A BIOARCHAEOLOGICAL STUDY OF MORTUARY PRACTICE AND CHANGE AMONG THE PIEDMONT SIOUAN INDIANS

by

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A Dissertation submitted to the faculty of The University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Anthropology.

Chapel Hill

1988

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SUSAN HOMES HOGUE. A Bioarchaeological Study of Mortuary Practice and Change Among the Piedmont Siouan Indians. (Under the direction of George R. Holcomb.)

ABSTRACT

This study represents a bioarchaeological approach to the investigation of culture change among the non-Catawba Indian groups who inhabited the Piedmont of the Carolinas and Virginia during the late prehistoric to contact period. Five levels of inquiry comprise this investigation: biological diversity and distance studies, demographic analyses, assessment of trace element assays, analyses of pathologies, and examination of social organization. Ethnohistorical data are incorporated into the investigation where appropriate. Results of the biological diversity and distance study and the examination of social organization support a division of the Indian populations that inhabited the region into two broad categories that emulate the traditional northern and southern Siouan categories formulated by previous researchers. As a direct result of this research it is suggested that certain of the northern groups may possibly have Iroquoian affiliations rather than Siouan connections.

The investigation of the demographic data and the pathologies present indicates a decrease in the overall health of the contact period burial samples. Changes in diet are indicated with protein from animal and nut resources being more important dietary elements in the contact period burial samples. Finally, questions concerning diet, health, demography, social relations and social organization are formulated for future research.

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ACKNOWLEDGEMENTS

I wish at this time to pause and thank a number of individuals and institutions that contributed to the completion of this dissertation. First, my heart-felt appreciation has to go to my Ph.D. committee--George Holcomb, Julia Crane, William Pollitzer, Richard Yarnell, and Vin Steponitis--for the help and direction they provided me throughout this grueling, invigorating process. A very special thanks is extended to George Holcomb who assumed the role of advisor after the death of Roy Dickens.

I wish to thank the Research Laboratories of Anthropology, The University of North Carolina at Chapel Hill for allowing me to make use of the skeletal series from the Fredricks site, the Wall site, and the two Upper Saratown sites curated by that institution, for providing me with the maps for the Fredricks and Wall sites, for permitting me to use data concerning the archaeology of the Fredricks site, Wall site, and the two Upper Saratown sites, and for allowing me to photograph the bone elements illustrated in Plates I and II of this study.

The Shannon site skeletal series was made available for analysis by Ed Garner of the National Museum of Natural History in Washington, D.C.. The animal bone and field records from the Shannon site were provided courtesy of Keith Egloff and the Virginia Research Center for Archaeology in Yorktown, Virginia.

The trace element assays used in this investigation were conducted by Benton Jones of the Department of Horticulture at the University of Georgia in Athens.

Funding for the travel, trace element assays, computer analyses, and numerous other expenses was provided in part by grants from Sigma Xi and the Robert Bellemy Foundation of Miami, Florida. Trace element assay of the Upper Saratown-Locality 2 burials was made possible by a National Science Foundation grant directed by H. Trawick Ward and R.P. Steven Davis of the Research Laboratories of Anthropology.

The Clustan statistical package was used in this study through arangement with the Department of Computational Science, University of St. Andrews, St. Andrews, Scotland and the Traingle Universities Computation Center.

A number of individuals have provided me with considerable support and intellectual stimulation during my career in graduate school, including Michael Trinkley, Estella Stansbury, Annie Holm, Chris Gremillion, Julie Hammett, Dan Simpkins, and Linda Carnes.

Two invaluable friends, Laura Castellanos and Sherry Paylor, provided unlimited support and understanding during my dissertation writing. Thanks guys.

To my parents Cy and Maryann, and my siblings, Ann and Cy, I can only say thank you for your love, support, and understanding during my years in graduate school.

And finally, to a very special individual, Jack Wilson, who served as teacher, friend, companion, typist and map producer, thank you for invaluable help and persistence in my finishing this work. I will always love you and regard you as a very special friend.

CHAPTER I

INTRODUCTION

This study represents a bioarchaeological approach to the investigation of culture change among the non-Catawba Indian groups who inhabited the Piedmont of the Carolinas and Virginia during the late prehistoric to contact period. Specifically, the effects of European contact on these Indian groups will be investigated by examining the change in biological characteristics and relationships and in mortuary practices that occurred during this era. Traditionally, these Piedmont Indians have been identified with the Siouan linguistic and ethnic families (Griffin 1945; Mooney 1894; Swanton 1946; J. Wilson 1983), and have generally been thought to have had a tribal type of sociocultural integration (Dickens et al. 1987; Navey 1982; Ward 1987; H. Wilson 1983a, 1983b; J. Wilson 1983).

Early European explorers upon arriving in the North Carolina and Virginia Piedmont found the region inhabited by a number of small Indian groups that researchers have come to associate with a common culture and language. A linguistic category called "Siouan" is identified with these Indians of the Piedmont and a number of other Eastern Indian groups, who presumably spoke a language similar to that of the Dakota Sioux of the Midwest (Lewis 1951; Mooney 1894; Neumann 1952; Swanton 1946).

The category of Eastern Siouan into which the Piedmont Indians are placed is based primarily on linguistic evidence, which has proven to be a tenuous form of evidence in the past (cf. J. Wilson 1983:588-591), geography (they all inhabited the Piedmont of Virginia and the Carolinas), and history (most of the groups amalgamated into two larger groups--the Catawba and the Fort Christanna tributaries--generally identified as being Siouan) (Lewis 1951:1-2).

Lewis (1951:1-12) provides an excellent summary of the linguistic evidence for the various Siouan identities and affiliations, noting that word lists exist for only three of these supposedly Siouan goups--the Catawba, the Tutelo, and the Woccon. The linguistic research among the Catawba Indians (Barton 1798, Gallatin 1836, Lieber 1856, Mooney 1894, Morgan 1870), the Tutelo (Hale 1883, Mooney 1894), and the Woccon (Adelung and Vater 1816; Gallatin 1836; Lawson 1967; Mooney 1894) has produced a number of vocabularies for the Catawba, three small Tutelo word lists obtained during fieldwork among the last survivors of the Tutelo resident with the Iroquois-speaking Cayuga of New York (Frachtenberg 1913; Hale 1883; Sapir 1913), and a list of 192 Woccon words provided by John Lawson (1967) in his 1701 journal. The final conclusion that can be reached concerning this research (Lewis 1951:7) is that there are two basic divisions within the Siouan languages in general, but particularly among the dialects spoken by the Indian groups of the Carolina and Virginia Piedmont (Speck 1935:221; Swanton 1923:34). This division is based in part on the general similarity of Catawba to certain Muskogean languages (Michelson 1914:83-84, in Lewis

1951:6). Swanton (1932a:12; 1932b:66, in Lewis 1951:8) labels these two groupings the "northern" division of Siouan Indians, composed of those Virginia Indian groups historically related to the Tutelo, and a "southern" division of Siouan Indians, composed of those North Carolina Indian groups historically associated with the Catawba Indians. This division mirrors the perceived differences in the Catawba and Tutelo dialects, which are described by Siebert (1945:103-104) as two "lexically dissimilar" languages. Lewis (1951:10-11) provides the basic position that has guided the research of the Siouan Indians of the Carolina and Virginia Piedmont for the last four decades in the following four propositions:

> 1. Most of the tribes of the Carolinas and southern Virginia spoke dialects of the Siouan linguistic stock.
> 2. The Siouan-speaking tribes in Virginia and part of northern North Carolina spoke dialects related to one another and forming a "Tutelo" or "northern" division of the eastern Siouan-speaking tribes, the language of this division being closely related to the languages of certain western Siouan-speaking tribes.
> 3. The remainder of the Siouan speaking tribes in the two Carolinas, including the Sara tribe, spoke dialects related to one another and forming a "Catawba" or "southern" division of the eastern Siouan-speaking tribes, the language of this division being rather different from that of the "northern" division and the western Siouan languages, and possibly related in some aspects to languages of the Muskhogean linguistic stock.
> 4. The linguistic differences between the two eastern divisions indicate other cultural differences, as yet unknown.

Lewis (1951:11) goes on to note that two major hypotheses constructed from these four generalizations can be investigated through the use of archaeology and ethnohistory. These two hypotheses state that

> 1. A territorially coterminous group of tribes in Virginia and the Carolinas, speaking dialects of the Siouan linguistic stock, possessed a language and culture which differed significantly from that of other indigenous groups which bordered it.
> 2. Within this group there were linguistic differences of such cultural significance that the culture common to tribes of the "northern" unit differed from the culture common to tribes of the "southern" group".

Any research that is conducted on any of the Indian groups traditionally assigned to either the northern or southern divisions has to consider the implications of these two hypotheses for the basic assumptions of that research.

From this early research into the Siouan-speaking Indians of the Carolinas and Virginia, the Indian groups of the Carolina and Virginia Piedmont have traditionally been divided as follows. In the "northern" division are the Indians who resided at Fort Christanna in Virginia as tributaries--the Sapona, Tutelo, Occaneechi, and Stukanox, with the last-named group comprising the remains of the Manakens and the other Indians of the "Monacan Confederacey" of Virginia (Swanton 1946:201; Griffin 1945:321; J. Wilson 1983:4). The "southern" division of the Siouans are those groups that are thought to have incorporated with the Catawba Indians by the 1740s, including the Eno, Sara (Cheraw), Keyauwee, Shakori (Shoccores), Pedee (Pedea) Congaree, Wateree, and Santee (Swanton 1946:110; Griffin 1945:321; J. Wilson 1983:4-5).

