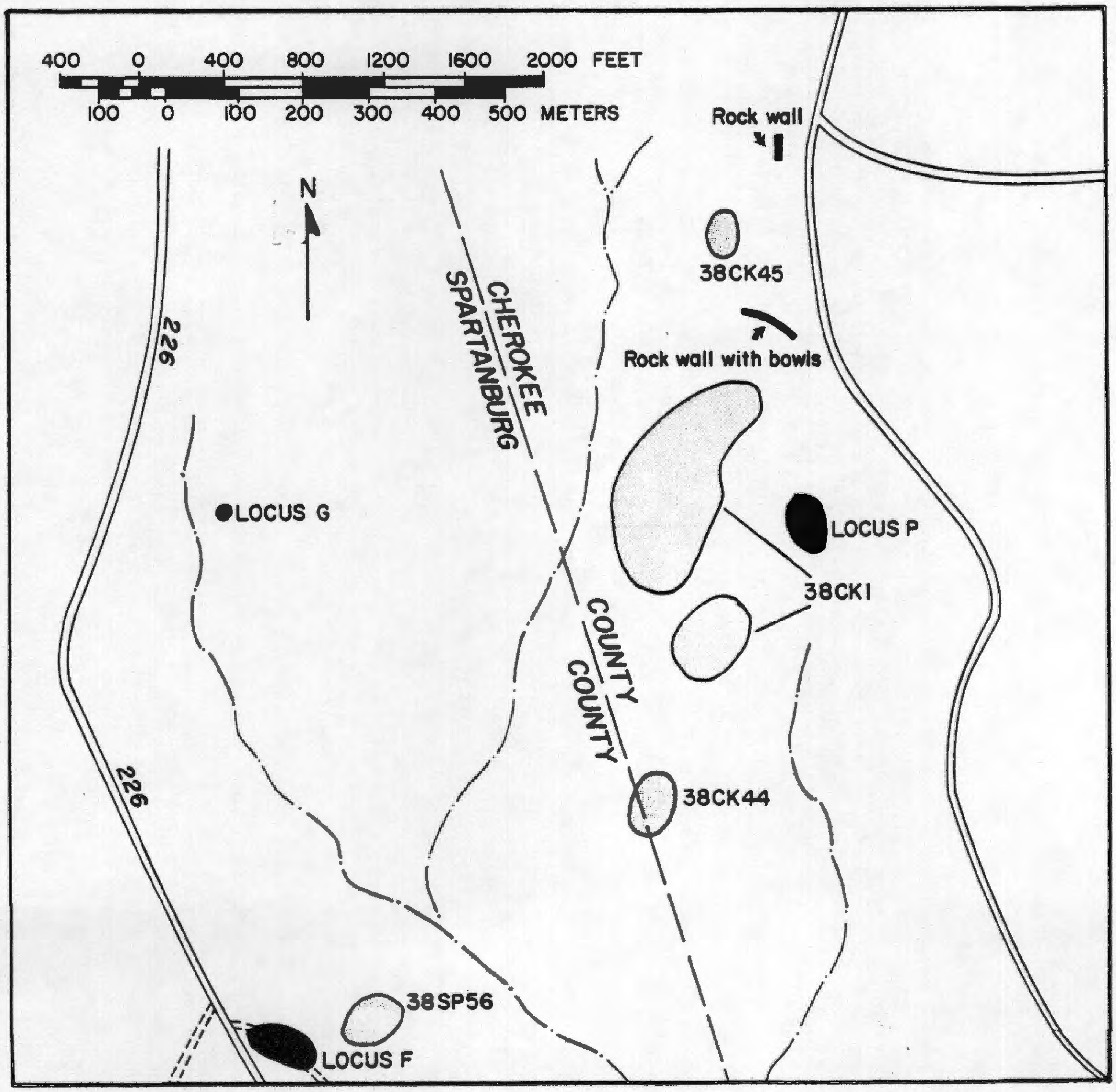


Figure 7. Site Locations: 38SP56, 38CK1, 38CK44, 38CK45, Locus F, Locus G, and Locus P.

TABLE 2. Quarry Site Descriptions.

Site Locations				Descriptions					
	UTM COORDINATES								
SITE	ZN	EAST	NORTH	ELEVATION (ft)	AREA (ha)	SOIL ASSOCIATION	QUARRY BOULDERS	QUARRY PITS	QUARRY PRODUCTS RECOVERED
38SP11	17	427500	3865500	650	4.2	Cecil Sandy Loam	X		7
38SP12	17	428650	3866000	580	1.5	Wilkes Sandy Loam	X	X	0
38SP13	17	428900	3866075	530	.4	Wilkes Sandy Loam	X		0
38SP14	17	430000	3866550	680	.8	Cecil Sandy Loam	X	X	0
38SP17	17	426175	3865100	730	1.5	Wilkes Sandy Loam	X	X	0
38SP18	17	426400	3865175	630	.9	Cecil Clay Loam	X		0
38SP19	17	426750	3865300	660	.5	Cecil Clay Loam			1
38SP20	17	429900	3866350	670	1.5	Wilkes Sandy Loam	X	X	0
38SP21	17	428300	3865800	640	1.5	Cecil Sandy Loam	X		1
38SP23	17	425875	3865000	720	1.0	Cecil Clay Loam	X	X	3
38SP52	17	429175	3866275	630	2.2	Wilkes Sandy Loam	X	X	0
38SP53	17	428575	3865825	620	.75	Cecil Sandy Loam	X		1
38SP54	17	425725	3865050	740	1.5	Cecil Clay Loam	X	X	307
38SP56	17	430275	3860675	660	.6	Cecil Sandy Loam			0
38SP57	17	424900	3864400	710	.75	Wilkes Sandy Loam	X		1
38CK1	17	430825	3867425	720	5.6	Cecil Clay Loam	X	X	4
38CK44	17	430700	3867050	720	1.6	Cecil Clay Loam	X		0
38CK45	17	430900	3867875	720	.3	Cecil Clay Loam			0

TABLE 3. Non-Quarry Site Descriptions.

SITE LOCUS	Site Locations: UTM COORDINATES ZN	EAST	NORTH	Descriptions: ELEVATION	AREA	SOIL ASSOCIATION	Components: ARCHAIC	WOODLAND	HISTORIC	UNKNOWN	PREHISTORIC
A (38SP61)	17	428450	3866050	620'	.75ha	Cecil Clay Loam	X				
B (38SP62)	17	428300	3866050	630'	$75m^2$	Cecil Clay Loam	X				
C (38SP63)	17	428175	3866010	660'	.2ha	Cecil Clay Loam	X				
D (38SP64)	17	427850	3865680	700'	.1ha	Cecil Clay Loam	X				
E (38SP65)	17	425750	3864950	740'	1.1ha	Cecil Clay Loam			X		X
F (38SP66)	17	430150	3866625	680'	.5ha	Cecil Sandy Loam			X		X
G (38SP67)	17	430115	3867425	635'	.25ha	Cecil Clay Loam					X
H (38SP68)	17	430300	3866525	680'	.25ha	Cecil Sandy Loam	X				
I (38SP69)	17	427650	3865615	695'	.2ha	Cecil Sandy Loam	X				
J (38SP70)	17	428325	3865090	560'	0ha	Cecil Clay Loam		X			
K (38SP71)	17	428865	3865180	600'	.075ha	Cecil Clay Loam					X
L (38SP72)	17	427725	3865820	660'	.04ha	Worsham Fine Sandy Loam					X
M (38SP73)	17	427650	3865900	675'	$30m^2$	Cecil Clay Loam	X				
N (38SP74)	17	427540	3866040	700'	.4ha	Cecil Sandy Loam					X
O (38SP75)	17	428175	3865200	620'	.05ha	Cecil Clay Loam					X
P (38CK53)	17	430050	3867390	725'	.6ha	Cecil Sandy Loam	X		X		
Q (38SP76)	17	426300	3864950	655'	0ha	Pacolet Sandy Loam	X				

TABLE 4. Description of Artifacts from Non-Quarry Sites.

Site Locus	Projectile Points/ Knives Fragments	Bifaces & Biface Fragments	Unifaces	Other Lithics	Bifacial Thinning Flakes	Unidentifiable Flakes and Angular Fragments	Chunks	Hammerstones and Pitted Cobbles	Soapstone Artifacts	Basalt Tools	Quartzite Discoidals	Historic Artifacts	Totals
A	3	11	2	4	9	101	22		4		1		157
B	2					3	1		1				7
C	1				3	16	1						21
D	1	5		1		21	4						32
E		4	2		10	31	3		1			3	54
F		2		2		23	9					2	38
G	1				3	29	5						38
H		1			8	184	1		1				195
I						5			2	4	1		12
J	1												1
K		1		1	1	4							9
L		3		1	3	13	2						22
M	1	1				1	1						4
N		1			3	9	3						16
O		2			4	9	1						16
P	1	2	1		1	6		2		1		2	16
Q									1				1
Type Totals	11	33	5	9	45	455	53	2	12	5	2	7	639

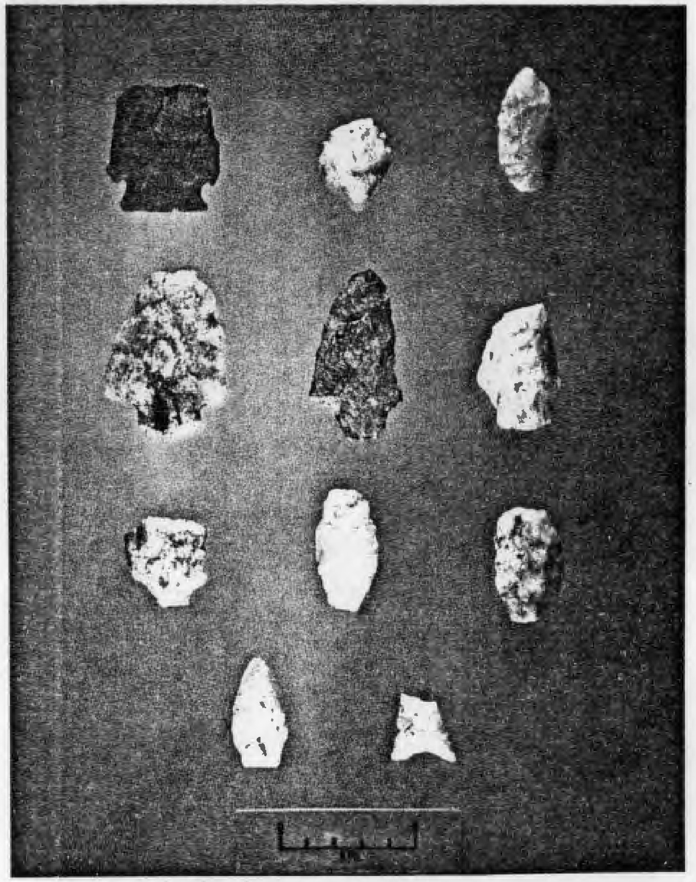


Figure 8. Projectile Points/Knives from Non-Quarry Sites in the Study Area.

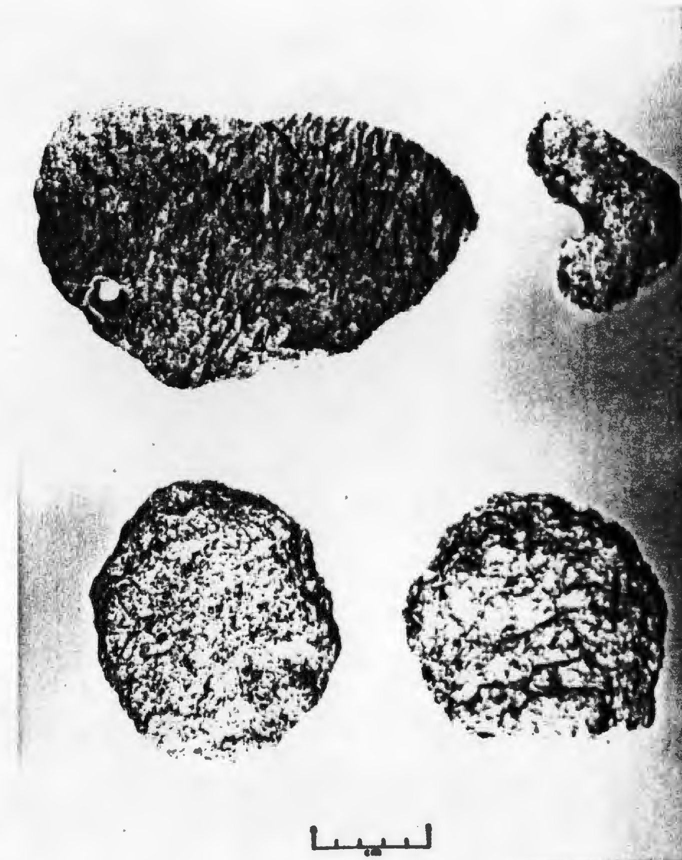


Figure 9. Artifacts from Non-Quarry Sites in the Study Area. (R to L: Vessel Sherd-Note Mend Hole; Unidentifiable Soapstone Artifact; 2 Quartzite Discoidal Choppers).

collections were too small, disturbed and lacking diagnostic artifacts to make such inferences (Table 3 and 4). It was also anticipated that inferences concerning non-soapstone lithic resource procurement patterns might be made. Although artifact recovery was small, the data suggest a localized lithic resource procurement pattern indicative of the Late Archaic Period (Table 5).

Phase 2

During the controlled surface collection of site 38SP54 approximately 400 plus artifacts consisting primarily of quarry products and quarry implements were recovered and their point provenience recorded. Table 6 summarizes the raw material distribution of the artifacts recovered. Figure 10 presents the distribution of the worked soapstone artifacts. If the data from the controlled surface collection is representative of the total site, a rough estimate of approximately 2000 plus artifacts can be made for the total surface scatter of site 38SP54.

Also during the second phase of the field research, Test Pit 1 was excavated to an average depth of 40 cm below ground surface. Four strata were delineated: a humus zone (Stratum I), an unconsolidated tan clay zone (Stratum II), a tan-orange clay zone (Stratum III) and an orange clay zone (Stratum IV). The amount of soapstone, both worked and unworked, contained in the test pit decreased with depth

TABLE 5. Non-Quarry Site Artifacts by Raw Material.

Site Locus	Quartz	Quartzite	Felsite	Chert	Soapstone	Basalt	Gneiss	Totals
A	150	1	2		4			157
B	6				1			7
C	19	2						21
D	32							32
E	49			1	1			51
F	34	1	1					36
G	38							38
H	194				1			195
I	5	1			2	4		12
J	1							1
K	6	1			2			9
L	22							22
M	4							4
N	16							16
O	16							16
P	10		1			1	2	16
Q					1			1
TOTALS	602	6	4	1	12	5	2	632
%	95%	1%	1%	<1%	2%	1%	<1%	100%

TABLE 6. Controlled Surface Collection: Site 38SP54.

Unit	Worked Soapstone	Basalt	Gneiss	Olivine	Quartzite
550S 510W	3				11
560S 510W	7			1	7
580S 510W	13*			1	18
590S 510W	27	3	1	4	27
620S 510W	21	1		2	4
600S 520W	17	1			6
550S 530W	8				6
620S 530W	11	1		1	9
580S 540W	13		1		2
590S 540W	14	1		2	1
600S 540W	28			3	7
560S 550W	7	1	1	1	11
590S 550W	14			3	4
Other Units	28	2			2
Totals	211	10	3	18	115

NOTE: * This total includes one unfinished tombstone.

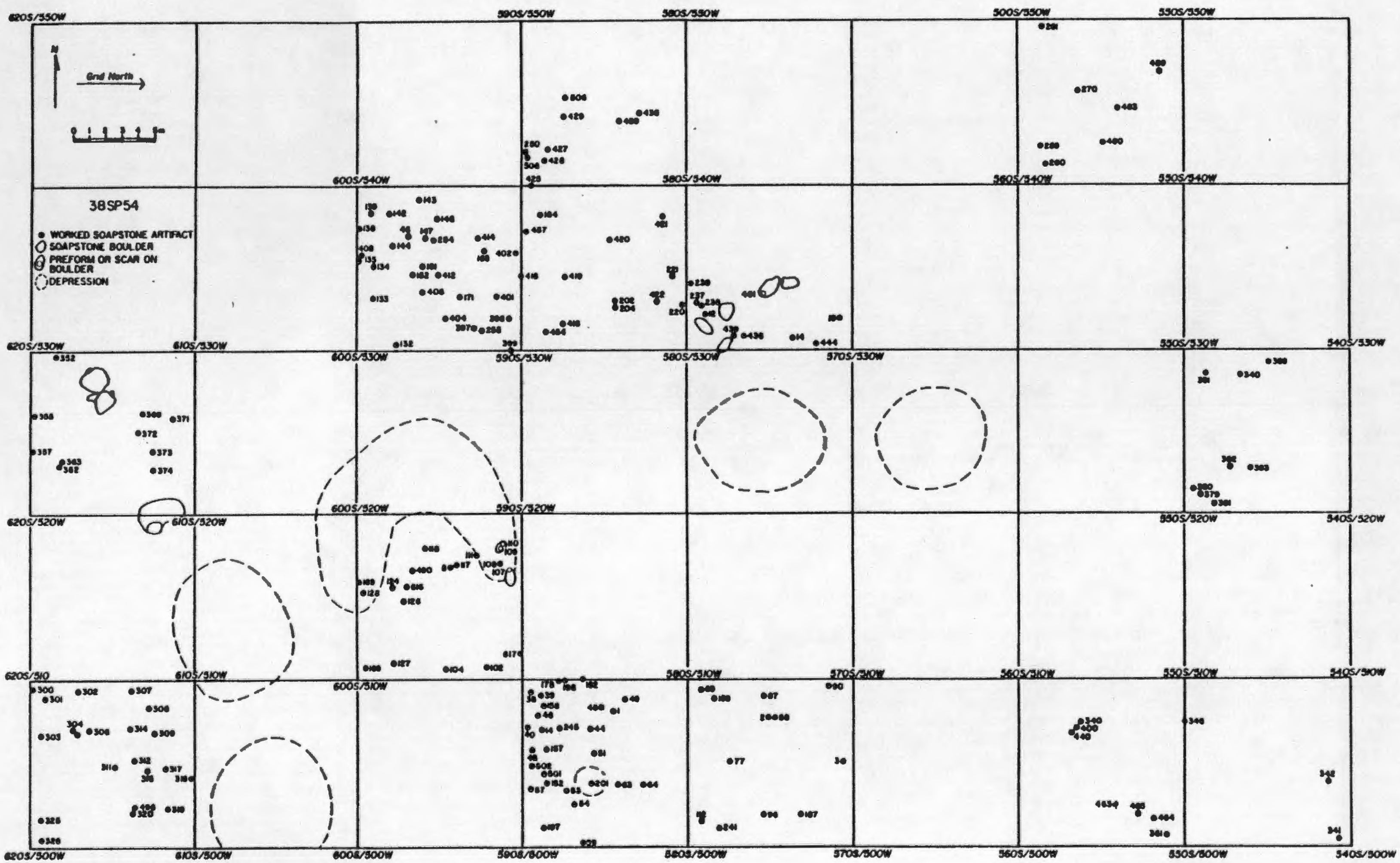


Figure 10. Distribution of Worked Soapstone from Controlled Surface Collection.

whereas the amount of quartzite increased with depth. It was assumed that the orange clay zone was sterile C Horizon soil or saprolite and therefore excavation ceased when it was reached. Artifacts and soapstone detritus were recovered from the humus and tan clay zones which had a combined average depth of approximately 25 cm below ground surface (Table 7).