This general interpretation of the cultural geography of the Carolina and Virginia Piedmont has not gone unchallenged. Carl Miller (1957) re-examined the primary and secondary sources for three of the northern division Indian groups--the Occaneechi, Saponi, and Tutelo. He concluded that their language was similar to the Algonkian spoken by the Indians of the Northeast and Middle Atlantic Coast (Miller 1957:115-211). The problem of the differing linguistic identifications, ethnic affinity, and the cultural composition and affiliations of the Piedmont Indian groups is addressed in Chapters III, VII, and VIII of this study.

In addition to the linguistic designation, another Eastern Siouan category has been devised based on the physical characteristics of certain Eastern Indians. Georg K. Neumann (1952:31) attempted to "provide a framework for the reconstruction of the racial history of the American Indian." Toward this end, eight human physical varieties were defined by Neumann (1952) for the Indians, with much of his work being built on Hrdlicka's (1916) study of a Monsee Indian cemetery in Delaware. Neumann (1952:33) recognized that considerable revisions to his work would be required as additional information became available, because, as he noted, the

> means of a few conventional measurements and indices do not tend to be diagnostic. In order to characterize each variety, it therefore becomes necessary to combine them with brief morphological descriptions.

In North Carolina, archaeological and ethnohistorical studies (Coe 1952a, 1952b; Coe and Lewis 1952; Coe et al. 1982; Dickens 1976; Keel 1976; Lewis 1951; Navey 1982; Phelps 1983; J. Wilson 1983) have identified four distinct cultural groups: the Algonquians and Tuscarora along the Northeast Coast and Coastal Plain; the Siouans of the Piedmont and the Southern Coast and Coastal Plain; the Muskhogeans in the Piedmont; and the Cherokee in the Mountains.

Using Neumann's physical typology, correlations can be suggested for the Lenapid variety and the Algonkians, the Iswanid variety and the Siouans, and the Cherokee and Muskhogeans with the Walcolid variety. These general correlations have been verified by a number of morphological studies including Neumann (n.d.), Pollitzer (1971), and Coe et al. (1982). What has yet to be demonstrated is an identical correlation between physical type, linguistic class, and culture type.

Recently Ubelaker (1978:88) has noted that

> many of the errors [misuse of biological data] stem from adherence to the discredited "typological" definition of a population. According to this view, a certain set of traits identify a "type" and all individuals possessing these traits belong to the same class. Among biologists, this thinking has been replaced by "population thinking", which recognized that all levels of biological difference . . incorporate a range of variation. .

Robbins (1977) has expressed similar disagreement with the tendancey to emphasize only description or morphology of skeletal series. She (Robbins 1977:1) states that the typological approach fails to investigate the "adaptive significance of the phenotypic variation" within study samples or populations.

A variety of metric and nonmetric techniques have been developed to determine intra- and inter-population relationships. Both multivariate and univariate techniques are being used to determine the parameters of population dynamics. There is an increased tendency to discuss biological distance, based on the degree of morphological similarity of the populations under study (Ubelaker 1978:87-88). Although the typological approach and redirection toward population dynamics offer somewhat different results, both ultimately contribute to a thorough understanding of the physical remains of past peoples (cf. Robbins 1977:11).

From this discussion it is evident that the data supporting these categorizations have been sparse and that more data are necessary before the general characterization of the Indians of the Virginia and Carolina Piedmont as speaking a common Siouan language, possessing a particular physical morphology, and sharing a common culture can be accepted, if that is a valid goal of research. Obviously, archaeology will not indicate what language a particular people spoke, and it is important to recognize that there is no necessary relationship between the language spoken, physical type, and cultural assemblage of Indian groups. It is possible, however, that a breeding population the members of which speak a common language will produce a patterned cultural assemblage (R. S. Dickens, personal communication, 1983). It is the task of the archaeologist to delineate these patterns, and to isolate, describe, and analyze culture change and continuity through time in order to better understand the underlying forces of human behavior. To accomplish these tasks in this case, the systematic collection and study of information concerning the aboriginal inhabitants of the North Carolina and Virginia Piedmont is necessary. A major part of such an investigation involves the analysis of demographic and mortuary data derived from archaeological contexts.

Although archaeologists have been studying the Piedmont Siouan Indians for over 50 years (Benthall 1969; Coe 1937, 1952a, 1964, n.d.; Coe and Lewis 1952; Dickens et al. 1986, 1987a; Gardner 1980; Griffin 1945; Keel 1972; Lewis 1951; Ward 1983; J. Wilson 1977, 1981, 1982, 1983), it is only within the last two decades that investigations involving biocultural data have been conducted (Graham 1973; Mecklenburg 1969; Navey 1982; H. Wilson 1985, 1987). Graham (1973) includes two Siouan burials in her examination of the dentition of 26 individuals from the Town Creek Indian Mound. This temple mound and associated ceremonial area is located on the Little River in central North Carolina. The mound complex itself dates to the late prehistoric/early protohistoric period (A.D. 1450-1600) and possesses an intrusive, late-seventeenth century contact-period component that is presumably Siouan (J. Wilson 1983:xii-xiii). Graham's study focuses on the effects of subsistence and cultural traits on dentition. Her research is very limited in reference to the Siouan population that inhabited the site, given that only two of the individuals in the study are Siouan. Demographic data, mortuary behavior, and other biocultural information is not included in her endeavor.

Mecklenburg's (1969) work utilizes data on 106 burials from the Shannon site, a possible Siouan occupation on the Upper Roanoke River in Montgomery County, Virginia. Her research makes use of information from the skeletal remains concerning age, sex, cranial indices, and pathologies to investigate questions concerning the representativeness, the ethnic identity, and the general health of the population sample. Unfortunately, data concerning mortuary behavior is not included in the study.

The most extensive biocultural study of the Piedmont Siouan Indians is Navey's (1982) examination of the skeletal remains and associated grave goods from 87 burials at Upper Saratown (31Sk1a), a late-protohistoric/early-contact-period Siouan village located on the Dan River in north central North Carolina (see Chapter II). Results of the analyses of the demographic characteristics and mortuary patterns of the sample are used by Navey to test Binford's (1971:18) proposition that there is a correlation between the complexity of the structure of a culture and the complexity of the group's mortuary behavior. Based on the age, sex, and grave associations of each burial, Navey (1982:192) concludes that the similar treatment accorded adults and subadults in Upper Saratown's mortuary complex does not correspond to the predictions of Binford's simple versus complex socio-cultural systems.

A recent study by Sorohan (1985) compares the dental pathologies exhibited by a late prehistoric/protohistoric period skeletal series with those of a contact period skeletal series in order to investigate the possible effects of European contact, especially changes in subsistence, on the Siouan Indian groups. The results of Sorohan's (1985:54) preliminary study indicate an overall increase in dental pathologies in the contact period sample.

In general, the investigations discussed above that utilize skeletal remains to study Siouan Indian populations are particularistic in nature and/or consider only a few of the biocultural data sets available for study. Mecklenburg's analysis addresses questions pertaining to ethnicity, demography, and pathologies, whereas Graham and Sorohan are concerned with the effects of the environment and behavior on the dentition as evidenced by dental pathologies. While Navey's work is the most intensive biocultural study of any Siouan population, demographic and mortuary data are only utilized to test a hypothesized relationship between complexity of mortuary practices and complexity of social organization. It is apparent, however, that enough information exists to warrent a biocultural study of the Siouan Indian groups of the Carolina and Virginia Piedmont that integrates demography, subsistence practices, disease states, ethnicity, and mortuary data.

Research Methods and Objectives

Within archaeology in general, and in this investigation of continuity and change in the biocultural aspect of Siouan culture, three theoretical levels of inquiry can be identified. On what can be described as the "high" plane of general theory, generalizations about culture can be achieved at the expense of explaining much of the actual variation that exists. At this high level, consideration of diversity becomes lost in the search for generalizations (Smith and Winterhalder 1981:4, 7). In order to give meaning to the lowest level of inquiry, the particularistic approach to the study of discrete cultural units, a middle level of theory has been proposed (cf. Binford 1977:7-9; 1983:31-39).

Considering first the "high" plane of theoretical explanation, the concepts of open and closed communities, first proposed by Durkheim in his investigation of religion (Evans-Pritchard 1965:54-55), provide a framework for the study of continuity and change in the biocultural aspect of Siouan culture. A closed community is characterized by a "religion" (culture traits ?) that is transmitted from one generation to another. This religion exists before an individual enters a society at birth and will continue after that person exits the society through death (or, presumably, some other means). Thus, religion is acquired by being born into a particular society, and is obligatory, as an individual has no option but to accept that to which everybody gives common assent. In an open society on the other hand, religious beliefs may not be transmitted at birth; religion is diversified; and religious beliefs are less obligatory, as individuals have a choice (Evans-Pritchard 1965:54-55).