Test Pit 2 (Table 8, Figures 11-16) was excavated to a maximum depth of approximately 90 cm below ground surface. Again, four strata were delineated: a humus zone (Stratum I), an unconsolidated tan clay zone (Stratum II), an orange sandy-clay zone of pegmetite saprolite (Stratum III) and a tan-orange clay zone which graded into soapstone saprolite (Stratum IV). The unconsolidated tan fill extended to a maximum depth of 80 cm below ground surface in some areas of the test pit. This fill contained artifacts and detritus throughout. These artifacts, along with the character of fill from Test Pit 2 are summarized in Table 8. During the excavation of Test Pit 2 it became apparent that a pit, not visible on the surface due to filling, surrounded the boulder. At a depth of 80 cm below surface artifacts were encountered which rested upon the bottom of the prehistoric pit.

TABLE 7. Test Pit 1 Artifact Summary: Site 38SP54.

Stratum	Worked Soapstone	Quartzite	Other Lithics	Volume of Fill	Volume of Debitage	Unworked Soapstone > 10cm
I	7	43	11			
II	9	505	16	Data Not Recorded		
III	16	85	13			
Totals	32	633	40			

TABLE 8. Test Pit 2 Artifact Summary: Site 38SP54

Stratum	Worked Soapstone	Quartzite	Other Lithics	Volume of Fill	Volume of Debitage	Unworked Soapstone > 10cm
I	2	10	—	13.2 l	5.7 l	22
II	17	120	8	22.7 l	16.1 l	54
III	8	115	12	35.9 l	7.6 l	56
IV	8	26	5	19.9 l	7.6 l	40
Totals	35	271	25	91.7 liters	37 liters	172

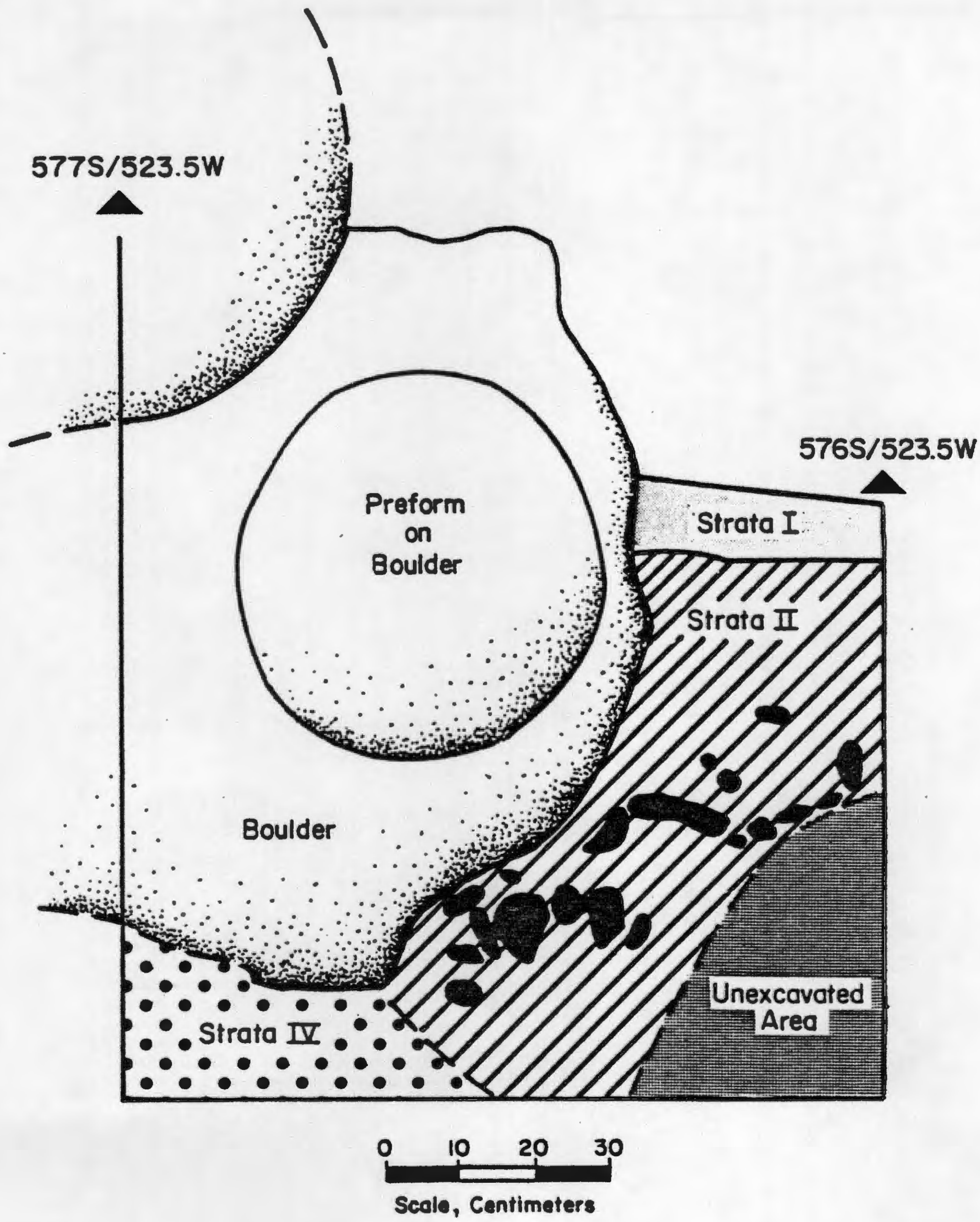


Figure 11. 38SP54 Test Pit 2 North Profile.

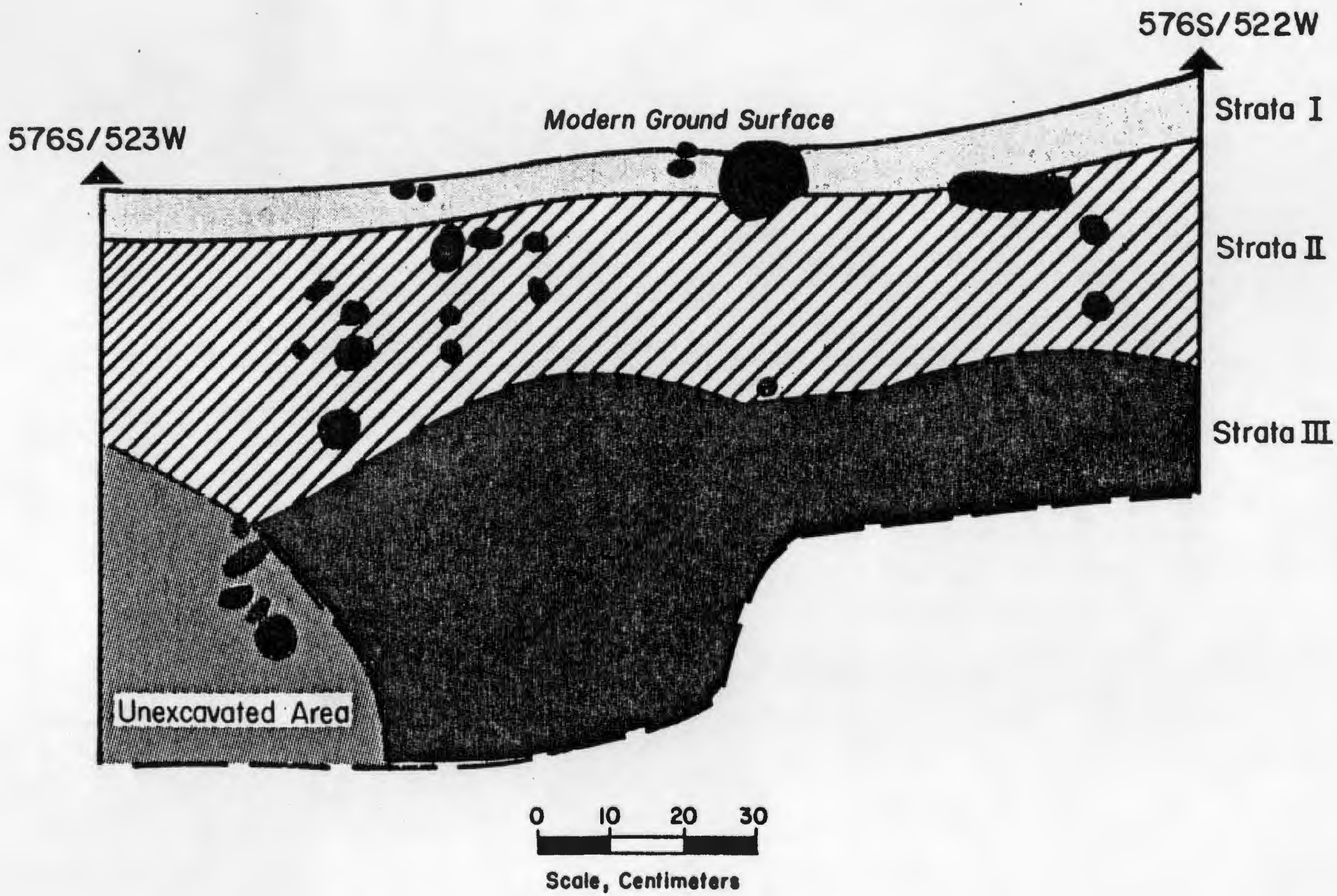


Figure 12. 38SP54 Test Pit 2 East Profile.

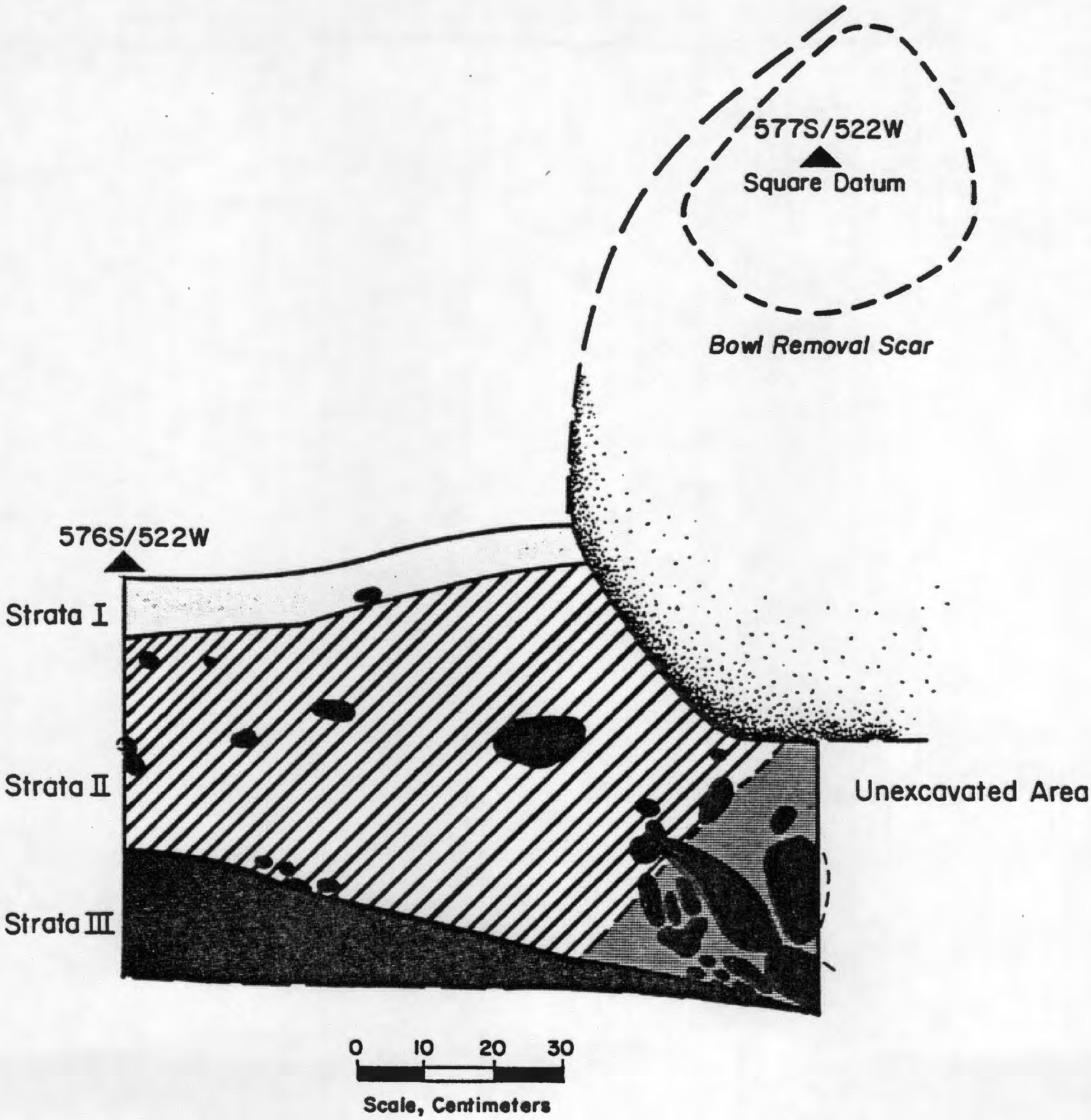


Figure 13. 38SP54 Test Pit 2 South Profile.

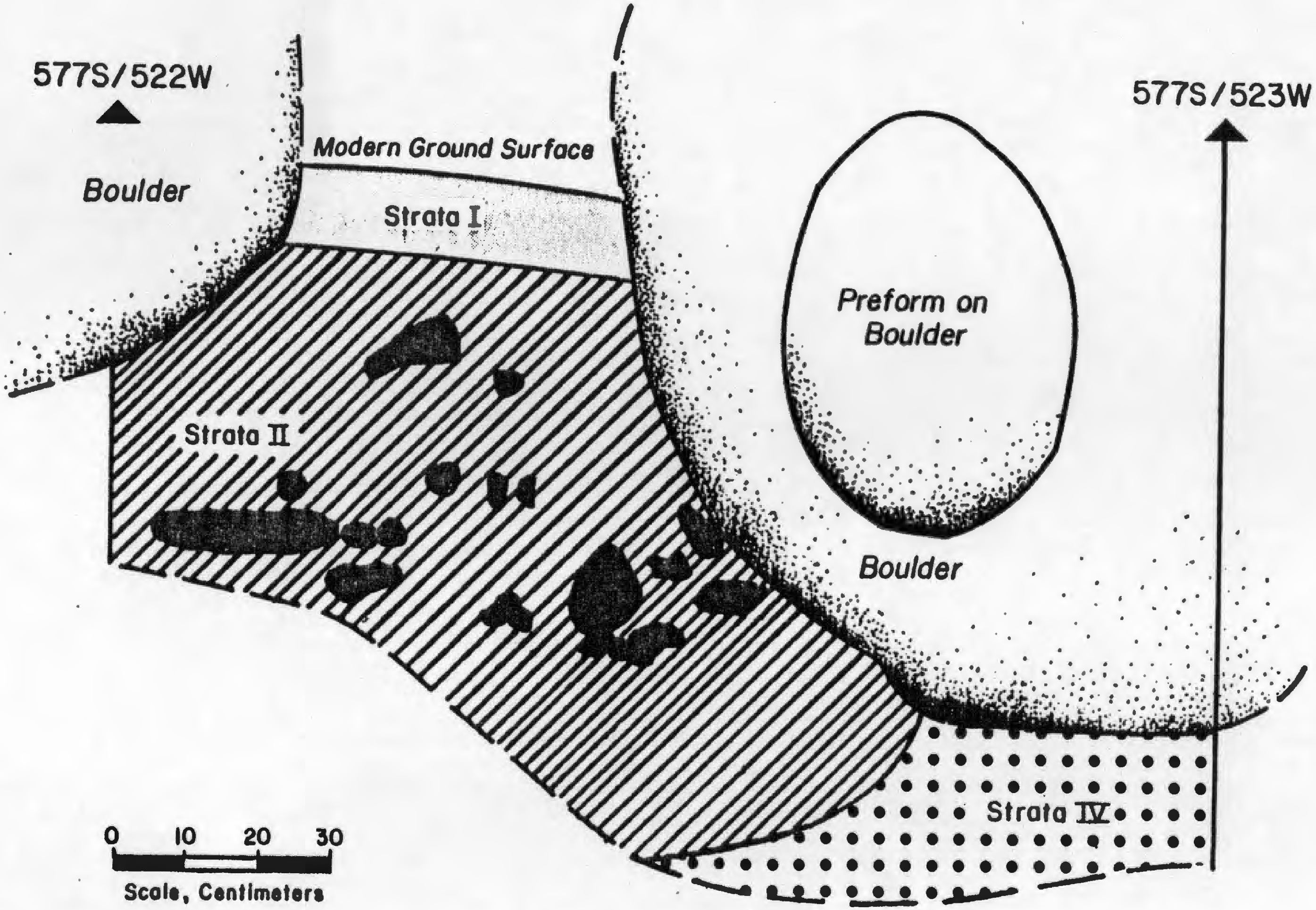


Figure 14. 38SP54 Test Pit 2 West Profile.

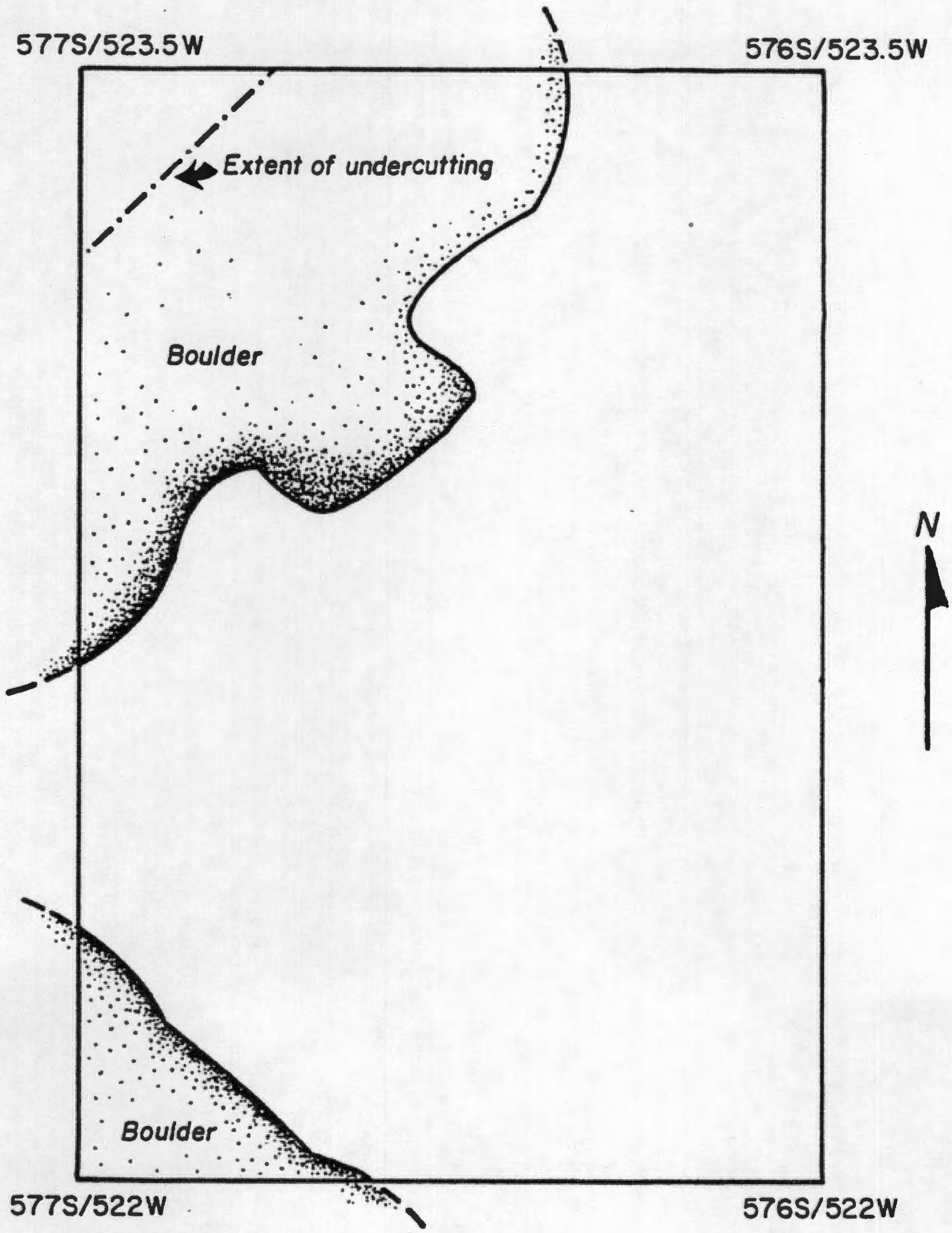


Figure 15. 38SP54 Test Pit 2 Top View.

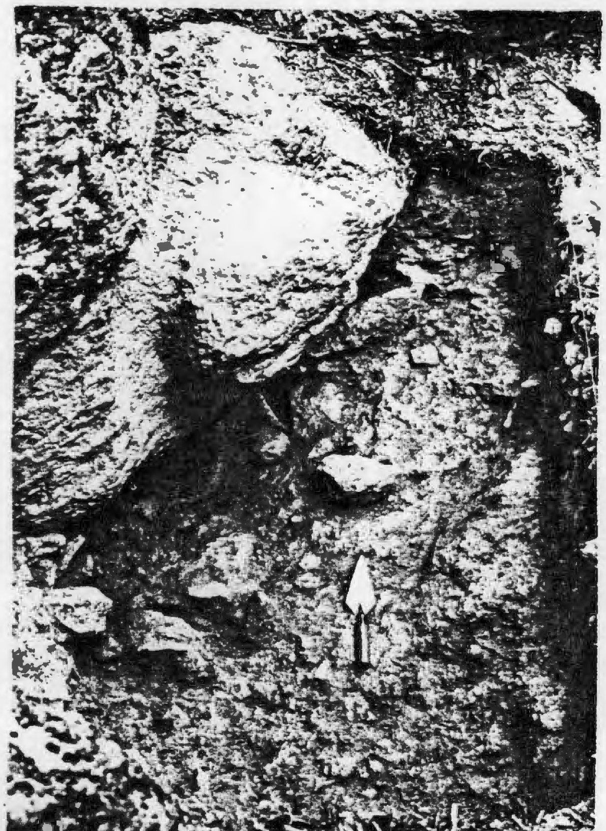


Figure 16. Test Pit 2: Site 38SP54.

Phase 3

The results of the geologic shovel testing indicate that the area of soapstone deposit investigated has a width of from 90 to 350 m. Shovel testing has a wide margin for error and a few anomalous figures for width were obtained during the testing. But in spite of the high probability for error, a few important factors are indicated. First, a gross estimate estimate for width no exists to aid in distributional and structural analysis of the overall occurrence of soapstone where no such information previously existed. Second, there appears to be a degree of sub-surface continuity between visible outcrops. Finally the overall deposit appears to conform to the general northeast-southwest structural trends of the other rocks in the area.

The lithological inspection of boulders at sites 38SP12, 38SP14, 38SP23 and 38SP54 indicated that within a single quarry deposit there exists a great deal of variation within the outcrops due to differeing degrees of alteration during the formation process. Variation exists in lithology and there are also differences in homogeneity due to varying degrees of foliation. These factors were apparently involved in the prehistoric decision making process as to whether or not a particular boulder was suitable for vessel production. The field investigations indicate that the most heavily exploited areas of soapstone are the most massive and homogeneous and possessed the most talc due to higher degrees of hydrothermal alteration. Therefore they were the softest and most manageable soapstone. The preceding factors also indicate why outcrops of chlorite rich rocks similar to soapstone were noted during the powerline transect of Phase 1 and northeast of quarries 38SP20 and 38SP52. These outcrops were approximately 500 m northwest of the soapstone outcrops. These rocks are generally harder and less homogeneous than soapstone probably due to a lower degree of hydro-thermal alteration. A structural association between these rocks and the soapstone is indicated but the nature of this relationship could not be readily determined and was considered beyond the scope of this study.

Finally, during Phase 3 it was noted that the joint surfaces found within the massive boulders were utilized prehistorically as guides for the removal of material. However, when hidden during the removal stage and later stages of vessel production, these joint surfaces appeared to be the most common cause of breakage and consequent discard. Holmes (1897) noted similar prehistoric utilization of joints which he called laminations.

CHAPTER VI

QUARRY DESCRIPTION AND CONTEXT

The soapstone quarries near Spartanburg are morphologically similar, exhibiting the same general features and comparable contextual relationships. The quarries generally occur along ridges in mixed hardwood stands with surrounding areas composed primarily of conifers (Figure 17). Technically the whole series of outcrops discussed in this thesis can be considered a single site or extraction zone. In the field however, distinct sites were defined. The criteria listed below were used in defining quarry sites:

1. The presence of outcropping boulders exhibiting prehistoric modification.
2. The presence of large man-made depressions created in the process of acquiring unweathered soapstone.
3. The presence of a well defined concentration of worked and unworked soapstone with a high relative density compared to adjacent areas.

These criteria were satisfied in most cases but the presence of all three was not a necessary requirement for site determination.

Before proceeding to a detailed quarry description, a consideration of what Schiffer (1976: 27-40) terms cultural and noncultural site formation processes or what Wildesen (1973: 6-17) terms site development processes is

Figure 17. Site 38SP11.

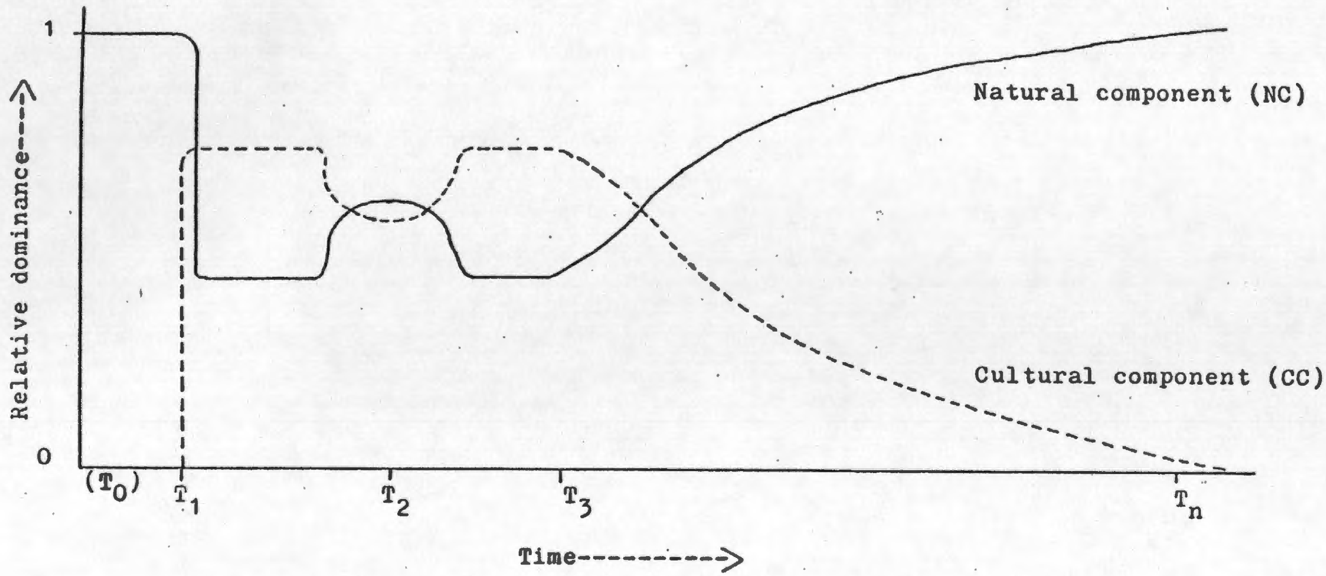
required. Consideration of these processes is vital to an understanding of the contextual relationships within quarries.

Wildesen (1973: 7) considers an archeological site as a functionally distinct system composed of two components or subsystems: one cultural, the other natural. The operation of processes within these two subsystems determines the spatial and temporal boundaries of the site which Wildesen (1973: 3) defines as a four dimensional unit of time and space.

> The spatial boundaries of any site are defined by the line of transition from archaeological properties to non-archaeological properties; the temporal boundaries are defined initially by the onset of occupation, and finally by the obliteration of distinctive archaeological properties. The site development process can be viewed as the overall trajectory of the total site system through time (Wildesen 1973: 7).

Wildesen (1973: 9-10) presents an idealized model describing the trajectory of a site system through time. This model has been reproduced in Figure 18.

Within the site system the cultural and natural subsystems function interactively and can be conceived of as having specific periods of dominance although the overall pattern of interaction is one of co-dominance. To understand the pattern of co-dominance and the function of a site as a system, it is of primary importance to understand the concept of dynamic or active equilibrium. A system



T_0 Before human occupation. The properties of a spot in the landscape are entirely the result of the operation of natural processes. The system trajectory is that of a natural system.

T_1 Initial human occupation. This defines a temporal boundary of the site system.

T_3 After final abandonment. The natural component again dominates site system behavior. With increasing time, to T_n, the effects of human occupation become decreasingly evident, and the site system trajectory increasingly approximates the trajectory of a purely natural system.

Figure 18. Relationship Through Time of the Cultural Component (CC) and the Natural Component (NC) of an Archeological Site System. (After Wildesen 1973:11)

in dynamic equilibrium is sustained by negative feedback and is characterized by continual minor oscillation and energy input. As Wildesen (1973: 8) points out, the site system during occupation is in a state of dynamic equilibrium:

> . . . at anytime after T_1, the site system remains the same system, although it may pass through a series of states. Thus a shift in dominance of cultural and natural subsystems (as at T_2) is defined as an alteration in the internal configuration of the system . . . .

In this discussion, Wildesen's term alteration is synonymous with oscillation. These oscillations can be described as a series of events.

> The kinds of events reflected at T_2 may include replacement of one culture by another, abandonment and subsequent reoccupation by members of the same culture, or an episode of natural component dominance during a more or less continuout occupation (Wildesen 1973: 8).

The energy input from both cultural and natural energy is unceasing although variable for the site system during occupation (T_1 through T_3 in Figure 18). It should be noted that human site occupation not only includes prehistoric use but also post-Columbian use as well.

Utilizing Wildesen's model (Figure 18) for an archeological site system, an evaluation can be made of the site formation processes for a generalized soapstone quarry site. Since soapstone is a lithic resource, the primary noncultural processes of the natural component are geologic. At time T_0 the natural component represents a distinct subsystem of the ecosystem which is also in dynamic equilibrium and has an important past trajectory. Since the forming of soapstone approximately 180 million years ago in a specific three dimensional space, which will eventually be delineated by the spatial boundaries of the site system at time T_1, geologic processes have occurred which effect the structure of the site system. Specifically, 12 to 18 miles of rock have been removed by weathering and subsequent erosion to expose the prehistoric landscape. The primary process has been differential erosion caused by mechanical and chemical weathering of rock units with varying degrees of resistance to weathering. The results of differential weathering are the production and development of:

1. Ridge topography.
2. Soil and soil horizons.
3. Outcropping boulders of soapstone. These boulders were in many cases moved down slope away from their original positions by rock and soil creep or flow.

At point T_1 the site system originates with the introduction of cultural activity and the deposition of cultural residues association with occupation. Prehistoric utilization of the quarry sites consists of:

1. The reduction of boulders to procure stone. This process possibly involved the further rolling of

boulders down slope by man to expose unweathered rock.

2. The excavation of pits to procure unweathered rock.
3. The deposition of cultural residues, specifically quarry products and quarry implements.
4. The removal of vegetation to expedite site activities.

Coinciding and alternating with the cultural processes are natural processes, again primarily weathering and erosion. These processes involved:

1. The erosional and depositional modification of disturbed areas. This included such things as the removal of soil primarily by sheet wash and the related alteration and filling of prehistoric excavations with surface material.
2. The modification, destruction and movement of cultural residues. This includeded such things as weathering, deterioration and sorting.
3. The continuation of boulder weathering and soil production along with the continued down slope movement of both rocks and soil due to rock creep, soil creep, flow or frost action.

The interaction of the natural and cultural components continues through time T_2. Also occurring at this point along the trajectory are post-Columbian modifications. These inputs into the site system include:

1. The clearing of vegetation.
2. The removal and destruction of prehistoric cultural residues.
3. The further reduction of boulders and in-place rock to procure economically useful material.

It should be noted that the removal and destruction of prehistoric cultural residues include archeological investigations.

The natural processes interacting with the post-Columbian cultural processes are the same as those interacting with prehistoric processes with the exception that the erosional and depositional modification of the site area occurs more rapidly and over a wider area due primarily to logging activity thus causing increased site deflation.

This framework for site development although cursory and idealized, serves as a heuristic device in clarifying the following description of quarry sites. This description is generalized to cover all sites although it is developed primarily for site 38SP54. Site 38SP54 was chosen for more intensive consideration due to its degree of preservation and representative character. General site information for all 18 soapstone quarry sites recorded is summarized in Table 2, page 37.

The most prominent quarry site features are large outcropping boulders. The boulders range in size from approximately 1 m to 5 m in diameter. Similar outcropping boulders exhibiting quarry activity have been reported by Cushing (1879), Dickens and Carnes (1976) and Sheldon (1976). As noted above, in most cases natural processes have moved the boulders down slope from the dike where they were originally located. It is also probable that they have been rolled further down slope by the prehistoric inhabitants to expose less weathered rock. In most cases the boulders exhibit extensive evidence of aboriginaly quarrying activity primarily from the procurement of soapstone for vessel manufacture (Figures 19-20). There are some boulders, however, which exhibit little or no quarrying activity. The worked boulders exhibit vessel preforms in various stages of removal as well as circular scars of varying depth left by preform removal. Measurements were taken of the dimensions on all observable features on the surface of worked boulders from four selected quarry localities: 38SP13, 38SP17, 38SP18 and 38SP23. The measurements are summarized in Tables 9 through 13. These measurements compare favorably with similar measurements reported by Sheldon (1976).

The second most prominent features are large depressions which are locations where pits were excavated to expose unweathered rock. These depressions occur around or

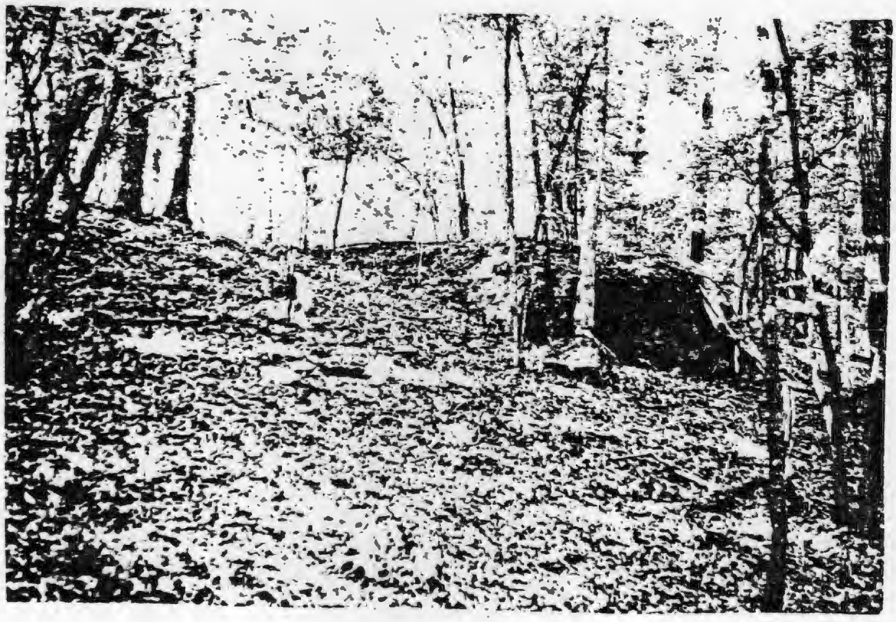


Figure 19. General Setting: Site 38SP23.

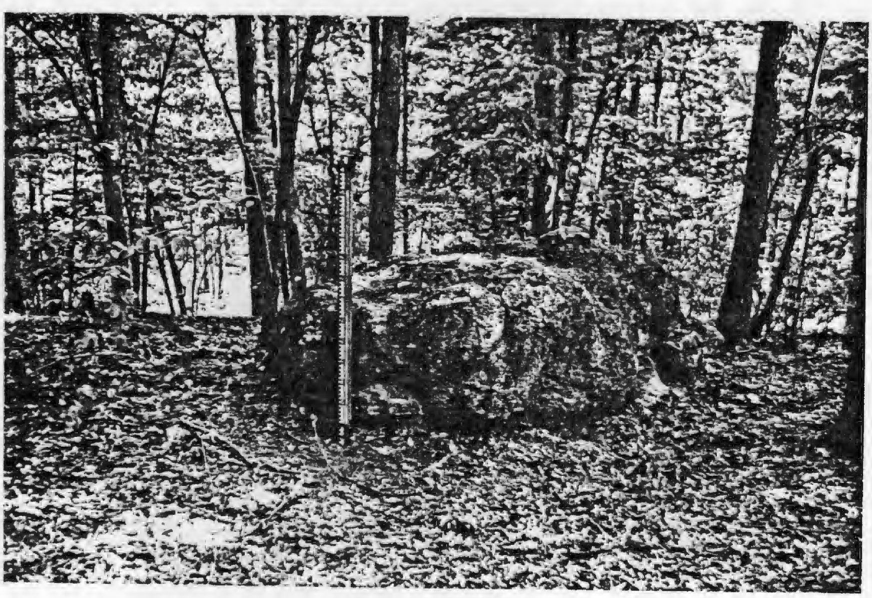


Figure 20. Quarried Boulder and Depression: Site 38SP23.