By including other cultural traits (behavior patterns) with religion in this consideration of Siouan culture change and continuity, it is suggested that prior to European contact, the Siouan Indian groups of the Piedmont exhibited characteristics of a closed community. After contact, an open society, or diversity, becomes necessary for either adaptive purposes (cf. Sahlins and Service 1973:46-47), or because people from different societies were interacting more and eventually joining together (cf. Evans-Pritchard 1965:55). Archaeologically, the contact period situation would be reflected in increased diversity in the morphology of the population, diet, and mortuary patterns at sites over that noted at pre-contact period sites. Greater diversity in the types of pathologies exhibited by contact period populations might also occur as individuals from different environments with different stresses would be clustered together in a composite population.

At the low or particularistic level of investigation and theory, diversity is accounted for in aggregate, but is not explained in a theoretical fashion (Smith and Winterhalder 1981:4).

For example, the level of sociocultural integration (cf. Steward 1955) of many prehistoric and contact period aboriginal societies in the Southeast has been defined as either "tribes" or "chiefdoms", but no explanation of how such a level of sociocultural integration came about is offered. Service (1962:113-115) states that the reason for a tribe to exist is basically conflict, which can be interpreted more broadly as competition, over scarce resources. Tribes can be defined, as opposed to explained, as boundable systems of relationships whose devices for connecting members are sodalities, cross-cutting associations devoted to kinship affiliations, age grades, secret societies, and ritual configuration. The major institutions of social control are manifested in roles and egalitarian statuses that have no governmental function (Service 1962:111). Tribes are adaptive as they provide the alliance and solidarity needed to cope with a certain level of competition (Service 1962:12).

Chiefdoms are profoundly non-egalitarian, with the "chief" having the ability to plan, organize, and deploy public labor (Service 1962:150). Chiefdoms transcend the tribe in two respects. Chiefdoms represent a denser and usually larger and more populous society made possible by greater productivity. And chiefdoms are more complex and more organized. Redistribution of goods by a central agent or agency is another characteristic associated with a chiefdom (Service 1962:143).

The use of any typology, including that which contains tribes and chiefdoms, to define particular aboriginal groups, societies, cultural systems, etc., is not especially useful, except possibly at the synchronic level of inquiry. It is more useful to be able to consider the groups, societies, cultural systems, etc., within an evolutionary framework, i.e. change through time, and to address questions of why and how the different types such as tribes and chiefdoms change and develop.

In this study, it is hypothesized that the late prehistoric Siouan societies possessed egalitarian social systems, or, for lack of a better description, tribal types of social organization. With increased conflict/competition brought about by European contact, a tribal type of sociocultural integration would have been necessary for the aboriginal societies. This follows from Service's (1962:113-115) observations that tribal units are adaptive in the face of conflict. It is also hypothesized that with the advent of European contact, a more complex tribal organization would be necessary to accommodate integration of previously autonomous tribal units that occurred, i.e., more stringent rules may have been necessary for the different people to live together. Such an increase in complexity might be reflected in differential diets for certain segments of a population, and a more complex mortuary pattern.

The third level of inquiry involves middle-level theory. Models at the middle level of investigation are formulated with attention given to both the diversity present and the formulation of generalizations (Smith and Winterhalder 1981:7). Generally, middle-range theory concerns the formation processes of the archaeological record. The primary question that can be asked is what processes responsible for change and diversification are reflected in the southeast exhibited immediately prior to the appearance of European explorers (Leacock 1971:9-10; J. Wilson 1983:35, 572-573). The protohistoric period is represented by early, sporadic contacts, either directly with European explorers, missionaries and traders, or indirectly via goods traded through other Indians who acted as intermediaries (Leacock 1971:11; J. Wilson 1983:36, 575). Interaction between the Europeans and the Indian groups during the protohistoric perid was fleeting and non-lasting. The contact period in the Carolina Piedmont is the time when direct and ongoing interaction between the Indians of the region and the Europeans (the English in this case) was established. The early part of this period from circa 1665 until 1675-1680, which roughly covers the time from planning and establishment of the English settlement at Charlestown in 1670 and the defeat of the Occaneechi by Nathaniel Bacon in 1676 to their subsequent removal into North Carolina from the Roanoke River drainage (J. Wilson 1983:575; 1987), can be separated from the later contact period. The middle contact period covers the years of interaction between the Indians and the Euro-Americans before the migration of the Piedmont Indians southward into South Carolina or to Fort Christanna in Virginia, a process completed by 1712 (J. Wilson 1983:576; 1987).

The two general questions that are the focus of this study are how the Siouan biocultural systems changed from the late prehistoric to the contact period, when Europeans appeared in North Carolina and Virginia; and what are the effects of contact upon the overall health of the Siouan populations.

Research Techniques

Mortuary and population data from five areas of inquiry--consideration of biological continuity, studies of demographics, assessment of trace element levels in skeletal remains, analysis of pathologies, and examination of patterning in the mortuary practices--are used here to study the changing patterns of behavior of these Indian groups.

Information about the possible biological connections between late prehistoric and/or contact populations, and the extent of population disruption and movement following contact, is provided by the study of the skeletal material using both metric (cranial and post-cranial indices) and non-metric (discrete skeletal traits) techniques of analysis. Non-metric data are utilized in formulae for measuring sample diversity (cf. Lieberson 1969) and divergence (cf. Buikstra 1976) in order to evaluate the amount of variation within a population sample and the biological distance between population samples. The metric data consist of measurements and calculated indices for cranial and postcranial remains, and stature estimates, which are used to investigate the similarities and differences within and between the study samples.

Demographic analyses provide information pertinent to the study of the overall health and fitness of the samples. Changes in the mortality rates of certain age and sex groups would be expected among the study samples given the disruptions of the environment (considered in this study to consist of natural and cultural components) of the Piedmont Indian groups during contact with the Europeans. Life expectancies would also be expected to change during the contact period with the introduction of additional stresses related to European diseases and the skin/fur trade, and an increase in existing stresses, such as warfare, in the environment.

Assuming that the environment of the Piedmont region remained relatively constant with respect to food resources from the late prehistoric to contact periods, changes in the diet of individuals within populations can be investigated through trace element analysis of human bone samples. By monitoring the concentrations of such trace elements as zinc, copper, magnesium and strontium, it is possible to estimate the relative contributions of floral and faunal resources to the diet of both individuals and groups of individuals (Szpunar et al. 1978).

Although some diseases, such as influenza and measles, leave no marks on skeletal remains, and only preliminary results have been obtained in the study of the effects of smallpox on bone material recovered from an archaeological context (cf. Jackes 1983), consideration of bone pathologies can provide additional insights into the presence of disease-induced stress. Categories of bone pathologies and the occurrence of the respective types of pathologies in the study samples are compared between samples to assess whether more stress is evident in the contact period than in pre-contact times. For example, changes in the frequencies of certain types of pathologies, such as cut and puncture wounds, might be expected in a contact-period population sample within an environment in which warfare is a prominent feature.

The fifth line of inquiry involves consideration of mortuary practices, a domain that includes data from the other four lines of inquiry. Attributes concerning such characteristics as age and sex, diet, and mortuary behavior are integrated to investigate possible differences across space and changes through time in status and social organization that mark the study samples. Although these Siouan groups are generally considered to have been tribal societies, there occurred changes in the sociocultural composition that can be studied through an examination of the mortuary practices of the study populations (cf. O'Shea 1984).

CHAPTER II

THE ARCHAEOLOGICAL SITES AND STUDY POPULATIONS

The data utilized in this work are drawn from archaeological sites of the Piedmont region of North Carolina and Virginia. The boundaries of the study area are formed by the Roanoke River in Virginia to the north, the Eno River in North Carolina to the south, the Fall Line to the east, and the Blue Ridge Mountains to the west (Figure 1).

Five archaeological sites are available for use in this study (Table 1). These are the Shannon site (44My8), late prehistoric; Wall site (31Or11), late prehistoric/protohistoric; Upper Saratown-Locality 1 (31Sk1), protohistoric; Upper Saratown-Locality 2 (31Sk1a), late protohistoric/early contact; and the Fredricks site (31Or231), middle contact. These sites are included in this study because each represents a different temporal span of the Indian occupation of the Piedmont. Also, two of the sites, Shannon and Upper Saratown, have skeletal series that number approximately 100 individuals. Unfortunately, the Wall and Fredricks sites on the Eno River and Upper Saratown-Locality 1 on the Dan River in North Carolina have considerably smaller samples, but they are incorporated into this study as they are the only skeletal material from the appropriate temporal periods available for the