TABLE 9. Boulder Features By Type.

38SP13 Field Specimen	38SP13 Description	38SP17 Field Specimen	38SP17 Description	38SP18 Field Specimen	38SP18 Description	38SP23 Field Specimen	38SP23 Description
1	Bowl Scar	1	Bowl Preform	1	Bowl Preform	1	Bowl Preform
2	Bowl Scar	2	Bowl Scar	3	Bowl Preform	2	Bowl Preform
3	Bowl Preform	3	Bowl Scar	4	Bowl Preform	3	Bowl Preform
4	Bowl Scar	4	Bowl Scar	5a	Bowl Preform	4	Bowl Preform
5	Bowl Preform	5	Bowl Scar	5b	Bowl Preform	5	Bowl Scar
6	Bowl Preform	6	Bowl Scar	6	Bowl Preform	6	Bowl Scar
7	Bowl Preform	7	Bowl Scar	7	Bowl Preform	7	Bowl Scar
8	Bowl Preform	8	Bowl Scar	8	Bowl Preform	8	Bowl Scar
9	Bowl Scar	9	Bowl Scar	9	Bowl Preform	9	Bowl Scar
10	Bowl Scar	10	Bowl Scar	10	Bowl Preform	10	Bowl Scar
11	Bowl Scar	11	Bowl Preform	11	Bowl Scar	11	Bowl Scar
12	Bowl Preform	12	Bowl Scar	12	Bowl Preform	12	Bowl Scar
13	Bowl Scar	13	Bowl Scar	13a	Bowl Preform	13	Bowl Scar
14	Bowl Scar	14	Bowl Scar	13b	Bowl Scar	21	Bowl Preform
15	Bowl Preform	15	Bowl Preform	16	Bowl Preform		
16	Bowl Preform	16	Bowl Scar				
17	Bowl Scar	17a	Bowl Preform				
18	Bowl Scar	17b	Bowl Preform				
19	Bowl Preform	18	Bowl Preform				
20	Bowl Scar	19	Bowl Scar				
21	Bowl Preform	20	Bowl Preform				
22	Bowl Preform	21	Bowl Scar				
23	Bowl Scar	22	Bowl Scar				
24	Bowl Scar	23	Bowl Preform				
Totals							
11 Bowl Preforms		7 Bowl Preforms		13 Bowl Preforms		5 Bowl Preforms	
13 Bowl Scars		16 Bowl Scars		2 Bowl Scars		9 Bowl Scars	

TABLE 10. Removal Scar Diameter.

38SP13		38SP17		38SP18		38SP23	
F.S./Diameter		F.S./Diameter		F.S./Diameter		F.S./Diameter	
1	64 cm	1	73 cm	1	60 cm	1	75 cm
2	51 cm	2	60 cm	3'	83 cm	2	75 cm
3	46 cm	3	64 cm	4	63 cm	3	75 cm
4	42 cm	4	53 cm	5a	53 cm	4	75 cm
5	61 cm	5	62 cm	5b	18 cm	5	79 cm
6	44 cm	6	42 cm	6	75 cm	6	80 cm
7	72 cm	7	34 cm	7	60 cm	7	80 cm
8	56 cm	8	42 cm	8	53 cm	8	90 cm
9	52 cm	9	45 cm	9	45 cm	9	75 cm
10	62 cm	10	25 cm	10	45 cm	10	60 cm
11	67 cm	11	36 cm	11	59 cm	11	56 cm
12	66 cm	12	30 cm	12	48 cm	12	60 cm
13	57 cm	13	31 cm	13a	corner	13	100 cm
14	61 cm	14	32 cm	13b	16 cm	21	68 cm
15	67 cm	15	63 cm	16	55 cm		
16	75 cm	16	46 cm				
17	58 cm	17	57 cm				
18	86 cm	18	54 cm				
19	68 cm	19	42 cm				
20	55 cm	20	49 cm				
21	73 cm	21	52 cm				
22	59 cm	22	12 cm				
23	73 cm	23	64 cm				
24	47 cm						
Median 61		Median 46		Median 54		Median 75	
Mean 60.92		Mean 46.87		Mean 52.36		Mean 74.86	
S.D. 10.66		S.D. 15.05		S.D. 17.65		S.D. 11.26	

TABLE 11. Removal Scar Depth.

38SP13		38SP17		38SP18		38SP23
F.S./Depth		F.S./Depth		F.S./Depth		F.S./Depth
1	16 cm	1	13 cm	1	14 cm	
2	9 cm	3	8 cm	3	28 cm	Data Not
3	6 cm	4	4 cm	4	14 cm	
4	11 cm	5	3 cm	5	10 cm	Recorded
5	11 cm	6	3 cm	5	2 cm	
6	4 cm	10	4 cm	6	10 cm	
7	5 cm	12	10 cm	7	10 cm	
8	3 cm	14	3 cm	8	3 cm	
9	9 cm	15	12 cm	9	11 cm	
11	4 cm	16	7 cm	10	4 cm	
12	11 cm	18	12 cm	11	12 cm	
16	20 cm	19	4 cm	12	10 cm	
19	5 cm	20	4 cm	13	corner	
20	30 cm	22	7 cm	13	2 cm	
21	7 cm	23	8 cm	16	5 cm	
23	3 cm					
24	10 cm					
Median 9		Median 4		Median 10		
Mean 9.65		Mean 7.47		Mean 9.64		
S.D. 6.79		S.D. 4.46		S.D. 6.53		

TABLE 12. Soar Stem Diameter.

38SP13		38SP17		38SP18		38SP23	
F.S.	/Diameter	F.S.	/Diameter	F.S.	/Diameter	F.S.	/Diameter
1	18 cm	2	27 cm	7	16 cm	5	26 cm
9	21 cm	3	26 cm	9	15 cm	6	28 cm
10	21 cm	4	31 cm	11	24 cm	7	22 cm
11	16 cm	5	29 cm	13[b]	8 cm	8	40 cm
13	21 cm	7	17 cm			9	27 cm
14	14 cm	8	21 cm			10	32 cm
17	25 cm	9	23 cm			11	18 cm
18	24 cm	10	11 cm			12	26 cm
20	23 cm	12	8 cm				
24	25 cm	13	11 cm				
		14	16 cm				
		16	21 cm				
		19	12 cm				
		21	18 cm				
Median 21		Median 19.5		Median 15.5		Median 26.5	
Mean 21,55		Mean 19.36		Mean 15.75		Mean 27.38	
S.D. 4.4		S.D. 7.03		S.D. 5.67		S.D. 6.14	

TABLE 13. Bowl Preform Diameter.

38SP13		38SP17		38SP18		38SP23	
F.S./Diameter		F.S./Diameter		F.S./Diameter		F.S./Diameter	
3	26 cm	1	37 cm	1	45 cm	1	48 cm
5	39 cm	11	16 cm	3	42 cm	2	40 cm
6	18 cm	15	45 cm	4	38 cm	3	43 cm
7	13 cm	17a	32 cm	5a	35 cm	4	38 cm
8	27 cm	17b	18 cm	5b	10 cm	17	34 cm
12	38 cm	18	48 cm	6	41 cm	18	32 cm
15	35 cm	20	33 cm	8	42 cm	21	23 cm
16	38 cm	23	43 cm	10	32 cm		
19	30 cm			12	25 cm		
21	24 cm			13	30 cm		
22	23 cm			16	42 cm		
Median 27		Median 35		Median 35		Median 38	
Mean 28.27		Mean 34.0		Mean 34.73		Mean 36.86	
S.D. 8.23		S.D. 11.14		S.D. 9.77		S.D. 7.53	

adjacent to quarried boulders as well as elsehwere in the quarries. The depressions in some cases are aligned parallel with the strike of the soapstone deposit. In some cases the boundaries between adjacent pits are intersecting, producing a trench-like feature. Similar depressions, some exhibiting alignment or clustering have been reported by Reynolds (1878), Cushing (1879), Holmes (1890, 1897), Wright (1971) and Dickens and Carnes (1976).

At site 38SP54 the depressions range from approximately 5 to 10 m in diameter and currently are less than one meter deep having been filled by repeated episodes of erosion. These dimensions compare with similar features reported from other quarry sites. Reynolds (1878) reports a depression with a diameter of 3 m to 1.2 m and a depth of .6 m to .9 m at the southern half of the Rose Hill quarry in Washington, D.C. Cushing (1879) reports a depression at the Chula quarry near Amelia, Virginia with a diameter from 3 m to 21,3 m. Holmes (1897) reports a row of five depressions at the northern half of the Rose Hill quarry in Washington, D.C., the largest of which was 7.6 m in diameter by .6 m in depth. Holmes (1897) also reported two depressions from a quarry near Clifton, Virginia. One had a diameter of 7.6 m while the other depression had a diameter of 6.1 m. The largest reported depression was that found by Fowke near Culpepper, Virginia but reported by Holmes (1897). That depression had a diameter of 45.7 m.

Bushnell (1926) reported on a row of over 20 depressions from a quarry from Albemarle County, Virginia, the largest of which had a diameter of 3 m to 9 m with a depth of .9 m to 1.2 m. Bushnell (1937) also reported on a depression at a quarry near Johnston, Rhode Island with a diameter of 3 m to 1.8 m and a depth of 1.5 m. Dickens and Carnes (1976) report that at one quarry site 12 depressions were found ranging from 1.8 m to 6.1 m in diameter and from .9 m to 10.7 m in depth.

In some cases where excavations of depressions have been reported by Putnam (1878) and Bushnell (1937), the exposed surfaces of soapstone exhibit the same features of vessel production as the quarried boulders. In other cases (Holmes 1890) only irregular surfaces of stone exhibiting removal of rock along joints were reported. These depressions have been worked to varying depths through overlying soil and into the soapstone bedrock. Holmes (1890) reported depressions at the Rose Hill quarry worked to depths of from .6 m to 1.5 m below the ground surface. At the Clifton, Virginia quarry, Holmes (1897) reported one pit excavated to a depth of 2.4 m to 3 m below surface and another to a depth of 4.9 m.

Test Pit 2 at 38SP54 and similar test pits excavated by Cushing (1879) and Sheldon (1976) indicate that the depressions around and adjacent to such boulders were made to allow the prehistoric inhabitants to expose unweathered surfaces and in some cases to pedestal the aboveground mass by undercutting the outcrop. Test Pit 2 showed evidence of excavation to a depth of .6 m. Aboveground evidence of undercutting is visible at sites 38SP23 and 38SP52.

Around the depressions are concentrations of debitage produced by quarrying activity. Evidence of these concentrations can be observed in the clustered distribution of worked soapstone artifacts around depressions at site 38SP54 in Figure 10, page 44. This debitage consists primarily of pulverized soapstone. Mixed within this litter are rejected quarry products in various stages of completion. In some cases quarry implements occur along with the quarry products. The fill from Test Pits 1 and 2 at site 38SP54 which were placed within quarry pits, contained the same kind of debitage as found around quarry pits within a soil matrix thus indicating a secondary deposition. Similar debitage around and within depressions has been reported by Putnam (1878), Cushing (1879), Holmes (1890) and Bushnell (1926, 1937). At a quarry near Johnston, Rhode Island, Bushnell (1937) reported the recovery of antler, bone and shell in addition to quarry products and quarry implements.

Rejected quarry products and quarry implements are also found scattered throughout the quarries although in less dense concentrations than around the depressions

(Figures 21-26). The quarry products recovered during this study and described in earlier studies are rejected or incompleted vessels representing all stages of production. The vessels have many different forms and stylistic differences. Some are shallow circular to oblong bowl-like forms. Others are deep, conical forms with flat bases. Similar variability in vessel form has been noted by Holmes (1897) and Dickens and Carnes (1976).

The quarry implements recovered during this study are similar to those described by Holmes (1919: 359):

> Many of the implements employed in the quarries and shops were improvised natural forms, while others were made especially for the particular purpose. Some were edged tools employed originally for other purposes, as the ax, celt, and gouge.

From the above description, three varieties of implements can be distinguished in the South Carolina quarries similar to those described by Holmes (1919: 359-361). The first variety is angular or sharp-edged pieces of rock or cobbles with a hardness greater than that of soapstone. In some cases these angular rocks and cobbles were used in an unmodified form. In other cases, tools were fashioned by limited flaking and in some cases by grinding. Examples of such implements include both unifaces and bifaces.

The second variety of implements are those with tools which were produced specifically for modification of soapstone. A common tool or working edge occurring on these

Figure 21. Preform Fragment with Stem: Site 38SP54. (Note Pecking).

Figure 22. Bowl Blank Fragment with Initial Interior Modification: Site 38SP54.

Figure 23. Quarry Implements: Site 38SP54.

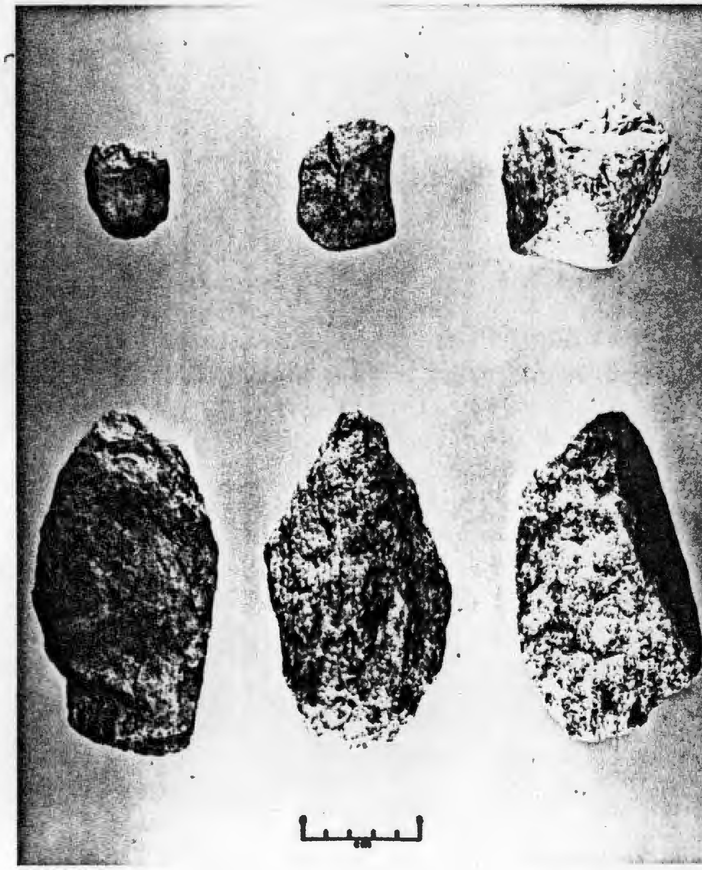


Figure 24. Quarry Implements: Site 38SP54.

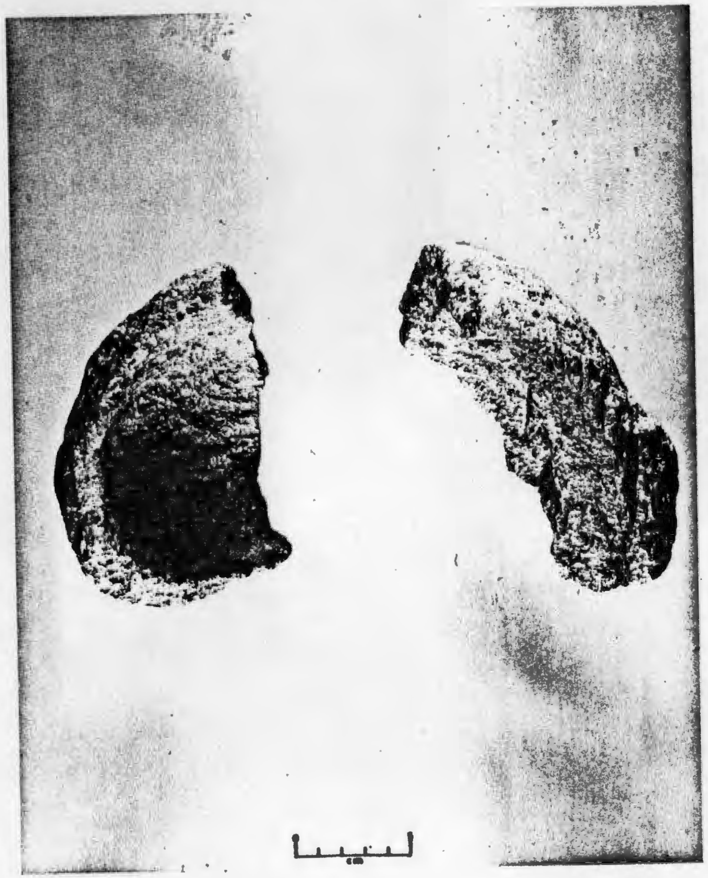


Figure 25. Vessel Fragments: Site 38SP54. (Note Lug Handle on Vessel on Right).

Figure 26. Vessel Side View: Test Pit 2: Site 38SP54.

implements from both the study area and on material from the Rose Hill soapstone quarry, Washington, D.C., is an isolated-rounded point. An example of such a point can be seen on implements in Figure 23. Putnam (1878) and Reynolds (1878) describe similar tools. In most cases these tools occur on implements with limited modification similar to those of the first variety. One specialized implement in the study area from site 38SP20 exhibited a point bit on a well formed, full-grooved ax similar to the tool described above.

The third variety of tools are those which have been recycled. The primary implement of this type noted in the study area are full-grooved axes which show in most cases extreme battering and modification. Such implements have been recovered at sites 38SP54 and 38CK1 and have been reported by Holmes (1919).

Various lithic raw materials were utilized for all three varieties of implements. Usually these materials were locally available in the vicinity of the quarries. In the South Carolina quarries investigated in this study these implements were made of quartzite, gneiss, olivine and basalt. Kengla (1883), Holmes (1897) and Bushnell (1926, 1937) describe these implements as being made from quartz and quartztie. Holmes (1897) and Dickens and Carnes (1976) describe such implements as being made from metamorphic and igneous rocks.

The controlled surface collection of quarry site 38SP54 produced 142 possible quarry implements (Table 6, page 43). Of these artifacts, 134 are of the unmodified or slightly modified variety described above. The majority are probably unmodified quartzite but due to the coarse grained nature of the quartzite, modification either by intent or through use is difficult to determine. Three artifacts exhibiting a formalized tool or working edge are classified as the second variety. Finally, one implement of the third variety, a broken and modified basalt ground ax, was recovered.