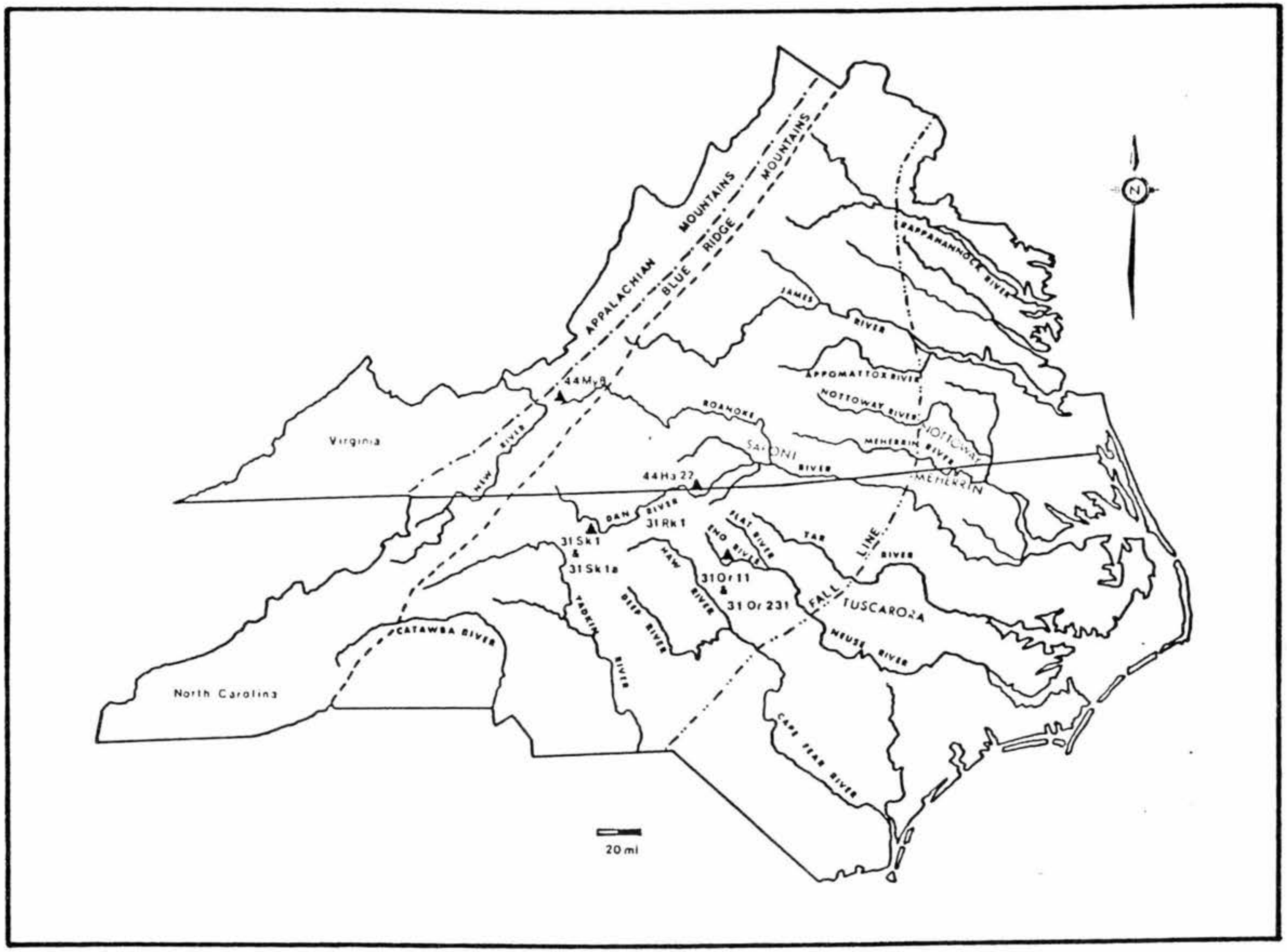

Figure 1. Location of the archaeological sites considered in this study.

TABLE 1.

Identified Sites and their Posited Temporal and Cultural Affiliation.

SITE	TEMPORAL PERIOD	LOCATION	AFFILIATION
Shannon (44My8)	Late Prehistoric (ca., A.D. 1450 -1525)	Roanoke River	Tutelo (?)
Lower Saratown (31Rk1)	Late Prehistoric (ca., A.D. 1450-1525)	Dan River	Sara (?)
Reedy Creek (44Ha22)	Late Prehistoric (ca., A.D. 1450-1525)	Dan River	Sapona (?) or Tutelo (?)
Wall (31Or11)	Late Prehistoric/ Early Protohistoric (ca., A.D. 1547)	Eno River	Possibly Siouan or Iroquoian
Upper Saratown-Locality 1 (31Sk1)	Protohistoric (ca., A.D. 1600-1630)	Dan River	Sara
Upper Saratown-Locality 2 (31Sk1a)	Late Protohistoric/ Early Contact (ca., A.D. 1630-1665)	Dan River	Sara
Fredricks (31Or231)	Middle Contact (ca., A.D. 1680-1712)	Eno River	Occaneechi

region. The following section discusses each site and its respective archaeological assemblage in detail.

The Shannon Site (44My8)

The Shannon site (Figure 2) is situated on the North Fork of the Roanoke River in Montgomery County, Virginia. It is approximately 5 miles east of Blacksburg, Virginia, and 20 miles north of the main channel of the Roanoke River. The site lies within the Ellett Valley, a subsection of the Roanoke Valley, at an elevation of 1500 feet above sea level. The topography of the Ellett Valley consists of gently sloping terrain with low ridges extending from the mountains to the edge of the river flood-plain. The Roanoke River has extensively eroded the flood-plain, creating numerous knolls and ridges, and exposing the underlying sediments in a number of locations. Flood-deposited silts containing quartzite, jasper, and chert pebbles, utilized by the aboriginal inhabitants of the valley, are found in most low lying areas. The valley was once covered by oak-hickory climax forest, interspersed with clearings in various stages of succession (Benthall 1969:1).

Prior to the appearance of white settlers in 1750, the area is thought to have been the home of the Siouan-speaking Tutelo Indians (Benthall 1969:ix). Swanton (1946:178) places the "Totero" (Tutelo) village visited in 1671 by Thomas Batts and Robert Fallam on the Roanoke River near Salem, Virginia, some 20 miles east of the Shannon site. Later, the Tutelo are thought to have moved to an island in the Roanoke River near its confluence with the Dan River (Swanton 1946:200). In 1701, John Lawson (1967:53) located the Tutelo near

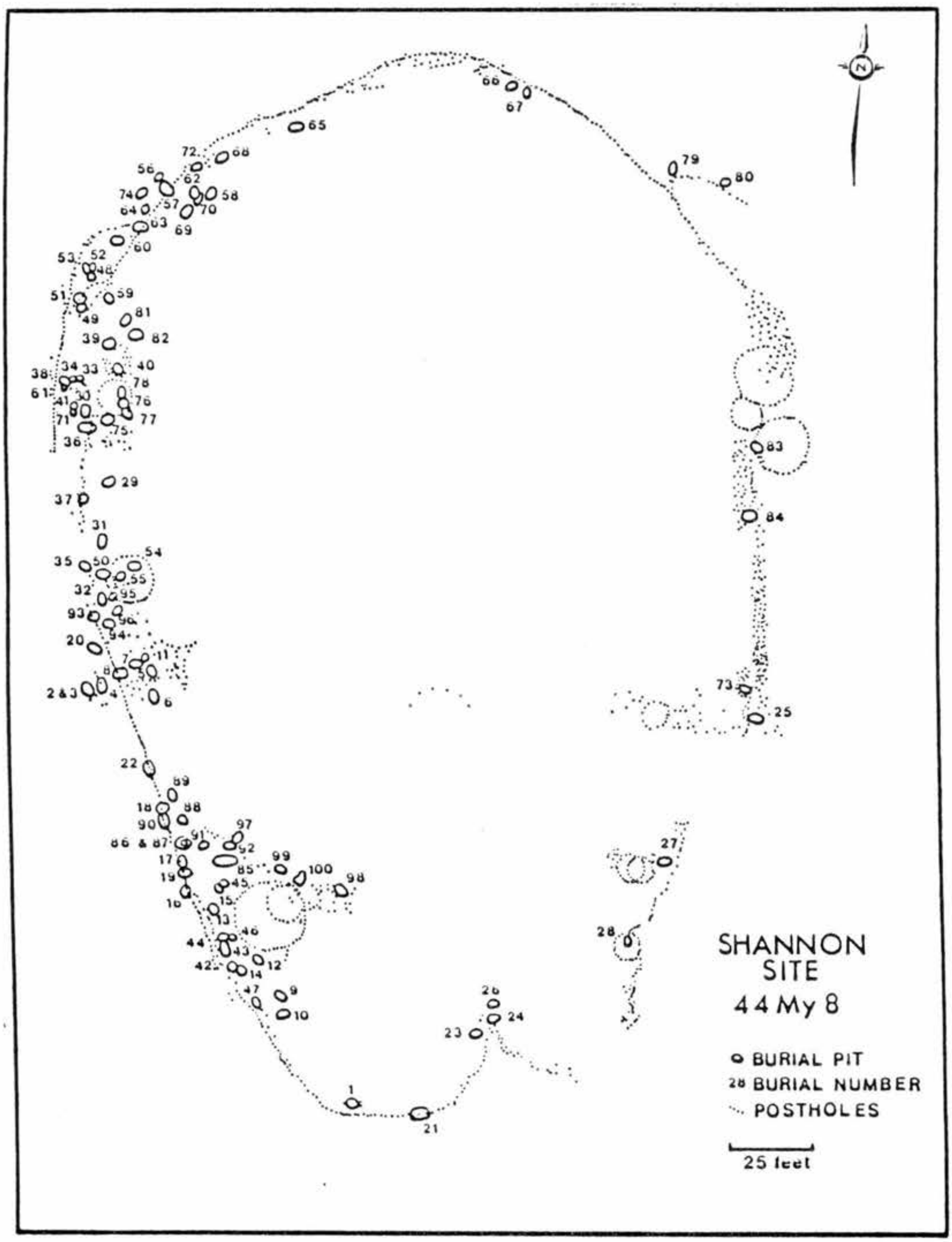

Figure 2. Map of the excavated burials and posthole patterns at the Shannon Site. (Adapted from Benthall 1969 using data furnished by the Virginia Research Center for Archaeology).

the headwaters of the Yadkin River. In 1711, the Tutelo were accepted as tributary Indians by the colony of Virginia, and were settled with the Saponi and Occaneechi Indians first on the Meherrin River (McIlwaine 1928:307-310), and later in 1714 at Fort Christanna (Brock 1882:88). About 1740, the Tutelo and the other Indian groups joined with the Saponi moved northward and were incorporated with the Iroquois Indians, being settled for a time on the Susquehanna River at an Indian village known as "Shamokin" (Mooney 1894:50; Swanton 1946:178).

Although the ethnic affiliation of the prehistoric Shannon site inhabitants with the historically known Tutelo Indians is based primarily on circumstantial evidence (cf. Benthall 1969:147-148; Mecklenburg 1969), portions of the material culture do reflect Siouan influences. Ceramics at the Shannon site include both Clarksville and Dan River series sherds (Benthall 1969:147), which are traditionally associated with Siouan Indian occupations of the late prehistoric period (Coe and Lewis 1952; Lewis 1951: 214-264; J. Wilson 1983:314-315). Radford Series ceramics are the predominant pottery at the site, and show numerous similarities to the Clarksville Series in rim profiles, surface decorations, handles, surface treatment and vessel shape (Benthall 1969:147). The only difference in the two is that Radford ceramics are tempered with crushed limestone and Clarkesville ceramics are tempered with fine to medium sand (Benthall 1969:116, 123, 147).

The skeletal sample from the Shannon site consists of 129 burials curated at the National Museum of Natural History in Washington, D.C.. Unfortunately, provenience information for 29 of these burials is missing. Therefore, only the 100 burials with provenience information are included in this study. Of these 100 burials, four with nothing more than burial numbers and location had to be excluded from the analysis. Burial data utilized are derived from Benthall (1969), from field records housed at the Division of Historic Landmarks, Virginia Department of Conservation and Historic Resources, Richmond, Virginia, and from original analyses conducted by the author.

The Wall Site (31Or11)

The Wall site is located in a bend of the Eno River near Hillsborough, North Carolina. Excavations were conducted at this site in the summer of 1937, late fall and winter of 1940, and the summers of 1983 and 1984 by the Research Laboratories of Anthropology, The University of North Carolina at Chapel Hill (Figure 3). The earlier excavations were part of a WPA program administered through The University of North Carolina under the direction of Robert Wauchope and Joffre L. Coe. An area of 14,225 square feet was excavated by this early work, and five burials were exposed (J. Wilson 1983:342).

The work conducted during the 1980s was part of the revised Siouan Project coordinated by Roy S. Dickens, Jr.. Three additional burials were uncovered at the Wall site by the 1983 excavations. Combined, the excavations have revealed the greater part of a palisaded village with at least 73 features and 12 structures (Petherick 1987:30-49). C^{14} assays date the Wall site occupation to A.D. 1545 $\pm$80 years, which lies within the late prehistoric/early

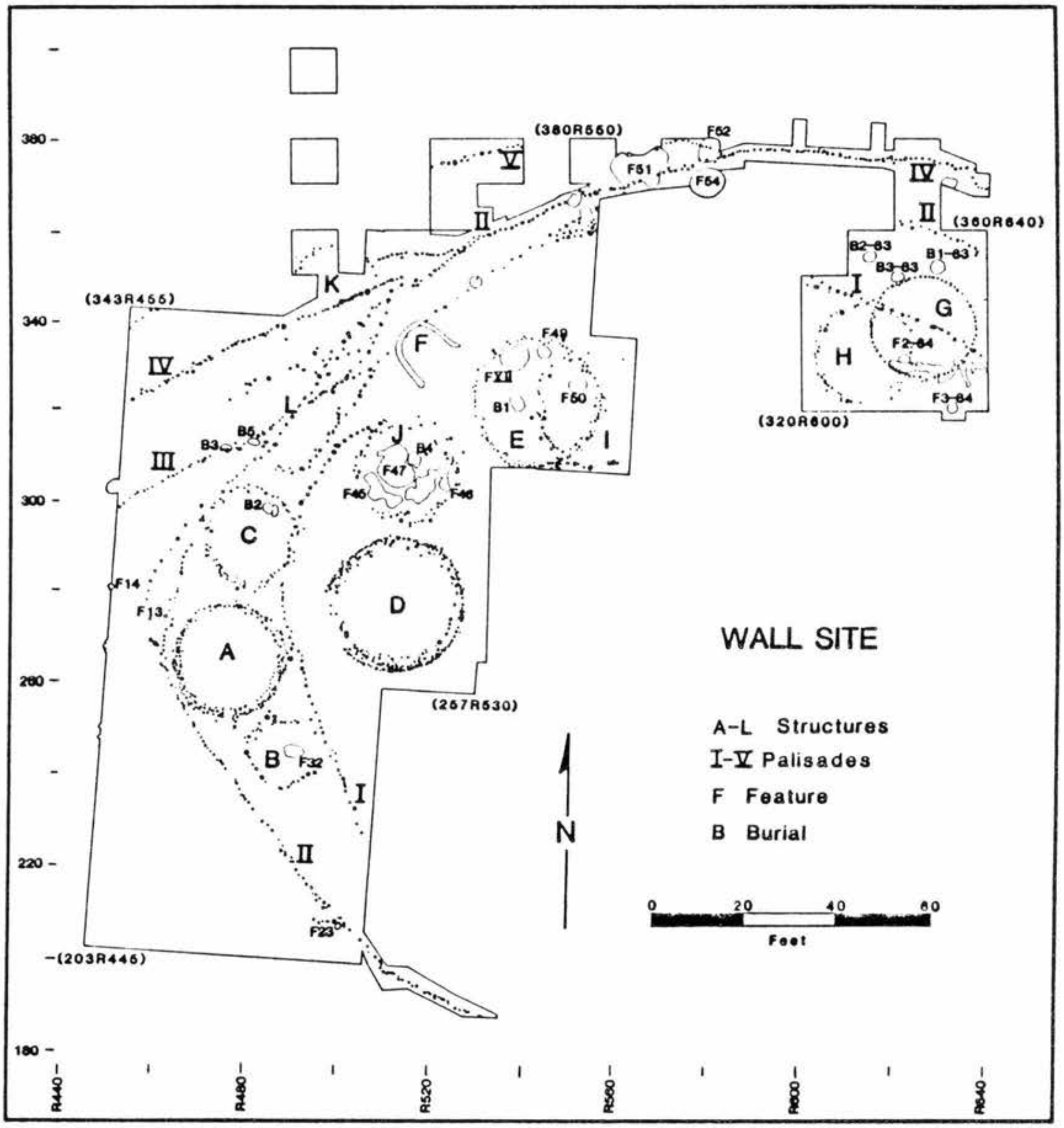

Figure 3. Map of the excavated burials, features, and posthole patterns at the Wall site. (Map provided courtesy of the Research Laboratories of Anthropology, UNC-Chapel Hill).

protohistoric period (Dickens et al. 1987:6). Again, no definite ethnic relationship can be documented for the Wall site at this time, although Coe (1952a:310-311) originally identified the site with the historic Occaneechi of 1700. Recent analyses of the ceramics from the site suggest a possible non-Siouan affiliation for the site however (Davis 1987:214; J. Wilson 1983:369). The Wall site ceramics are similar to those found at the later Fredricks site located within 100 yards of the Wall site (Davis 1987:213-214), with the later materials being identified with a 1701 village of the Occaneechi Indians (see below), an Indian group that had traditionally been identified as Siouan (cf. Mooney 1894; Swanton 1946; Coe 1952a).

Upper Saratown-Locality 1 (31Sk1)

The earlier of the two Upper Saratown sites, Locality 1 (31Sk1) is situated on the Dan River near Walnut Cove in Stokes County, North Carolina. Excavations at this site were conducted by the Research Laboratories of Anthropology under the direction of Jack Wilson during the summer of 1981. These excavations were conducted to provide preliminary information pertinent to a study of the cultural continuity and change of the Indians who had lived within this section of the Dan River (J. Wilson 1983:378). A total of 40 features and 6 burials were uncovered by this initial work at the site (Figure 4). The only European items recovered from the undisturbed areas of the excavations were 2 blue glass trade beads, a piece of brass scrap, and one peach pit. These artifacts reflect a low level of interaction with the Europeans and suggest a