Only a few small artifacts, primarily flakes, were recovered during the controlled collection of site 38SP54. Four cores were also recovered indicating that smaller artifacts may be under represented in the sample due to the collection procedure. However, no small implements were found in Test Pits 1 and 2. Among the scattered worked soapstone artifacts are unworked pieces of soapstone in varying concentrations. These unworked pieces were either exposed on the surface during prehistoric occupation or have been exposed on the surface since prehistoric occupation due to weathering and erosion. Unworked pieces in the vicinity of the depressions may also have been rejected and thrown out during the initial excavation of the quarry pits.

The limits of sites were determined from the relative density of surface scatter. The scatter of the worked and unworked pieces of soapstone are generally clustered around worked boulders and depressions with the concentrations falling off with increasing distance from these features. A distinct decrease in the density of scatter was generally detected when transects were walked in the cardinal directions away from areas of intensive use. But since unworked pieces of soapstone or float blocks are common surface occurrences in geologic phenomena of this kind, distinct boundaries between quarry areas are difficult to determine in some cases. For example, while walking the survey transect between quarries 38SP20 to 38CK1, unworked pieces of soapstone with a very low density were encountered nearly continuously. No more than approximately 100 m was covered without at least a specimen of soapstone being encountered.

Most quarries are relatively undisturbed and well preserved. In contrast, a few quarries have recently been disturbed and almost destroyed. Others are currently threatened by the growth and expansion of the city of Spartanburg. For example, most of quarry site 38SP56 was destroyed by a major land clearing operation during the last five years and quarry sites 38SP23, 38SP17, 38SP18, 38SP19, 38SP21 and 38SP53 are currently within the boundaries of residential subdivisions.

Historic disturbance of the quarries until recently had been relatively mild. The areas of primary prehistoric activity have been untouched by agricultural activities due to the abundance of rock on and below the ground surface. Evidence of historic cultivation can be seen along the edges of the quarry areas in several forms. Furrow remnants can be observed as undulations of the ground surface in the stands of conifers around several quarries. Differences in vegetation between the quarries and the surrounding areas supplies additional evidence of differential land use. There are also two types of historic features at the margin of several quarries which also indicate agricultural land use. The first type of features are numerous large piles of rock which are probably the result of field clearing. The second type of historic features are rock walls which also indicate field clearing as well as erosion prevention activities. At quarry sites 38SP11, 38SP23, 38SP54 and 38CK46 discarded quarry products have been observed associated with these historic features along with unworked pieces of soapstone.

Historic exploitation of the soapstone boulders is also indicated and takes two forms. The first is the procurement of soapstone slabs used primarily for the production of tombstones. Numerous examples of such tombstones have been noted in the area. The cemetery at Croft State Park located southwest of the study area is composed almost entirely of soapstone tombstones dating to the early 1800's. At present there are approximately a dozen soapstone tombstones at the Croft cemetery but informants indicate many others have been removed. The other form of historic exploitation was in the production of soapstone vessels. These vessels differ from the aboriginal vessels in that they are usually rectangular or extremely irregular, have a fresher appearance and exhibit definite metal tool marks. Some of these historic vessels can be seen in use even today in the project area in the form of feeding troughs. Evidence of historic exploitation although present in several quarries is not extensive and has seldom disturbed the prehistoric remains.

CHAPTER VII

MODEL BUILDING

Previous Hypotheses

Several previous studies discuss hypothetical quarrying procedures and association reduction sequences (Putnam 1878; Reynolds 1878; Schumacher 1878; McGuire 1883; Holmes 1890, 1897, 1919; and Bushnell 1937). In the following discussion, these procedures and reduction sequences will be summarized and compared. From this a behavioral reduction sequence model will be generalized. Finally, portions of this model will be evaluated utilizing data from site 38SP54.

The initial phase of the quarrying procedure involved the procurement of suitably sized pieces of stone. Holmes (1897) suggests that loose masses, conveniently on the surface, were exploited first. When these were exhausted, outcropping boulders and/or buried in-place masses of soapstone were exploited. Two procedures have been suggested for the removal of rock from the outcropping boulders and buried masses. Reynolds (1878), Holmes (1890) and Bushnell (1937) suggest that pieces were removed in unmodified form by striking and prying along joints. The second procedure, suggested by Putnam (1878), Schumacher (1878), McGuire (1993), Holmes (1897, 1919) and Bushnell (1937) involved the excavation of a circular groove around a natural projection or at a desired point along a smooth surface of massive soapstone (Figure 27). The groove was deepened and eventually angled such that a vessel preform of desired shape and size was pedestaled (Figure 28). The resultant form resembles that of a mushroom. The preform was then removed, probably with the assistance of a lever, leaving a depressed area and remnant of the stem (Figure 29). A variation of this procedure noted by Ferguson (1976) and Dickens and Carnes (1978) involved scoring small boulders to eventually produce two or more preforms of suitable size (Figure 30).

The subsequent phases of the manufacturing procedure involve the shaping of the vessel exterior and the excavation and shaping of the interior. But the order of these phases vary depending upon the reduction sequence followed. If the second procedure of the intial procurement phase described above is followed, the exterior shaping is well underway when the vessel preform is removed. Thus the procedure chosen during the initial procurement phase obviously affects subsequent phases of vessel manufacture. Schumacher (1878) suggests that the exterior was modified during and subsequent to removal of the preform from the soapstone mass. Only after all exterior shaping was completed was the interior excavated. Putnam (1878) suggested that after the exterior was initially shaped during the

Figure 27. Bowl Preform: Site 38SP17.

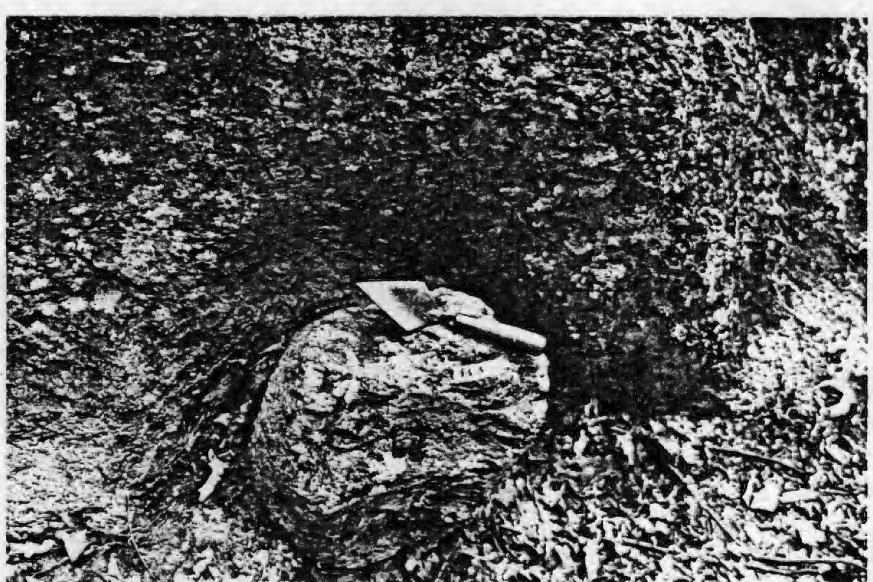


Figure 28. Bowl Preform: Site 38SP23.

Figure 29. Bowl Scar: Site 38SP23.

Figure 30. Double Preform: Site 38SP17.

removal of the vessel preform from the outcrop but that after removal the interior was hollowed out prior to subsequent shaping of the exterior. Reynolds (1878) and Holmes (1890), both of whom suggested the initial procurement of unmodified blocks, hypothesized that all external shaping took place prior to interior excavation. Reynolds (1878) also suggests interior hollowing as taking place first. Finally, it has even been suggested, probably by William Dinwiddie in 1893 or 1894 (Anonymous n.d.) that both exterior shaping and some interior excavation and shaping took place prior to and during the removal of the vessel preform from the soapstone boulder.

Variations also exist in the procedures suggested for the removal of the vessel interior. One procedure suggested by Reynolds (1878) involved the commencement of gouging at the edges and working in a sloping fashion downward and inward toward the center, then back toward the edge working downward and outward. A similar procedure suggested by Holmes (1890) consisted of completely outlining the outside edge of the area to be removed and then working inward isolating and finally removing the center. Another procedure suggested by Kengla (1883) and Holmes (1890) involved starting the excavation at the center and working outward to the wall of the vessel. It should be noted that Holmes (1890) also suggested that no single uniform procedure actually existed.

Technological Processes

Different modes and techniques of reduction have been suggested to have been used during the various phases of vessel production. The best and most comprehensive discussion of the modes and techniques of soapstone modification are presented by Holmes (1919). The principal modes of reduction utilized during soapstone vessel manufacture are described by Holmes (1919: 358-362) as incising processes. Holmes differentiates between two techniques of incising:

> Pressure Incising
>
> (a) Cutting or shaving the stone to be shaped by pressure with a sharp, laterally-edged tool held in the hand as a knife.
>
> (b) Chiseling the stone to be shaped with a terminally-edged implement, hafted or unhafted, held in the hand and pushed.
>
> Percussion Incising
>
> (a) Chiseling the stone to be shaped with a terminally-edged implement, hafted or unhafted, forcibly driven with a hammer or mallet.
>
> (b) Chopping the stone to be shaped with a terminally-edged tool, as an ax or adz, a chisel, hatchet, pick or gouge, hafted or unhafted (1919: 358).

In some cases percussion incising merges into another mode which Holmes (1919: 359) terms the crumbling process. Holmes defines three distinct techniques of crumbling:

> Direct Free-Hand Percussion
>
> Crumbling the surface of the stone treated with a hammerstone, pick, or kindred tool, hafted or unhafted, held in one hand, the stone being worked in the other hand.
>
> Direct Rest Percussion
>
> Crumbling the surface of the stone treated with a hammer, pick or kindred tool, hafted or

> unhafted, held in one or both hands, the stone worked being stationary.
>
> Indirect Rest Percussions
>
> Crumbling the surface of the stone under treatment by means of a chisel, drill, or like tool, hafted or unhafted, held in one hand and driven by a hammer or mallet held in the other hand, the stone being stationary (1919: 330).

In describing the working of soapstone by incising techniques Holmes states:

> Soapstone . . . was hewn out of the quarry and shaped into implements, utensils, and other artifacts chiefly by means of the pick, gouge, and chisel, the incising edge being generally quite narrow and merging into the pointed pick, the process at the same time merging into the crumbling type. These tools were used hafted or unhafted and were operated by pushing or by striking or by indirect percussion, as with the aid of a mallet (1919: 358-359).

There is no concensus among previous researchers as to whether or not hafted tools were used during various phases of production. Since controlled experimentation and comparison concerning variations of the quarrying procedures is unavailable, serious discussion of the question of hafting is premature. It is probably safe to say that both hafted and unhafted implements were utilized during most phases of production, and as far as this study is concerned there is no attempt to differentiate between them.

Analytical Constructs

The data which can most readily be assessed and which produces useful constructs for a reduction sequence model are the artifacts themselves. The various procedures described above are based on observation of the quarry products and associated quarry implements. The predominant observable attributes on quarry products are two distinct groups of tool marks relating to the processes of crumbling and incising. The first group are oblong D-shaped indentations. These tool marks have been replicated by the author in limited experimentation utilizing pointed quartzite and basalt implements on soapstone with a pecking action. This suggests that these tool marks are related primarily to the process of crumbling and appear usually on vessels in early stages of manufacture. The second group of tool marks are single or multiple parallel grooves of varying lengths. In some cases these grooves exhibit interior striations. These tool marks have been replicated by the author in limited experimentation utilizing bone and chert implements on soapstone with a chiseling action. This suggests that these tool marks are related primarily to the incising process and occur primarily on quarry products in late stages of production.

Holmes (1897: 111) states that implements of wood, bone and antler might have been used, primarily for excavating pits and prying loose stone. However, Holmes indicates that the shaping of vessels was conducted only with lithic implements like those described in the preceding chapters.

Dickens and Carnes (1976) suggest that none of the lithic implements recovered during their study in Georgia were suitable for shaping and excavation of the vessel interiors. Based on a limited and uncontrolled replication study, Dickens and Carnes (1976) hypothesize that a tool kit composed of three antler chisels, a wooden mallet, a chipped stone knife and an abrader are adequate implements to carry out the interior excavation procedures. This hypothesized tool kit is based on negative evidence since no such implements or lithic implements for manufacturing bone and antler tools were recovered during their study. Both bone and antler as well as shell are reported from a quarry in Rhode Island by Bushnell (1937) although there is no indication whether these artifacts exhibited signs of use-wear. The lack of small quarry implements from site 38SP54 tends to support Dickens and Carnes (1976) suggestion concerning the utilization of wood, bone or antler tools. But the presence of cores and flakes at site 38SP54 also indicates that small lithic implements might also have been used in secondary vessel manufacture.

Size variation is evident in the lithic implements reported by Holmes (1897) and those recovered from site 38SP54. Whether this is related to specific procedures used during the various phases of vessel production is not clear, although it is assumed that some relationship exists. Holmes states:

> No clear distinction is to be drawn between the implements used in quarrying and cutting out the soapstone masses in the quarry and those employed in shaping the artifacts made of these masses, yet it may be assumed that in general the heavier, ruder tools associated with the quarry sites were used in excavating and quarrying, and that the more delicate sharp-edged and pointed tools served for shaping and finishing (1919: 359).

As Holmes (1919) indicates, no direct associations can be made between the varieties of quarry implements and the quarry procedures. But an indirect association can be made with the quarry products. Two general categories of quarry implements can be delineated: those producing crumbling or pecking tool marks and those producing chiseling tool marks on the quarry products. Thirteen quarrying implements and 12 quarry products from the Rose Hill soapstone quarry (Holmes 1897) were examined at the Smithsonian Institution to evaluate the association of tool size to tool mark (Table 14). The primary assumption of this evaluation was that the width of the tool, tip or working edge on an implement will correspond with the width of the tool mark produced by that implement. Preliminary uncontrolled experimentation utilizing pointed basalt and chert implements on soapstone indicates that this is a valid assumption. The tool or tip of these implements were in most cases well defined. The working

TABLE 14. Rose Hill Quarry Artifact Summary.

Quarry Implements		Quarry Products			
Museum Number	Tool Width	Museum Number	Exterior Peck Mark Width	Exterior Chisel Mark Width	Interior chisel Mark Width
99240	1.85	99245	1.4		1.4
99242	2.9	99288	1.6		.8
99244	2.25	135733a		.95/1.5	
135734(1)	1.2	135733b		.8	.8
135734(2)	1.25	135734	2.1		1.35/3.95
135734(4)	1.3	149403	1.6	1.35	
135734(5)	1.9	149927(1)	1.1		
135734(6)	2.05	149927(2)	1.35	1.0	1.1
135734(7)	2.85	149927(3)	1.5/2.8	1.7	1.7
244853(1)	1.85	149927(4)		1.2	1.0
244854(2)	1.25	149927(5)		1.9	2.25
244855(3)	1.45	247857		1.5/1.7	.6/1.4
247859	2.3	34438			1.2
Mean	1.88		1.68	1.36	1.42
Standard Deviation	.58		.53	.37	.77

surface was generally well defined by use-wear polish. This polish, along with a distinct change in the angle of the tool were the criteria used to define tool or tip width.

Preliminary experimentation indicates that the long axis of oblong D-shaped pecking marks is associated with the working edge of the tool. The width of the pecking tool marks on a given quarry product is based on the consistent measurements of three or more tool marks across this long axis. If another different set of measurements could be made on three or more tool marks on the same vessel then two different implements were assumed to have been utilized and two estimations of tool mark width were recorded. The widths of the parallel grooves of the chiseling tool marks were recorded in a like fashion.

Evaluation of the implements and quarry products from the Rose Hill quarry (Holmes 1897) allows us to assess Holmes' suggestion that only lithic implements were used during all stages of soapstone vessel manufacture. A Student's t-test was used to compare the average of 13 tool widths with the average of eight exterior pecking tool marks and with the average of 12 interior chiseling tool marks. For the comparison of the tool widths and exterior pecking marks, a test statistic of .79 was produced. Therefore, at an alpha level of .05 no significant difference between the means could be demonstrated. For the comparison of the interior chiseling marks, a test statistic of 1.69 was produced. Therefore, at an alpha level of .05 no significant difference between the means is demonstrated. These comparisons suggest that lithic implements could have been utilized for all quarrying procedures. This contention, though, should be assessed with regard to two additional pieces of information. First the range of tool tip width does not completely cover the lower limits of the range of chisel marks. Second, when the 12 interior chisel marks are combined with 10 exterior chisel marks and their average compared with the average of the 13 tool tip widths, a significant difference is noted at an alpha level of .05, thus indicating that two distinct tool kits are a possibility. The test statistic calculated for this comparison was 2.33.

Caution should also be used in assessing these comparisons due to the small sample sizes. In order to control for this problem the same measurements as described above were made when possible on 175 of the 212 worked soapstone artifacts recovered during the controlled surface collection of site 38SP54. In this evaluation, a paired Student's t-test was utilized to compare the difference between 48 pairs of exterior pecking marks and the interior chiseling marks located on the same quarry product. A test statistic of 17.47 was produced. Therefore a significant difference is indicated at an alpha level of .05.

Based on this significant difference, the probability of the same implement being utilized for both the exterior shaping and interior excavation and shaping is extremely low.

To further evaluate this assumption, four additional comparisons were made of the artifacts from 38SP54 using the Student's t-test. A comparison was made between the mean width for 98 exterior pecking marks (Figure 31) and the mean width of 90 interior chiseling marks (Figure 32). A test statistic of 21.97 was calculated. At an alpha level of .05, a significant difference is indicated between the two means. As a further test, the mean width for the same 98 exterior pecking marks was compared with the mean width of 63 exterior chiseling marks (Figure 33). A test statistic of 20.51 was calculated. This also indicates that a significant difference exists between the two sample means. These comparisons then lend further support to the hypothesis that two distinct tool kits were used during the reduction process at site 38SP54.

As a final test for assuming the existence to two general categories of implements and their usage across various quarrying procedures, two comparisons were made. A comparison between the mean width of the 63 exterior chisel marks and the mean width of the 90 interior chisel marks was made. A test statistic of .45 was calculated. At an alpha level of .05 the existence of a significant

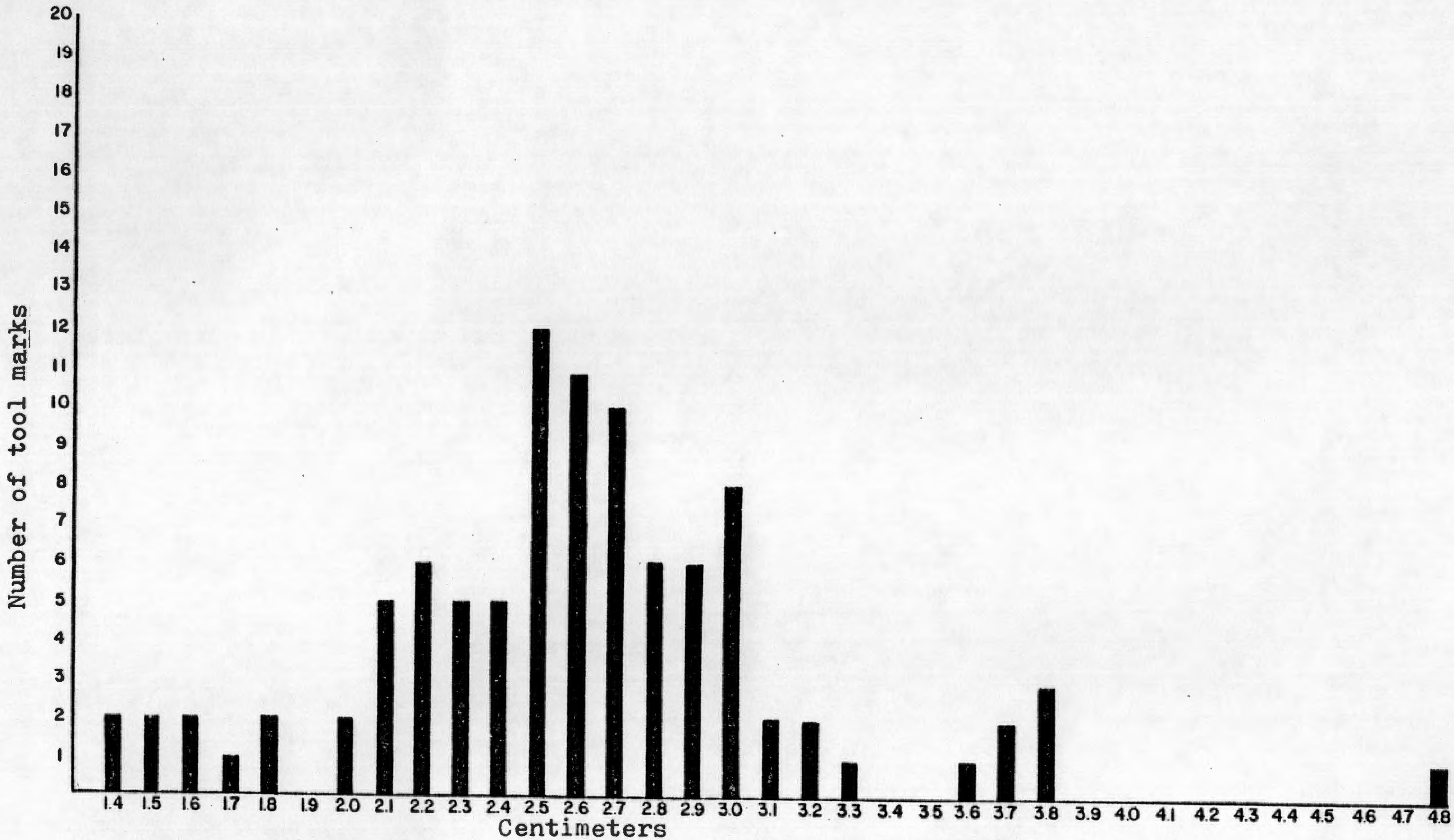


Figure 31. Width of Exterior Pecking Tool Marks: Site 38SP54.

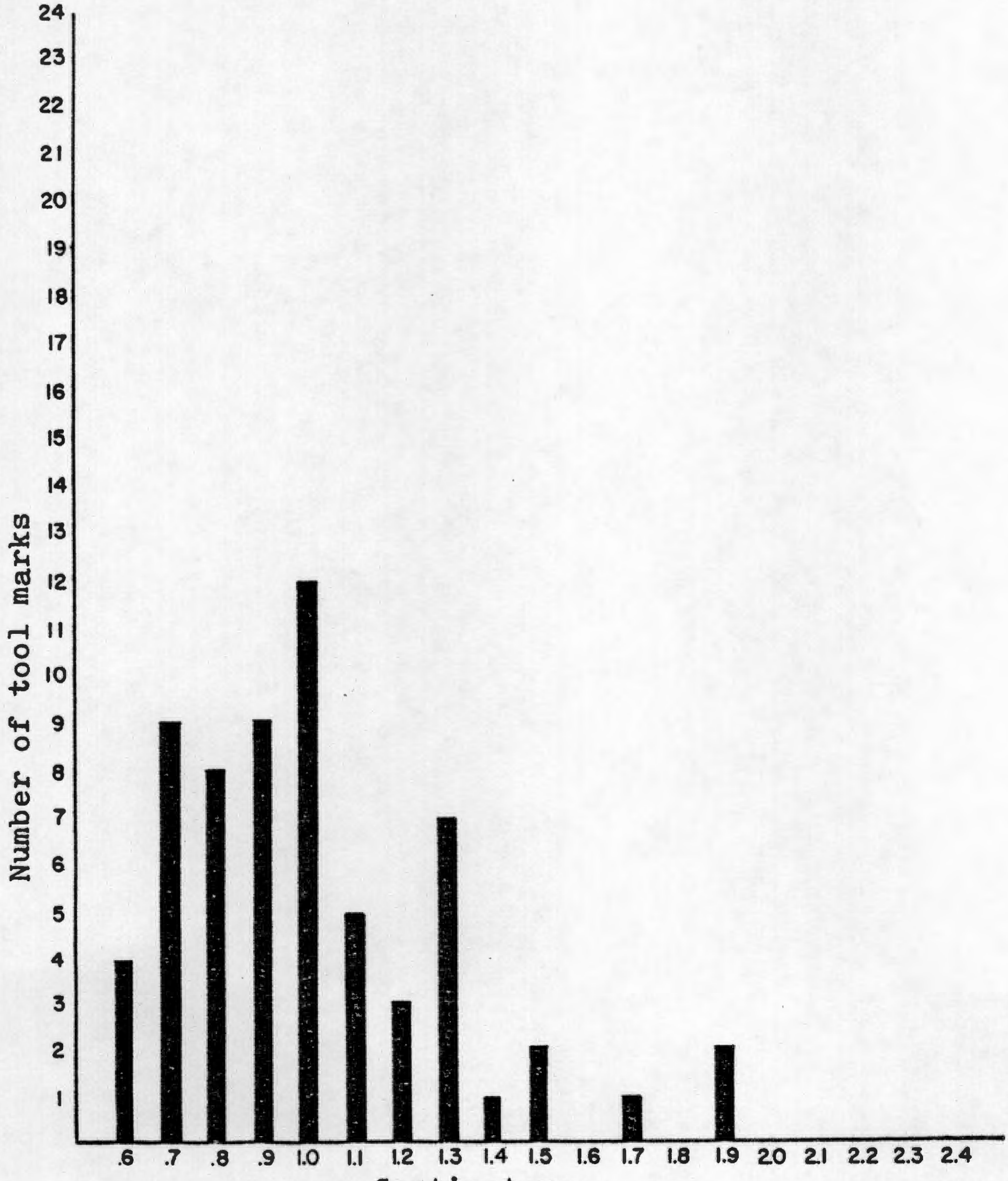


Figure 32. Width of Exterior Chiseling Tool Marks: Site 38SP54.

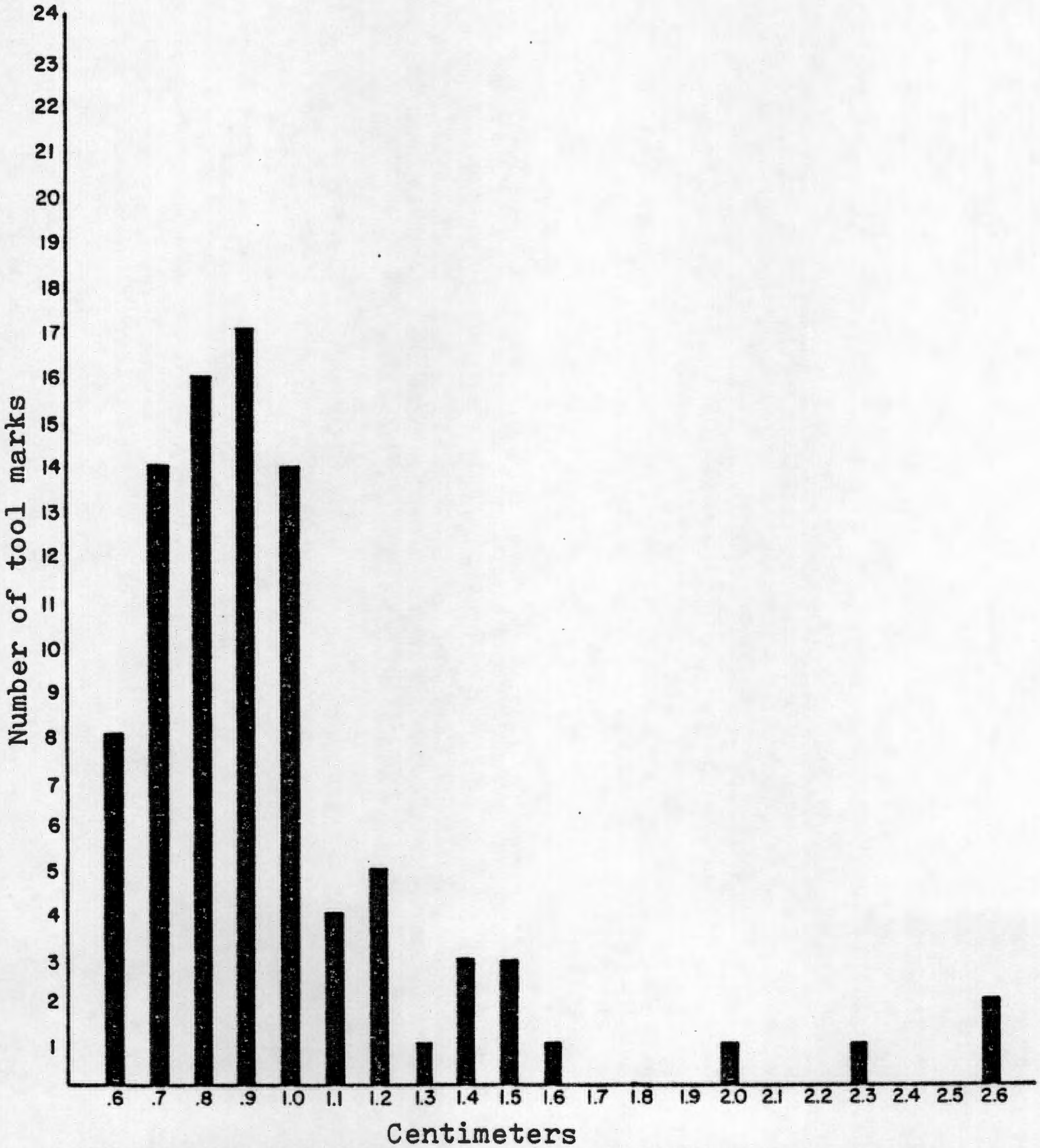


Figure 33. Width of Interior Chiseling Tool Marks: Site 38SP54.

difference between the two means could not be determined. Finally, a comparison of the mean width of the 98 exterior pecking marks was compared with the mean width of six interior pecking marks. A test statistic of .89 was calculated. At an alpha level of .05 the existence of a significant difference could not be determined in this case either. These comparisons indicate that there were two tool kits: one tool kit used for producing chiseling, both interior and exterior, and another tool kit which was used for both interior and exterior pecking.

Based on the preceding statistical comparisons, a high probability exists that two distinct tool categories did exist at site 38SP54. One category is comprised of those implements used to produce pecking tool marks. Since pecking tool marks occur primarily on vessels in the early stages of production, these implements can be further categorized as heavy duty, general purpose quarrying implements utilized principally in the initial stages of vessel manufacture. Based solely on artifactual evidence recovered from quarry sites, these implements appear to have been made of lithic raw materials rather than bone, wood or antler. The second category is comprised of implements producing chiseling tool marks. These implements appear to have been made of bone, wood or antler although small lithic implements might also have been used. Since these tool marks appear primarily on vessels in the latter stages of reduction, these implements can be categorized as secondary, light duty implements.

Reduction Sequence Model

Based on the preceding discussion, two distinct behavioral patterns can be inferred: the activity of pecking and the activity of chiseling. The technological attributes exhibited on the quarry products are the artifactual manifestations of these behavioral patterns. Therefore, utilizing the quarry products, it is possible to generate a comprehensive reduction sequence model for soapstone quarrying and vessel production.

The constructs of this model are the four discrete attributes: exterior pecking marks, exterior chiseling marks, interior pecking marks and interior chiseling marks. These attributes can be expressed in binary form relative to their presence or absence on a vessel. Therefore, a string of four numeric characters, either 1, signifying presence, or 0, signifying absence, can be used to describe any possible state or combination of the four technological attributes for any possible quarry product. A string can be broken down into four distinct field:

<u>exterior</u>		<u>interior</u>	
1	0	1	0
pecking	chiseling	pecking	chiseling

The string 1010 for example, describes a quarry product exhibiting exterior pecking without exterior chiseling and interior pecking without interior chiseling. Similarly, the string 0101 indicates evidence of exterior chiseling without exterior pecking and interior chiseling without interior pecking. Sixteen possible states or combinations exist for these four attributes:

1) 1000	5) 0111	9) 1001	13) 1010
2) 1100	6) 0011	10) 1101	14) 0010
3) 1110	7) 0001	11) 1011	15) 0100
4) 1111	8) 0000	12) 0101	16) 0110

These 16 states can be arranged in various orders to form trajectories within a pathway model. Movement from one state to another along a particular trajectory is achieved by changing one and only one attribute at each step. Thus a logical ordering can be maintained and transitional states completely represented.

The 16 possible states for the four technological attributes of exterior pecking, exterior chiseling, interior pecking and interior chiseling have been arranged to form trajectories in a comprehensive pathway model for soapstone reduction (Figure 34). In Figure 34, attribute combinations or states are expressed verbally, solely on those attributes present, in addition to numerically, to aid in clarification. The string 0000 represents unmodified soapstone and is therefore the logical starting point of all trajectories. The state 0101 or the presence of exterior

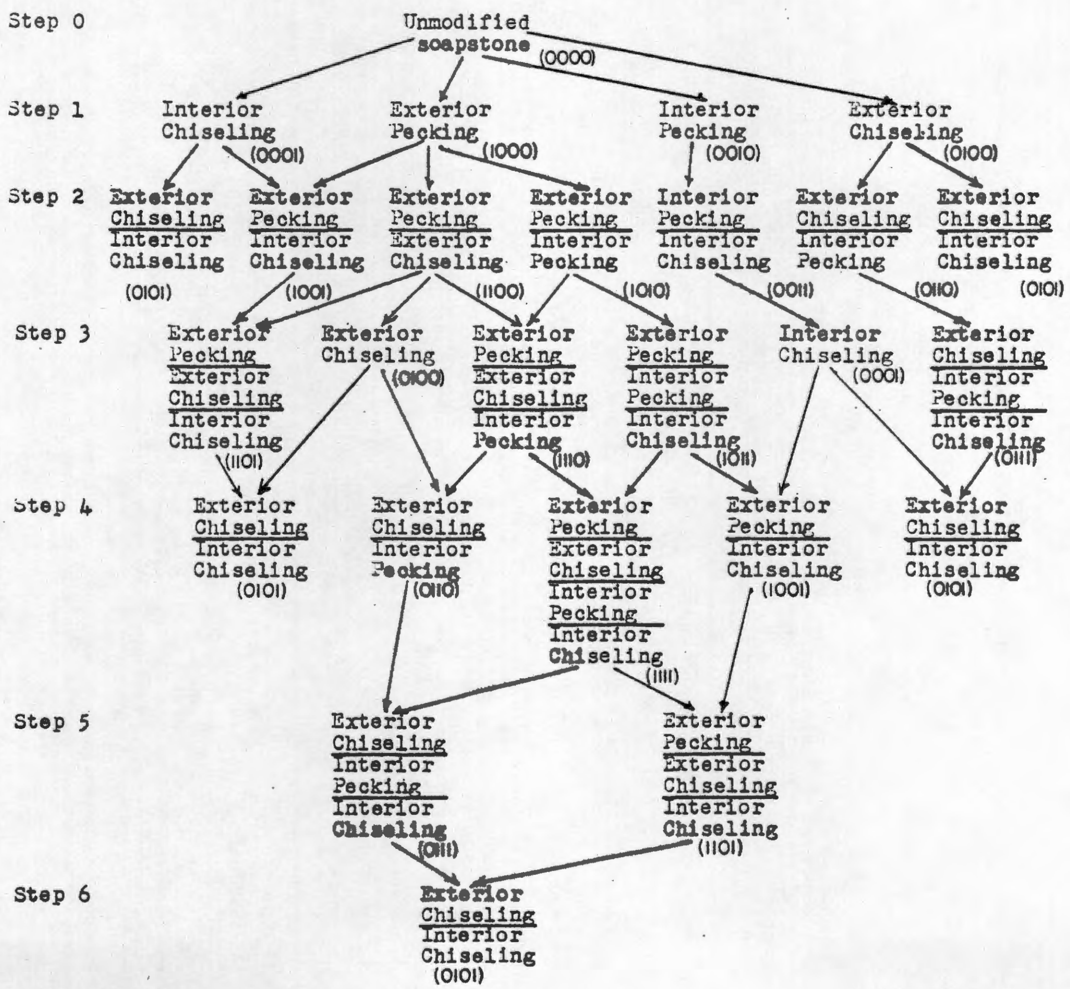


Figure 34. Generalized Reduction Sequence Model.

and interior chiseling only has been selected to represent the final state for this model whenever it occurs in a trajectory. This selection is due to the assumption put forth by Holmes (1897) based on the fact that no finished vessels have been recovered at quarry sites, that finishing of the vessels was conducted away from the quarry. This assumption is supported by the fact that few vessels in or near completed form were observed at any of the quarries in the study area and those nearest completion generally exhibited the state 0101. Finally, state 0101 was chosen as an end point for the trajectories in order to keep the model logically simple and concise.

Several of the trajectories which can be traced through Figure 34, approximate the sequences of procedures for vessel reduction suggested in previous studies for quarry and vessel manufacture. For example, Putnam's (1878) suggested sequence could follow the four step pathway:

1000 → 1001 → 1101 → 0101.

Putnam's (1878) suggested sequence could also follow a six step pathway:

1000 → 1010 → 1011 → 1001 → 1101 → 0101.

The procedures suggested by Schumacher (1878) can be followed through the following pathways:

1000 → 1100 → 0100 → 0101.

1000 → 1100 → 0100 → 0110 → 0111 → 0101.

The procedures suggested by Reynolds (1878) and Holmes (1890) can be traced through the same two pathways as those of Schumacher (1878) as well as two additional pathways:

0100 → 0101.

0100 → 0110 → 0111 → 0101.

Reynolds (1878) also suggests a second set of procedures which can be followed through four pathways:

0001 → 1001 → 1101 → 0101.