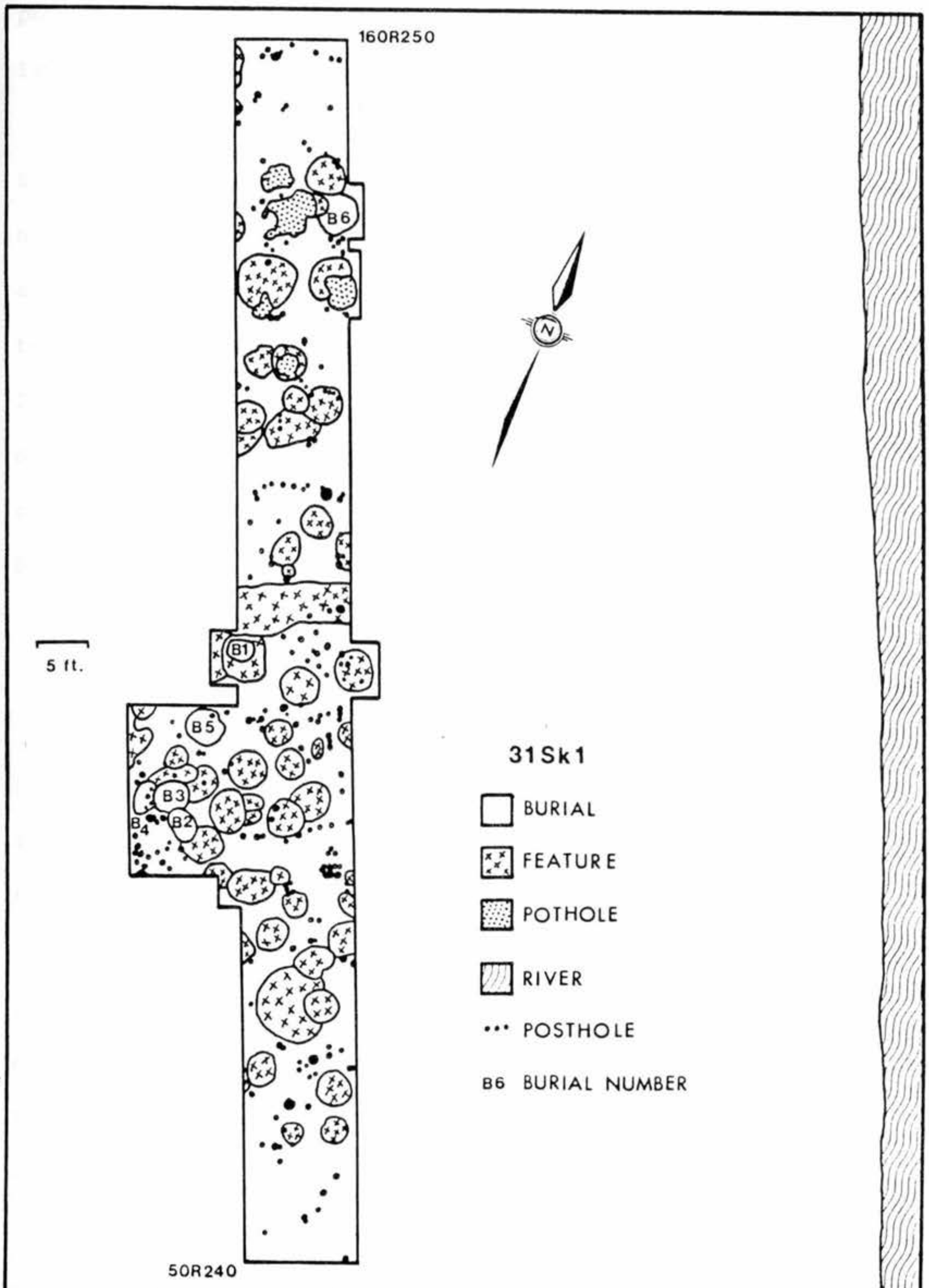

Figure 4. Map of the excavated burials, features, and postholes at the Upper Saratown-Locality 1 site. (Adapted from J. Wilson 1983 using data furnished by the Research Laboratories of Anthropology, UNC-Chapel Hill).

protohistoric period occupation for the site (J. Wilson 1983:385; 1987), which would date between 1600 and 1640.

Mooney (1894), Swanton (1946), and Lewis (1951) identify the Sara Indians as inhabitants of this area of the Dan River during historic times. Certainly the material culture of these sites along the Dan River has long been associated by archaeologists with the Siouan Sara Indians (Griffin 1945; Lewis 1951; Coe 1952a; Coe 1952b; J. Wilson 1983). Apparently, the Dan River was home to the Sara Indians until sometime in the first decade of the eighteenth century, for by 1712 they had moved south to the Pee Dee River in South Carolina (J. Wilson 1983:192-194).

Upper Saratown-Locality 2 (31Sk1a)

Located some 500 yards south of 31Sk1 on the Dan River is the site of 31Sk1a, Upper Saratown-Locality 2. Excavations were initiated at this site in 1972 in an attempt to salvage information that was being actively destroyed by relic hunters. To date some 16,400 square feet of the site have been excavated (Figure 5), with 225 features, 111 burials, portions of at least 4 palisade lines, and all or part of 13 house structures being documented (J. Wilson 1983:414). As noted above, these remains are associated with the Siouan Sara Indians. Given the types of European trade artifacts present (glass beads, worked brass, brass bells, and a few iron items such as scissors, a hoe, an axe, and a spike/chisel) and the European artifacts absent (guns, metal containers, clothing articles) (J. Wilson 1983:416-424), this site can be dated to the late protohistoric/early contact period. Two metal spoons of

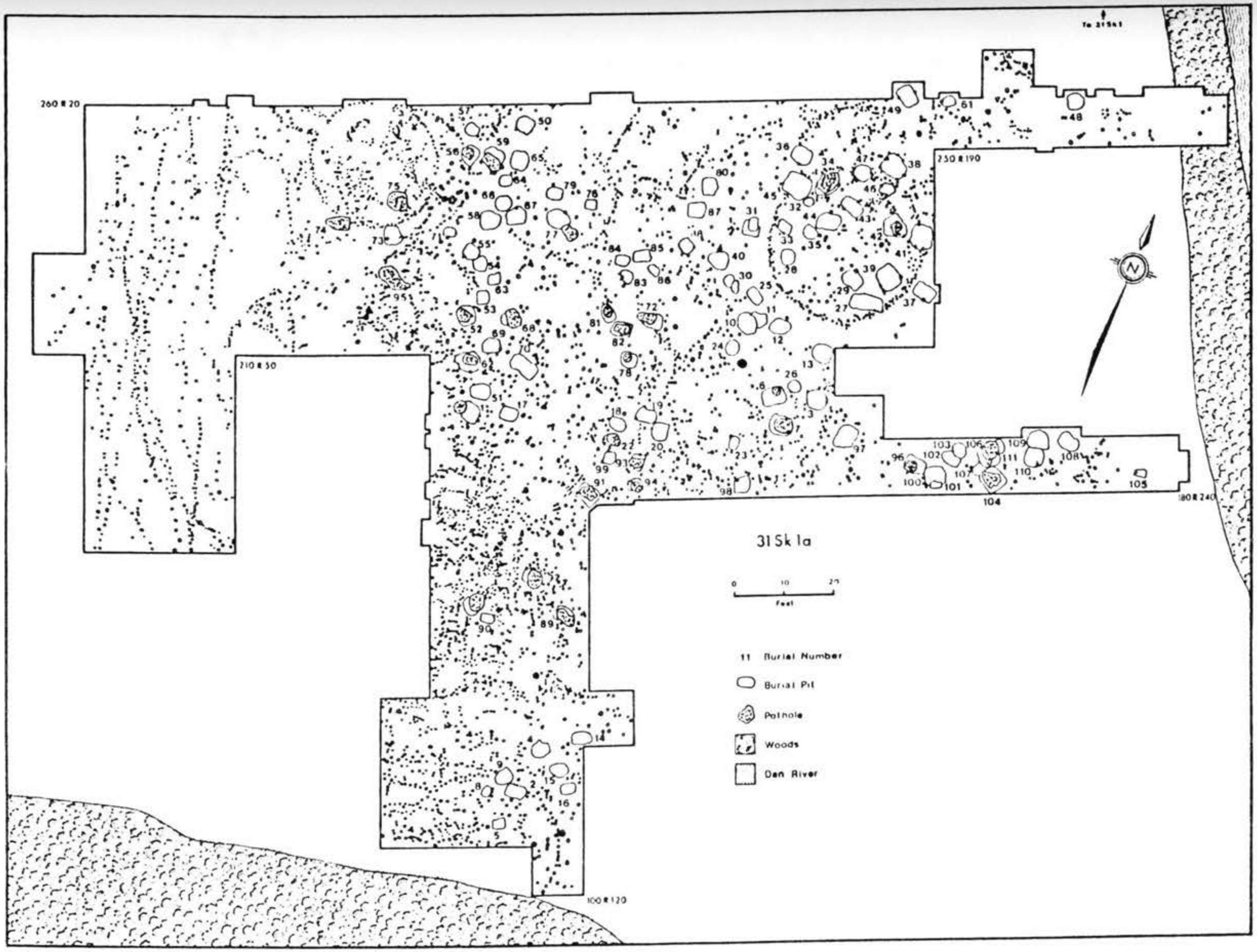

Figure 5. Map of the excavated burials and posthole patterns at the Upper Saratown-Locality 2 site. (Adapted from J. Wilson 1983 using data provided by the Research Laboratories of Anthropology, UNC-Chapel Hill).

European origin in the burials at Upper Saratown-Locality 2 can be dated between 1630 and 1650 (Wilson 1977:xiv). Also, large beads in Burial 51 at the site are similar to large multi-colored beads that date to the 1630s in Dutch sites of New York (cf. Karklins 1984). John Lederer noted in 1671 that the "remoter Indians" preferred to trade for trinkets such as mirrors, pictures, glass beads, knives, scissors, "...and all manner of gaudy toys and knacks for children..." (Talbot 1958:42). All of this information suggests a date between 1640 and 1675 for Upper Saratown-Locality 2.