0001 0101.

0010 → 0011 → 0001 → 1001 → 1101 → 0101.

0010 → 0011 → 0001 → 0101.

One additional sequence of procedures (Anonymous n.d.) can be traced through two pathways:

1000 → 1010 → 1110 → 0110 → 0101.

1000 → 1010 → 1011 → 1001 → 0101.

An assessment of the usefulness of this model as a tool in archeological interpretation can be made through the evaluation of the quarrying procedures at site 38SP54 (Figure 35). This assumes that the data recovered during the controlled collection of site 38SP54 approximates a representative sample of all quarry products at that site. It also assumes that the greater the relative percentage of a particular attribute combination, the more likely the occurrence of that particular state at a particular stage or step of the reduction sequence. Conversely,

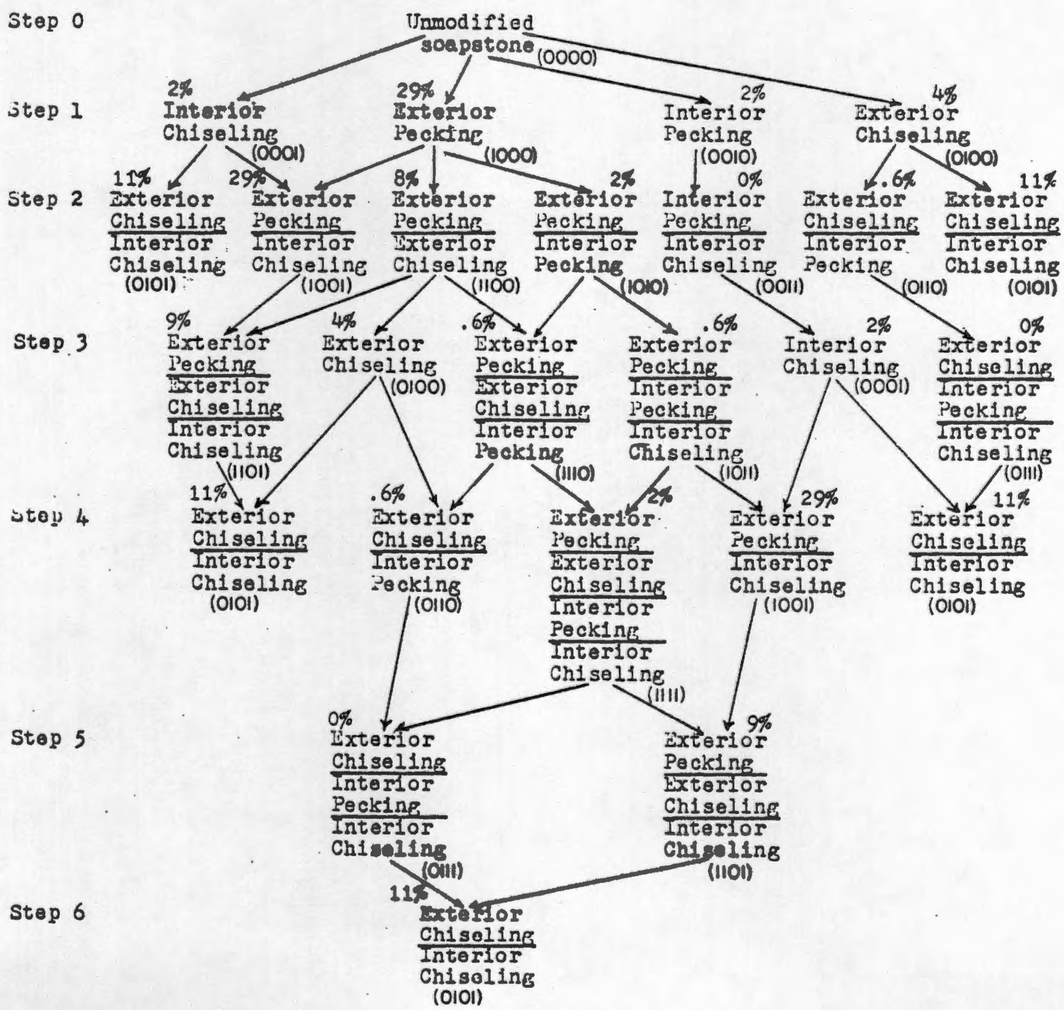


Figure 35. Reduction Sequence Model: Site 38SP54.

the lower the relative percentage, the less likely the occurrence. Finally, relatively equal breakage of quarry products is assumed at each stage of the sequence.

The 175 quarry products from 38SP54 were classified into 13 distinct clusters which correspond to 13 of the possible 16 combinations of attributes. The number of cases in each cluster and the relative percentage of cases in the sample are presented in Table 15. Table 15 also presents the number and percent of broken quarry products per state or cluster. These percentage figures produced an average figure for all the clusters of 76%. By comparing this average figure with the percentages for each cluster except for those with small sample sizes, the assumption that breakage was uniform can be seen to be reasonably valid.

Using the relative percentage figures for the artifacts comprising the clusters or states, the various possible reduction sequences can be ranked as to the probability of occurrence. This is based on the percentage of the total collection accounted for by a given pathway calculated by summarizing the relative percentages for each cluster or attribute combination. The probability that a particular pathway was followed at a particular site must also be assessed in relation to two additional factors. The first of these is simplicity. It is felt that the fewer

TABLE 15. Artifact State Summary For Site 38SP54.

Possible combinations	States	No. of Cases	Percent	No. of cases broken	Percent of cases broken
1)	1000	(51)	29	13	87
2)	1001	(50)	29	42	84
3)	0101	(19)	11	40	78
4)	1101	(15)	9	16	84
5)	1100	(14)	8	3	75
6)	0100	(7)	4	3	75
7)	1010	(4)	2	3	75
8)	0010	(4)	2	3	43
9)	0001	(4)	2	12	86
10)	1111	(4)	2	3	75
11)	1110	(1)	.6	1	100
12)	0110	(1)	.6	1	100
13)	1011	(1)	.6	1	100
14)	0111	(0)	0	0	0
15)	0011	(0)	0	0	0
16)	0000	(-)	-	-	-
		175	100%	141	

steps the pathway requires, while still accounting for a high percentage of the total sample, the better the model. The second factor is that the number of artifacts comprising a cluster or state will not decrease or increase markedly from one step to the next.

Based on the method of assessment outlined above, the pathway most probably utilized at site 38SP54 is the four step sequence suggested by Putnam (1878). Putnam's four step sequence accounts for 78% of the total artifacts recovered in the most economic manner with consistent quantities represented from one stage to the next.

$$\underset{1000}{n=51} \rightarrow \underset{1001}{n=50} \rightarrow \underset{1101}{n=15} \rightarrow \underset{0101}{n=19} \quad (78\%).$$

In other words, this sequence of procedures is the most likely utilized pathway. This is not to say that this was the only pathway used at site 38SP54, but only the most probable.

The other suggested sequences have lower probabilities of occurrence. Putnam's (1878) six step sequence accounts for 80% of the total number of artifacts recovered but was less economical than Putnam's four step pathway and also contains two states which are represented by only one artifact and four artifacts.

$$\underset{1000}{n=51} \rightarrow \underset{1010}{n=4} \rightarrow \underset{1011}{n=1} \rightarrow \underset{1001}{n=50} \rightarrow \underset{1101}{n=15} \rightarrow \underset{0101}{n=19} \quad (80\%).$$

Schumacher's (1878), Reynolds' (1878) and Holmes' (1890) four step pathway accounts for only 52% of the total number of artifacts recovered.

```
n=51   n=14   n=7    n=19
1000 → 1100 → 0100 → 0101   (52%).
```

Schumacher's (1878), Reynolds' (1878) and Holmes' (1890) six step pathway accounts for 53% of the total number of artifacts recovered but contains a state represented by only one artifact and another state represented by no artifacts.

```
n=51   n=14   n=7    n=1    n=0    n=19
1000 → 1100 → 0100 → 0110 → 0111 → 0101   (53%).
```

The sequences suggested by Reynolds (1878) and Holmes (1890) both account for only 15% of the total number of artifacts recovered.

```
n=7    n=19
0100 → 0101 →   (15%).

n=7    n=1    n=0    n=19
0100 → 0110 → 0111 → 0101   (15%).
```

The second set of pathways suggested by Reynolds (1878) account for 13% to 53% of the total number of artifacts from 38SP54. These pathways either contain poorly represented states, require too many steps to be economical or make illogical increases in numbers of artifacts represented.

```
n=4    n=50   n=15   n=19
0001 → 1001 → 1101 → 0101   (50%).

n=4    n=19
0001 → 0101   (13%).
```

```
n=4     n=0     n=4     n=50    n=15    n=19
0010 → 0011 → 0001 → 1001 → 1101 → 0101   (53%).

n=4     n=0     n=4     n=19
0010 → 0011 → 0001 → 0101   (15%).
```

Finally, the two pathways probably suggested by Dinwiddie (Anonymous n.d.) account for 43% and 71% of the total number of artifacts recovered from 38SP54 but both contain underrepresented states.

```
n=51    n=4     n=1     n=1     n=19
1000 → 1010 → 1110 → 0110 → 0101   (43%).

n=51    n=4     n=1     n=50    n=19
1000 → 1010 → 1011 → 1001 → 0101   (71%).
```

In summary, the reduction sequence model presented here will allow future researchers to quantitatively assess and compare soapstone vessel production between and within any soapstone quarry. Refinement of this model through the definition of additional essential attributes and the formulation of quantifiable postulates of use and discard of soapstone quarry products and implements will allow for even greater precision in such analysis.

Patterning of Quarry Location

Previous investigations in the study area generated a hypothesis concerning the association of quarry locations. This hypothesis simply stated is that if three or more quarries form a linear pattern, then a high probability exists that additional quarries will be located along the primary axis of this alignment. The basis for this patterning is geologic since soapstone and other ultramafics are generally concordant with the structural trends of the area in which they are located. Alternatively stated, the strike of a soapstone deposit is usually parallel to the strike of adjacent metamorphic rocks.

The field investigations described in this thesis were designed to evaluate this hypothesis. The results of these field investigations generally support the hypothesis. A transect walked along the linear axis or strike of the known quarries produced additional quarries. Since these field investigations were conducted, additional soapstone outcrops have been reported along the local strike both north and south of those reported in this study. Whether or not these outcrops exhibit quarrying activity has yet to be determined.

A second transect was walked perpendicular to the axis of the known quarry alignment between sites 38SP11 and 38SP21. It produced evidence of similar ultramafic rocks, but these as far as they could be traced, exhibited strike parallel to the soapstone deposits. As previously noted, these rocks are probably structurally related to the soapstone deposits. Therefore, to date no alignment of soapstone deposits have been observed in northwestern South Carolina which vary in strike from the local structural trend. Since the geology of the study area and the Piedmont in general is quite complex, alignments with a strike at variance with the local structural trends may occur. But none have yet been observed.

Utilizing the previously discussed hypothesis as a basis, a more formalized proposition can be generated regarding the locating of soapstone quarries based on geologic criteria. If three or more quarried soapstone outcrops are located which exhibit a linear alignment then that alignment will generally be concordant with the strike of the areal and regional structural trends. Conversely, if a single quarried soapstone outcrop is located within the Piedmont or Appalachian Highlands, then investigations of adjacent areas along the strike of the rock units of the area have a high probability of locating additional quarried outcrops. If the strike of the rock units in the area cannot be dtermined, then investigations conducted to the northeast and southwest of the initially located quarry will generally prove production.

This proposition is supported by data from other areas of the Piedmont near Washington, D.C. along the Potomac River and near Elberton, Georgia along the Savannah River (Holmes 1897). In Figure 36 the locations of soapstone quarries described by Holmes (1897) from the Chesapeake region are plotted. A linear alignment of these quarries, over both a large and small area, with the structural trends of the region is clearly visible. Tentative investigations by the author of six quarries in the area

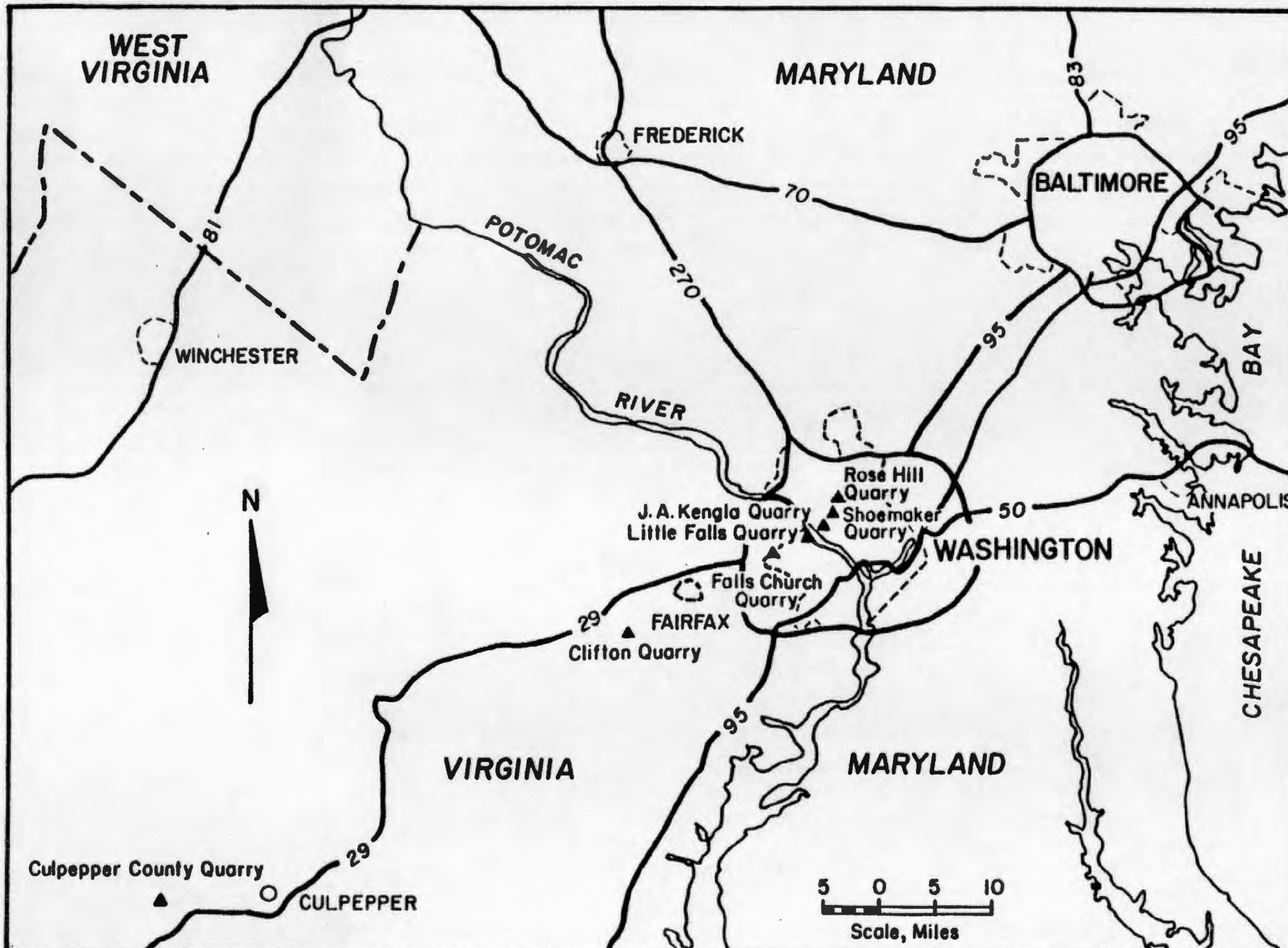


Figure 36. Soapstone Quarries in the Chesapeake Region. (From Holmes 1897)

to be impacted by the Richard B. Russell Reservoir Project also exhibit a linear alignment which supports the proposed model.

The major significance of this proposition for future archeological research in the Piedmont is that unlike other lithic resources such as obsidian which is usually geographically restricted, soapstone is a linear resource. Future research will have to consider procurement patterns for soapstone areas of the Piedmont in much the same manner as procurement patterns are considered for aquatic resources from rivers and streams.

By viewing soapstone and the major stream of a given drainage as linear resources, various research problems can be generated. For example, since the alignment of soapstone outcrops and the major streams of the Piedmont are generally perpendicular, hypotheses concerning site densities and fall-off rates for both subsistence and lithic resources could be tested within a single study. The importance of viewing soapstone as a linear resource as opposed to a point resource cannot be overstressed. Studies involving the modeling of soapstone procurement activities within a regional economic context will be of little value unless soapstone sources are viewed in this manner.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

In conclusion this study has concentrated on a distinct group of soapstone quarries in Spartanburg and Cherokee Counties of South Carolina. An attempt has been made to delineate and describe the universe of soapstone procurement activity within this area. These quarries are by no means all the quarries in northwestern South Carolina. The delineation of all quarries would have been a monumental and virtually impossible undertaking well beyond the scope and resources of this study. This thesis has also outlined a general behavioral model for soapstone vessel reduction and a proposition concerning quarry location patterning which will aid in future research of soapstone quarrying.

The reduction sequence model presented in this thesis is only a first approximation. But even in this state it has been demonstrated to be a useful interpretive tool. This model could be greatly improved through the pursuit of additional avenues of research. Del Bene and Shelley (1979) point out one such avenue for which the South Carolina quarries are aptly suited. Through the controlled comparison of the actual artifact characteristics and experimentally reproduced artifacts, it is possible to delineate specific types of wear patterns on tools indicative of specific types of use. This type of information is valuable not only for defining tool function but also for generalizing hypothetical constructs for models in areas where artifactual and objective interpretive knowledge are currently lacking. The use of controlled replication as well as ethnographic analogy might also suggest additional attributes such as preferred hardness and shear strength which could be integrated to refine the existing reduction sequence model. Finally the delineation of temporal-stylistic variation among the various artifact forms through the excavation of stratified sites in or near the quarry area would be advantageous. This would allow for a diachronic instead of a synchronic evaluation of the quarrying procedures, and might well produce processual inferences concerning the development and use of various quarrying and manufacturing procedures as well as patterns of use and discard.

The location proposition should aid in future research in the study area, especially cultural resource management surveys which are concerned with the prediction of archeological resources in given areas. The proposition could be refined through the joint efforts of geologists and archeologists in an intensive and interdisciplinary study.

The soapstone quarries in Spartanburg and Cherokee counties are valuable archeological resources in several other research areas. The soapstone quarries in the study area exhibit little utilization other than for prehistoric quarrying activities. No evidence has been found which indicates that habitation, hunting or plant collecting activities are associated with the quarries. This fact combined with their state of preservation make these quarries valuable information sources relative to the further study of site formation (Schiffer 1976) or site development processes (Wildesen 1973). Although only briefly considered here, a more comprehensive study could delineate as well as quantify (c.f. Wildesen 1973) a broader range of processes and their interactions. For example a quantitative study of soapstone soil formation and erosion of disturbed areas could provide data useful in the interpretation of the dynamics of artifact context at the soapstone quarries. Such studies would provide a more objective framework in which to assess contextual relationships as well as contribute to the general theoretical-methodological base of archeology.