The Fredricks Site (31Or231)

Located on the Eno River some 200 yards west of the Wall site, the Fredricks site (Figure 6) possesses the latest of all the assemblages discussed. This site is thought to be the remains of a village occupied by the Occaneechi Indians in the late seventeenth and early eighteenth centuries (Dickens et al. 1987:6), which was visited and described by John Lawson (1967) in 1701. Until shortly after 1681 the Occaneechi inhabited an island in the Roanoke River, before migrating south along the Great Trading Path into North Carolina, where John Lawson encountered them in 1701 along the Upper Eno River (J. Wilson 1983:183-185). In December of 1711, the Occaneechi, Saponi and Stukanox Indians were accepted as tributary Indians by the colony of Virginia, and settled on a parcel of land along the Meherrin River in Virginia (McIlwaine 1928:296). Thus, from 1711 until the early 1740s, the Occaneechi were residents of Virginia. Most researchers (Coe 1952a; Griffin 1945; Mooney 1894;

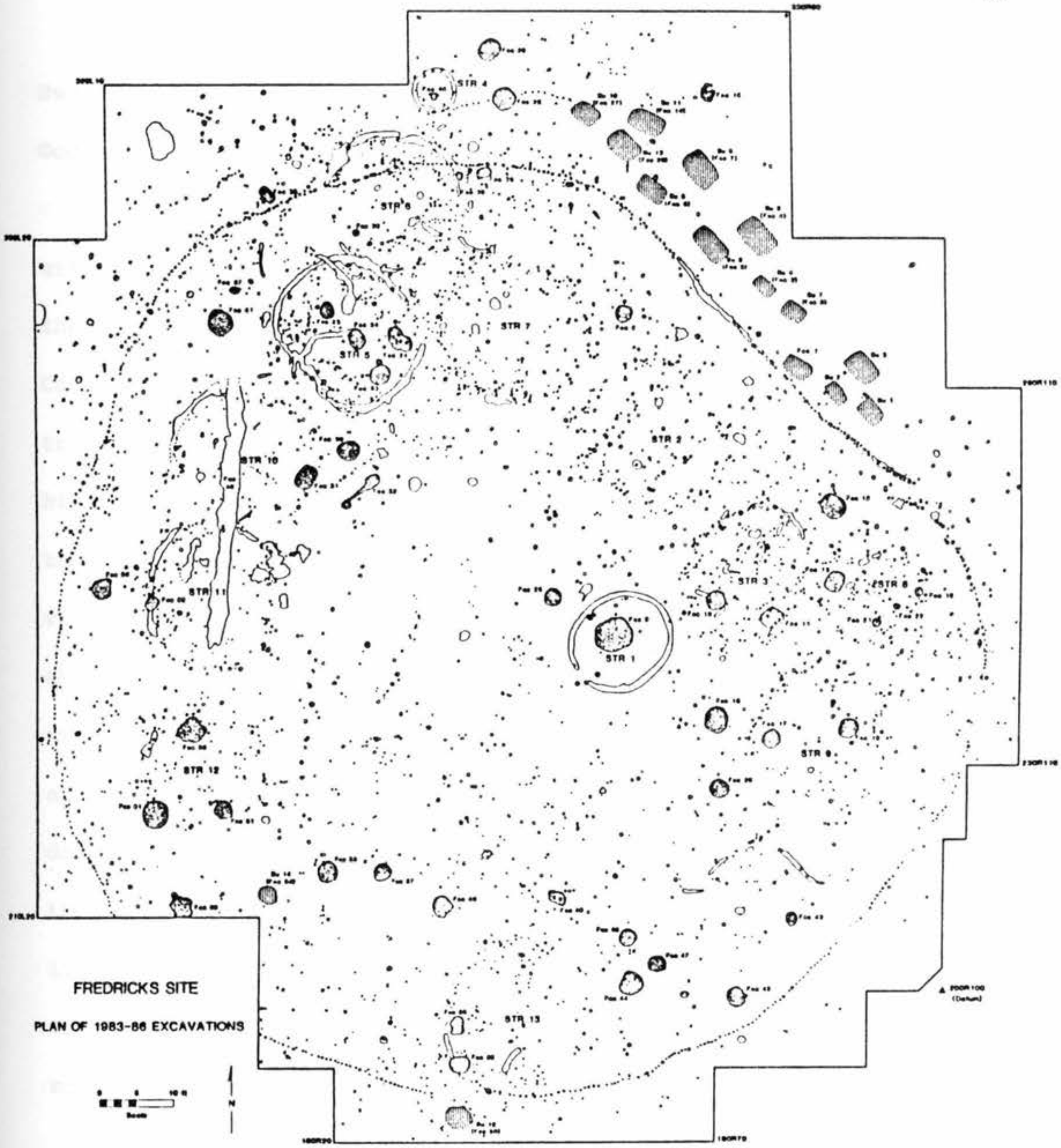

Figure 6. Map of the excavated burials, features, and posthole patterns at the Fredricks site. (Map provided courtesy of the Research Laboratories of Anthropology, UNC-Chapel Hill).

Swanton 1946; J. Wilson 1983) have traditionally identified the Occaneechi Indians as Siouan.

Archaeological investigations were initiated at the Fredricks site in 1983 as part of an intensive research project undertaken by the Research Laboratories of Anthropology, The University of North Carolina at Chapel Hill, to study culture change among the Siouan tribes of the North Carolina Piedmont during the protohistoric and historic periods (ca. A.D. 1525-1740). 31Or231 represents one of the latest occupied, and certainly the best preserved, aboriginal villages yet discovered in the Piedmont of North Carolina (Dickens et al. 1986:1). Over a period of three summer field seasons the site has almost been excavated in its entirety. A single palisade around the village, 11 structures, and 61 features have been documented for the site. An area outside the northwest portion of the palisade is thought to be a cemetery (Petherick 1987:74-75; Ward 1987:90) and contains 13 burials. Another two burials have been excavated within the village itself, giving a total burial sample of 15 from the Fredricks site.

Ancillary Sites

In addition to these five sites, two others--44Ha22 and 31Rk1--possess non-skeletal archaeological datasets (ceramics and faunal remains) that will be referred to later in this study. Both sites date to the late prehistoric period, and both are located on the Dan river (Figure 1).

The Reedy Creek site (44Ha22) is located on the north bank of the Dan River at South Boston, Virginia. Excavations were conducted in the late summer and fall of 1975 at this site under the auspices of the Virginia State Library (Coleman 1983). Excavations consisted of 18 five-foot-square test pits and three five-by-ten foot squares. Another section of the site had the topsoil stripped from it to expose features and burials. A total of nine burials and 48 features were excavated during the project. Portions of a palisade line and part of a single structure were documented. The ceramics recovered from the excavation were primarily of the Clarkesville type (cf. J. Wilson 1983:278-296). In addition to the ceramics, quantities of other material remains, including animal bone, charred plant remains, and chipped stone artifacts were recovered from the excavation of this small village site.

"Lower Sauro Town" is the name that has traditionally been assigned to the other ancillary site considered here, 31Rk1 (Griffin 1945; Coe and Lewis 1952; Coe 1952a). This site, however, appears to definitely date to the late prehistoric period (J. Wilson 1983:239), and not the historic period as has previously been thought. 31Rk1 is located on the south bank of the Dan River near the town of Eden, North Carolina, in Rockingham County (Figure 1), approximately 25 miles downstream from the two Upper Saratown locales. A total of 550 square feet of this site were excavated in the spring of 1938 (Lewis 1951:206). Only eight features were uncovered and approximately 60 postholes documented by this work. No burials were encountered in the small-scale excavations conducted at this site. The bulk of the ceramics recovered from 31Rk1 belong to the Dan River Series (Coe and Lewis 1952:1; Gardner 1980:54-80; Lewis 1951:214-253; J. Wilson 1983:240-265). This site appears to be a late prehistoric, possibly early protohistoric, village occupation of the Indians known in historic times as the Sara (J. Wilson 1983:239-240).

Summary

A total of 230 burials are available for study from five sites that have traditionally been identified with the Siouan Indians of the Carolina and Virginia Piedmont. These sites span the temporal periods from the late prehistoric (ca. A.D. 1325-1525) to the historic middle contact (ca. 1676-1710). The five populations have traditionally been thought to be similar in that they all spoke a Siouan dialect, and they possessed all or part of a similar material culture. Unfortunately, only two sites, Shannon and Upper Saratown-Locality 2, have burial samples that can be considered to be representative of the original resident population with all ages and both sexes being present (cf. Ubelaker 1978). The other three skeletal series are included primarily for comparison with particular patterns and trends that are identified in the consideration of the Shannon site and Upper Saratown-Locality 2 data.

CHAPTER III

POPULATION DIVERSITY AND DISTANCE

The subject of biological relationships between prehistoric and historic Siouan groups has not previously been studied in any formal manner. Researchers have usually based their investigations on analyses of historical, linguistic and/or material culture data (cf. Griffin 1945; Lewis 1951; Mooney 1894; Swanton 1946). These efforts have all used cultural connections/continuity to infer biological connections/continuity.

Biological distance is the expression of the genetic dissimilarities between two or more populations. The basic assumption of biological distance studies is that among a collection of individuals, those displaying the most similarities are most closely related (Buikstra 1976:49-54; Ubelaker 1978:87). This basic assumption provides the rationale for investigating here the changes in population similarities (ie., the gene pools) of selected aboriginal populations from the late prehistoric, protohistoric, and contact periods.