The study area also provides a resource base for the study of economic and subsistence subsystems of Late Archaic cultural systems. Soapstone is geologically restricted to the eastern North American Piedmont and Appalachian Highlands, yet it occurs archeologically over a much broader geographic area. Allen, Holland and Luckenbach (1974, 1975a,b,c), Luckenbach (1974a,b), Bohanon (1975) and Becker (1976) have attempted to correlate soapstone artifacts found on prehistoric habitation sites with source areas by means of physical and chemical examination, such as instrumental neutron-activation, petrographic and spectrographic analysis. The goal of these studies has been to produce models of local and regional distribution and exchange systems. Similar trace element studies utilizing the quarries in the study area could provide data for the generation and testing of such models for the South Carolina Piedmont and the Southeast in general.

The Late Archaic appears to have been a major period of transition in patterns of environmental exploitation. Population densities apparently increased over most of the Southeast. There seemed to have been a shift in patterns of environmental exploitation from extensive use of resources over wide geographic areas to the intensive utilization of resources in geographically restricted areas. Of primary importance there appears to have occurred a culmination of trends of intensive plant utilization which had developed during the Early and Middle Archaic periods. In conjunction with this trend during the Late Archaic Period there was also the introduction of Meso-American domesticates. For example, Chapman and Shea (1978) have found hickory nuts, walnuts, acorns, canary grass, chenopodium, sumac and grape seeds as well as the Meso-American domesticates squash and/or pumpkin at the Bacon Bend site, a Late Archaic period (2440 B.C.- 1630 B.C.) site on the lower Little Tennessee River. At the Iddins site (1705 B.C.-1255 B.C.), also on the lower Little Tennessee River, Chapman and Shea (1978) have found hickory nuts, walnuts, acorns, butternuts, chestnuts, grape seeds, sunflower seeds and chenopodium, and the Meso-American domesticates squash and gourd.

It is possible in this context that soapstone use developed as a response to changing patterns in the subsistence economy. The use of soapstone may be related to the introduction of Meso-American domesticates or sedentism related to the intensive utilization of smaller areas of land. As with the case of technological research, replicative studies and ethnographic analogies could be utilized in this context to develop valuable research questions concerning such areas as the adaptive potential of new cooking technology in a hunting and gathering society.

In addition to the research potential of the quarries, there exists an equally valuable education opportunity for the general public. These quarries are preserved windows into the prehistoric past from which the public could learn about prehistoric technology and economy. The conspicuous nature of the large worked boulders and quarry pits along with the current state of preservation make the quarries excellent candidates for development into archeological parks. There are several local and state groups who have shown an interest in the preservation and development of these resources. These groups include: the South Carolina Council of Governors, the South Carolina Heritage Trust and the Spartanburg Historical Society. It is recommended that steps be taken to unify the efforts and goals of these various groups and other interested individuals.

Finally it cannot be overly stressed that the greatest need for these soapstone quarries is preservation. The area in which the quarries are located is increasingly threatened by the urban expansion of the city of Spartanburg. These quarries are non-renewable resources and once destroyed are gone forever.

REFERENCES CITED

REFERENCES CITED

Allen, R.O., C.G. Holland and R.O. Luckenbach
1974 Preliminary Analysis of 44CF41 Steatite. Quarterly Bulletin, Archaeological Society of Virginia 29 (1): 27-30.

1975a Soapstone Artifacts: Tracing Prehistoric Trade Patterns in Virginia. Science 187 (4171): 57-58.

1975b The Application of Instrumental Neutron Activation Analysis to a Study of Prehistoric Steatite Artifacts and Source Material. Archaeometry 17 (1): 68-83.

1975c Movement of Prehistoric Soapstone in the James River Basin. Quarterly Bulletin, Archaeological Society of Virginia 24 (4): 183-203.

Anonymous
n.d. Aboriginal Steatite Quarry: Clifton, Fairfax County, Virginia. Unpublished manuscript 1952. Anthropology Archives, Museum of Natural History, Washington, D.C.

Baird, S.F.
1879 Report of Professor Baird. Annual Report of the Board of Regents of the Smithsonian Institution, 1878: 44-46. Washington, D.C.

Becker, M.F.
1976 Neutron Activation Analysis of Rare Earth Elements in Steatite and Related Rocks: Application to Archaeological Problems Throughout the World. MASCA Newsletter 12 (2): 1-2.

Bohanan, E.R., Jr.
1975 A Petrographic and Spectrographic Analysis of Several Soapstone Artifacts from Tennessee and Soapstone Deposits in North Carolina and South Carolina in an Attempt to Determine the Source Area of the Artifacts. Unpublished M.S. Thesis. Department of Geology, University of Tennessee, Knoxville.

Brandau, B. and J. Noakes
1975 University of Georgia Radiocarbon Dates IV. Radiocarbon 17 (1): 99-111.

Braun, E.L.
1950 Deciduous Forests of Eastern North America. The Bleakston Company, Philadelphia.

Bullen, R.P.
1940a The Dolly Bond Steatite Quarry. Society for American Archaeology, Notebook: 104-105.

1940b Further Notes on the Dolly Bond Steatite Quarry. Society for American Archaeology, Notebook: 158-160.

Bullen, R.P. and H.B. Green
1970 Stratigraphic Tests at Stallings Island, Georgia. Florida Anthropologist 23: 8-28.

Bushnell, D.I., Jr.
1926 Ancient Soapstone Quarry in Albemarle County, Virginia. Journal of the Washington Academy of Sciences 16 (19): 525-528.

1939 The Use of Soapstone by the Indians of the Eastern United States. Annual Report of the Smithsonian Institution, 1939: 471-489. Washington, D.C.

Caldwell, J.R.
1954 The Old Quartz Industry of Piedmont Georgia and South Carolina. Southern Indian Studies 6: 37-39.

Caldwell, J.R. and C.F. Miller
1948 Appraisal of the Archeological Resources of the Clark Hill Reservoir Area, South Carolina and Georgia. Unpublished manuscript. Institute of Archeology and Anthropology, University of South Carolina, Columbia.

Camp, W.J.
1968 Soil Survey of Spartanburg County South Carolina. United States Department of Agriculture, Washington, D.C.

Chapman, J. and A.B. Shea
1978 Paleoecological and Cultural Interpretations of Plant Remains Recovered from Archaic Period Site in the Lower Little Tennessee River Valley. Paper presented at the 34th Annual Meeting of the SEAC, Knoxville, Tennessee.

Claflin, W.H., Jr.
1931 The Stalling's Island Mound, Columbia, County, Georgia. Papers of the Peabody Museum of American Archaeology and Ethnology 14 (1).

Coe, J.L.
1952 Culture Sequence of the Carolina Piedmont. In Archaeology of the Eastern United States. Edited by J.B. Griffin. Chicago University Press.

1964 The Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society 54 (5), New Series.

Collins, M.B.
1975 Lithic Technology as a Means of Processual Inference. In Lithic Technology: Making and Using Stone Tools. Edited by E. Swanson. Mouton, Paris, pp. 15-34.

Cook, T.G.
1976 Broadpoint: Culture, Phase, Horizon, Tradtion, or Knife ? Journal of Anthropological Research 32: 337-357.

Crane, H.R. and J.B. Griffin
1965 University of Michigan Radiocarbon Dates II. Science 127: 1098-1105.

Cridelbaugh, P.A.
1977 An Analysis of the Morrow Mountain Component at the Ice House Bottom Site and a Reassessment of the Morrow Mountain Complex. Unpublished M.A. Thesis. Department of Anthropology, University of Tennessee, Knoxville.

Damon, P.E., C.W. Ferguson, A. Long and E.I. Wallick
1974 Dendrochronologic Calibration of the Radiocarbon Time Scale. American Antiquity 39 (2): 350-366.

Del Bene, T.A. and P.H. Shelley
1979 Soapstone Modification and Its Effects on Lithic Implements. In Lithic Use-Wear Analysis. Edited by Brian Hayden. Academic Press, New York.

Dice, L.R.
1943 The Biotic Provinces of North America. University of Michigan Press, Ann Arbor.

Dickens, R.S. and L.F. Carnes
1976 Preliminary Archeological Investigations at Soapstone Ridge, DeKalb County, Georgia. Paper presented at the 33rd SEAC meeting, Tuscaloosa, Alabama.

Dragoo, D.
1976 Some Aspects of Eastern North American Prehistory: A Review 1975. American Antiquity 4 (1): 1-28.

Edens, R.
1971 A Further Report on Archaic Soapstone Quarries in Upper South Carolina. Institute of Archeology and Anthropology, University of South Carolina, The Notebook IV (4).

Fairbanks, C.H.
1942 The Taxonomic Position of Stallings Island Georgia. American Antiquity 7: 223-231.

Faulkner, C.H. and J.B. Graham
1966 Westmoreland-Barber Site (40MI11) Nickajack Reservoir, Season II. Report of Investigations No. 3. Department of Anthropology, University of Tennessee, Knoxville.

Faulkner, C.H. and M.C.R. McCollough
1974 Excavations and Testing, Normandy Reservoir Salvage Project: 1972 Seasons. Report of Investigations No. 12. Department of Anthropology, University of Tennessee, Knoxville.

Fenneman, N.M.
1938 Physiography of the Eastern United States. McGraw-Hill, New York.

Ferguson, T.A.
1976 A Reconnaissance of Soapstone Quarries in the Area of Spartanburg County, South Carolina. Paper presented at the 33rd Annual Meeting of SEAC, Tuscaloosa, Alabama.

Ford, R.I.
1974 Northeastern Archeology: Past and Future Directions. Annual Review of Anthropology 3. Annual Review, Inc., Palo Alto, pp. 385-413.

Fowler, W.S.
1963 Classification of Stone Implements of the Northeast. Bulletin of the Massachusetts Archaeological Society 25 (1): 22-24.

1966 The Horne Hill Soapstone Quarry. Bulletin of the Massachusetts Archaeological Society 27 (2): 17-27.

1969 The Wilbrahan Stone Bowl Quarry. Bulletin of the Massachusetts Archaeological Society 30 (3-4): 9-22.

Glesson, P.
1970 Archaeological Investigations in the Tellico Reservoir, Interim Report, 1969. Report of Investigations 8. Department of Anthropology, University of Tennessee, Knoxville.

Goodyear, A.C., N.W. Ackerly and J.H. House
n.d. An Archeological Survey of the Primary Connector From Laurens to Anderson, South Carolina. Institute of Archeology and Anthropology, University of South Carolina, Research Manuscript Series, in preparation, Columbia.

Harwood, C.R.
1959 Quartzite Points and Tools from the Appalachian Highlands. Tennessee Archaeologist 15: 89-95.

Holmes, W.H.
1890 Excavations in an Ancient Soapstone Quarry in the District of Columbia. American Anthropologist 3: 321-330.

1897 Stone Implements of the Potomac-Chesapeake Tidewater Province. 15th Annual Report, Bureau of American Ethnology, pp. 13-152.

1919 Handbook of Aboriginal American Antiquities. Part I: Lithic Industries. Bureau of American Ethnology Bulletin 60: 380.

House, J.H.
1975 Prehistoric Lithic Resource Utilization in the Cache River Basin: Crowley's Ridge Chert and Quartzite and Pitkin Chert. In The Cache River Archaeological Project: An Experiment in Contract Archaeology. Edited by M.B. Schiffer and J.H. House. Arkansas Archaeology Survey, Publications in Archaeology, Research Series Number 8, Fayetteville.

House, J.H. and D.L. Ballenger
1976 An Archaeological Survey of the Interstate 77 Route in the South Carolina Piedmont. Institute of Archeology, University of South Carolina, Research Manuscript Series, Columbia.

House, J.H. and R.W. Wogaman
1978 Windy Ridge: A Prehistoric Site in the Interriverine Piedmont in South Carolina. Anthropological Studies 3. Occasional Papers of the Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Ingmanson, J.E.
1964 The Archaic Sequence in the Ocmulgee Bottoms. Southeastern Archaeological Conference, Bulletin 1: 31-32.

Jones, W.E.
1962 Soil Survey of Cherokee County, South Carolina. United States Department of Agriculture, Washington, D.C.

Keel, B.C.
1976 Cherokee Archaeology: A Study of the Appalachian Summit. University of Tennessee Press, Knoxville.

1978 Excavations at the Nowlin II Site (40CF35). In Sixth Report of the Normandy Archeological Project. Edited by M.C.R. McCollough and C.H. Faulkner. Report of Investigations No. 21. Department of Anthropology, University of Tennessee, Knoxville.

Kelly, A.R.
1938 A Preliminary Report on Archeological Exploration at Macon, Georgia. Bureau of American Ethnology, Anthropological Papers 1.

Kelly, J.E.
1972 An Archaeological Survey of the Piedmont Region in North Central South Carolina. Unpublished M.A. Thesis. Department of Anthropology, University of Wisconsin, Madison.

Kengla, L.A.
1883 Contributions to the Archeology of the District of Columbia, Washington, D.C. Smithsonian Institution, Washington, D.C.

Kneberg, M.D.
1956 Some Important Projectile Point Types Found in the Tennessee Area. Tennessee Archaeologist 12: 17-28.

Kronberg, N.
1968 Climate. In Soil Survey, Spartanburg County South Carolina. United States Department of Agriculture, Washington, D.C., pp. 51-52.

Loman, D.W. and S.L. Wheatley
1970 Archaic Soapstone Quarries in Upper South Carolina. Institute of Archaeology and Anthropology, University of South Carolina, The Notebook II (6-7): 6-12.

Luckenbach, A.H.
1974a Neutron Activation Analysis of Soapstone Artifacts. Eastern States Archaeological Federation, Proceedings of the Annual Meeting 33 (12).

1974b A Trace Element Study of Amerind Soapstone Artifacts in the Eastern United States. Southeastern Review 1 (2): 134-145.

McCollough, M.C.R. and C.H. Faulkner
1973 Excavation of the Higgs and Doughty Sites: I-75 Salvage Archaeology. Tennessee Archaeological Society, Miscellaneous Paper 12.

McGuire, J.D.
1883 Soapstone Quarries and Aboriginal Tools for Working Soapstone. Transaction of the Anthropological Society of Washington II: 39.

Manson, C.
1948 Marcey Creek Site: An Early Manifestation in the Potomac Valley. American Antiquity 13 (3): 223-226.

Michie, J.L.
1969 Excavations at Thom's Creek. Institute of Archeology and Anthropology, University of South Carolina, The Notebook I (10): 2-16.

Misra, K.C. and F.B. Keller
1978 Ultramafic Bodies in the Southern Appalachians: A Review. American Journal of Science 278: 389-418.

Neshko, J., Jr.
1970 Bakerville Stone Bowl Quarrying. Bulletin of the Massachusetts Archaeological Society 31 (1-2): 1-10.

Oosting, H.J.
1942 An Ecological Analysis of the Plant Communities of Piedmont, North Carolina. American Midland Naturalist 28: 1-126.

Overstreet, W.C. and H. Bell III
1965 The Crystalline Rocks of South Carolina. Geological Survey Bulletin 1183. United States Government Printing Office. Washington, D.C.

Overton, J.M.
1969 A Survey of Soapstone Quarry Sites. Institute of Archeology and Anthropology, University of South Carolina, The Notebook I (4): 6-7.

Putnam, F.W.
1878 The Manufacture of Soapstone Pots by the Indians of New England. 11th Annual Report of the Peabody Museum of Archaeology and Ethnology.

Reynolds, E.R.
1878 Aboriginal Soapstone Quarries in the District of Columbia. 13th Annual Report of the Peabody Museum of Archaeology and Ethnology: 526-535.

Ritchie, W.A.
1959 The Stony Brooke Site and Its Relation to Archaic and Transitional Cultures on Long Island. New York State Museum and Science Service Bulletin No. 372, Albany.

1969 The Archaeology of New York State. Second, revised edition. The Natural History Press, New York.

Schiffer, M.B.
1976 Behavioral Archeology. Academic Press, New York.

Schumacher, P.
1878 The Method of Manufacture of Several Artifacts by the Former Indians of Southern California. 11th and 12th Annual Reports of the Peabody Museum: 258-264.

Sheldon, C.T., Jr.
1976 Aboriginal Soapstone Exploitation in Carroll County, Georgia. Paper presented at the 33rd Meeting of the SEAC, Tuscaloosa, Alabama.

South, S.
1953 Archaeological Survey of Watauga County, North Carolina. Unpublished manuscripte. Institute of Archeology and Anthropology, University of South Carolina, Columbia.

Stephenson, R.L.
1975 An Archeological Preservation Plan for South Carolina. Institute of Archeology and Anthropology, University of South Carolina, Research Manuscript Series 84, Columbia.

Taylor, R.L. and M.F. Smith
1978 The Report of the Intensive Survey of the Richard Bo Russell Dam and Lake, Savannah River, Georgia and South Carolina. Institute of Archeology and Anthropology, University of South Carolina, Research Manuscript Series 142, Columbia.

Trimble, S.W.
1974 Man-induced Soil Erosion on the Southern Piedmont, 1700-1970. Conservation Society of America.

Turnbaugh, W.A.
1975 Toward an Explanation of the Broadpoint Dispersal in Eastern North American Prehistory. Journal of Anthropological Research 31 (1): 51-68.

Watley, J.
1968 A Soapstone Quarry at Carrollton, Georgia. Paper presented at the 1968 meeting of the Society for the Preservation of Early Georgia History, Athens.

Wauchope, R.
1966 An Archaeological Survey of Northern Georgia with a Test of Some Cultural Hypotheses. Memoirs of the Society for American Archaeology 21.

Wildesen, L.E.
1973 A Quantitative Model of Archaeological Site Development. Ph.D. Dissertation. Department of Anthropology, Washington State University, Pullman.

Witthoft, J.
1959 Notes on the Archaic of the Appalachian Region. American Antiquity 25: 79-85.

Wright, A.
1971 An Aboriginal Quarry in Tallapoosa County. Journal of the Alabama Academy of Science 45 (1): 17-21.

Yurkovich, S.P.
1976 The Corundum Hill Dunite, Macon County, North Carolina. Southeastern Geology 19 (1): 55-68.

VITA

Terry Andrew Ferguson was born 23 September, 1953 in Richmond, Virginia. He graduated from high school in Winston-Salem, North Carolina in 1971. In September 1971 he entered Wofford College in Spartanburg, South Carolina. He graduated from that institution in May of 1975 with a Bachelor of Arts degree in Sociology.

In January of 1976 Mr. Ferguson entered the Masters program in Anthropology at the University of Tennessee, Knoxville. His thesis was supported by a matching grant-in-aid from the South Carolina Department of Archives and History and the United States Department of the Interior. He graduated with a Masters degree in Anthropology in June of 1980.

Mr. Ferguson plans to continue his education toward a Doctoral degree in Anthropology.