It should be possible to examine the biological relationships that exist between the prehistoric Wall and the contact period Fredrick site burial samples. The main question that can be asked for these two assemblages is whether the Fredricks site occupants are descendants of the earlier Wall site occupants. Given that the two sites are located in the same bend of the Eno River, and that studies of their respective assemblages suggest a common ceramic tradition (Davis 1987:214), one would naturally expect there to be little biological difference between the two skeletal series.

In a similar manner, comparison of the Upper Saratown and the Shannon site burial samples can be made with reference to biological diversity and biological distance. Although the geographical distance between the two sites renders studies of biological continuity questionable, measures of biological diversity within each sample can be utilized to investigate questions concerning the relationship of the various Siouan groups to each other and other groups, and possible population movements by the Piedmont Indian groups after contact. Evidence abounds in the ethnohistoric record that during the historic period numerous previously separate Indian groups in the Middle Atlantic area joined together for the common good. At the time of Bacon's Rebellion in Virginia in 1676, reports show that several Indian groups resided with the Occaneechi at their stronghold on the Roanoke River (Billings 1975:267-269; Sainesbury 1893:414). Among these groups were the Manakins, Annalectins, and Susquehannock. The Susquehannock are Iroquoian speakers from the upper Chesapeake drainage (Swanton 1946:31; 1952;:56), and the Manakins are thought to have been a Piedmont Siouan group of Virginia (Swanton 1946:148-149). The Annalectins cannot be identified as any other known group.

A similar pattern of amalgamation apparently characterized the Occaneechi after their move to the Eno River, especially given the disruption caused them by Bacon's forces (J. Wilson 1983:104-105, 112-114). Certainly, the Occaneechi were living with the Saponi, Tutelo, and Manahoac at Fort Christanna on the Meherrin River in Virginia by 1714 (Swanton 1946:201; J. Wilson 1983:140-141). Also, the Sara Indians moved from the upper Dan River to the upper Pee Dee River in South Carolina sometime after 1709, but no mention is made of any other Indian group joining the Sara before this move (cf. J. Wilson 1983:128). The Sara themselves moved westward from the Pee Dee River and incorporated with the Catawba Indians in 1737 (J. Wilson 1983:167-168).

Given the apparent increase in the movement and amalgamation of Indian populations following European contact suggested by this brief consideration of the ethnohistoric records concerning the Indians of the Piedmont, one would expect less biological diversity in prehistoric burial samples when compared to the late protohistoric/contact period Indian burial samples. Likewise, the amount of similarity between the prehistoric and late protohistoric/contact period Indian samples would depend to a great extent on the percentage of the later sample comprised by the descendents of the prehistoric population.

Another question that can be addressed by this biological diversity and distance study is the division by some researchers (Griffin 1945; Lewis 1951:10-11; Swanton 1936:379) of the Virginia and Piedmont Siouan Indians into northern and southern divisions. The northern division consists primarily of the Occaneechi, Sapona, Tutelo, and Manahoac or Manakins (Griffin 1945:321), who are all found at Fort Christanna in Virginia in 1714. The major groups that composed the southern division include the Catawba, Sara, Keyauwee, and Saxapahaw (Griffin 1945:321), with the latter three Indian groups ultimately being incorporated with the Catawba after 1737 (J. Wilson 1984:191-196). Swanton (1936) noted that these two Siouan divisions could be defended on linguistic grounds, while Griffin (1945:328-330) proposed that the two groups could be identified on the basis of material remains, primarily ceramics.

It is possible that these two broad divisions might also be defined by the biological composition of the respective groups. Thus, the biological distance between groups in the northern and southern division would be greater than that within the groups of each of the two divisions. It is expected that the Sara and the Keyauwee will exhibit less biological distance when compared with each other than if the Sara are compared with the Tutelo Indians of the northern division. This assumption is based on the premise that the former two groups (the Sara and Keyauwee) possess similar material cultures and languages, and may have interacted more closely with one another than with other related northern groups with a slightly different language and material culture. Certainly, this question is worthy of investigation.

The accuracy with which biological relationships can be explored is dependent on how representative the skeletal samples are, and on the selection of morphological traits that are purely genetic (i.e., are not affected by environment or the age/sex of an individual) (Ubelaker 1978:87). Also, the practice of exogamy, or marriage outside the biological population, would affect biological diversity by creating more diversity in the gene pool. The first requirement presents a problem, as the samples from the Wall, Fredrick and Upper Saratown-Locality 1 sites are not fully representative of a normal population (i.e., a population with both sexes represented by all age groups). Ubelaker (1978:87) suggests that a sample comprising 100 individuals is sufficient for biological studies if there are no biases present in the selection of the sample. The maximum number of crania available for study are, for the prehistoric period, 41 from the Shannon site; for the late prehistoric/early protohistoric period, four from the Wall site; for the protohistoric period, one from Upper Saratown-Locality 1; for the late protohistoric/early contact period, 25 from Upper Saratown-Locality 2; and for the contact period, eight from the Fredricks site.

It is evident that in each case the sample is smaller than the minimum suggested by Ubelaker. Therefore, the results of the biological diversity and distance studies conducted using these samples and reported in the following pages have to be considered preliminary. This investigation does, however, suggest questions and directions for future research.

Three techniques are used in this study to determine the degree of similarity and difference within and between the five study skeletal series. The first involves a non-metric trait study identical to that employed by Buikstra (1976) in her investigation of prehistoric Illinois River population samples. This technique enables one to examine the genetic distance between individuals within a population and between two or more populations. The second technique also follows Buikstra's (1976) work, and combines the results of the non-metric trait study with Lieberson's (1969) formula for measuring population diversity. This second technique permits the biological diversity <u>within</u> a single population to be computed and is especially useful for small samples. The third and last technique employed here consists of the comparison of selected cranial and post-cranial indices and stature estimates in order to examine the similarities and differences of these variables within and between population samples.

Non-Metric Traits and Within Population Diversity

The analysis of the non-metric data involves coding the presence/absence of a select number of traits exhibited by the cranium (Buikstra 1976:53, 84). A total of nine non-metric traits were scored for each sample: 1) asterionic bone; 2) parietal notch bone; 3) supraorbital foramen; 4) multiple mental foramina; 5) mylohyoid arch; 6) divided hypoglossal canal; 7) multiple zygomatic facial foramina; 8) ossicle at lambda; and 9) superior sagittal sulcus flexes right. These variables are used in this study because they can be observed for the greatest portion of the study series, and each has been shown to be unaffected by age, sex, trait intercorrelation, or cultural/environmental deformation (Buikstra 1976:49-51).

Lieberson's (1969) diversity formula is utilized to explore the degree of similarity exhibited within the study samples. Lieberson's measure of diversity is a variation of Simpson's formula (Lieberson 1969) that describes the position of a population along a continuum from homogeneous to heterogeneous with respect to whatever trait is under study. The formula for calculating the within-sample diversity is expressed as

$$A_w = 1 - S = 1 - ((X_1)^2 + (X_2)^2 + (X_3)^2 + ... + (X_n)^2),$$

where A_w is the diversity, and X_n is the percentage occurrence of a particular trait in a sample. This index expresses the probability that two randomly paired traits of the sample will be different. This means that if $A_w = 0.375$, which is a low diversity index, there is only a 37.5% chance that two observations in the population will be different. A diversity index of 0.875 is considered very high, and indicates that there is an 87.5% probability that two observations will be different.

It should be noted here that diversity is dependent up to a certain point on sample size (Conkey 1980:617). In general, one would expect diversity to increase as the sample size increases (Conkey 1980:618). In this study where the study samples are small and are not biologically representative, the calculated diversity figures will be affected by this sample size relationship. This is especially true for the samples from the Wall and Fredricks sites. Therefore, the results of this investigation of biological diversity have to remain preliminary in nature.

Biological Diversity within the Study Burial Samples

Within-sample diversity indices calculated for each sample using the nine discrete biological traits previously defined and Lieberson's formula are given in Table 2. These indices reflect the heterogeneity of each trait as it occurs within the samples. The individual figures are summed for each sample, and means and standard deviations calculated to provide another measure of overall

TABLE 2.

Diversity for Each of the Nine Morphological Traits Within Each Sample Determined Using Lieberson's (1969) Formula.

VARIANT	SHANNON SITE	WALL SITE	UPPER SARATOWN-LOCALITY 2 SITE	FREDRICKS SITE
1- Asterionic Bone	0.456	0.375	0.435	0.412
n=	41	4	19	7
2- Parietal Notch	0.343	0.500	0.000	0.471
n=	39	4	16	8
3- Supraorbital Foramen	0.180	0.375	0.485	0.490
n=	34	4	22	7
4- Multiple Mental Foramina	0.255	-	0.000	-
n=	36	-	22	-
5- Mylohyoid Arch	0.575	0.455	0.211	0.596
n=	22	3	24	8
6- Divided Hypoglossal Canal	0.076	0.000	0.264	0.571
n=	26	3	13	7
7- Multiple Zygomatic Facial Foramena	0.493	0.455	0.000	0.000
n=	39	3	14	6
8- Ossicle At Lambda	0.354	0.375	0.211	0.480
n=	34	4	24	5
9- Right Superior Sagittal Sulcus Flexes	0.487	0.000	0.364	0.241
n=	35	4	21	7
Mean	0.358	0.317	0.219	0.408
Standard Deviation	0.1634	0.2009	0.1885	0.1975
Ceramic Surface Treatment Diversity[a]	0.3682[b]	0.5526	0.7714	0.660
Ceramic Decoration Diversity[a]	-	0.6381	0.8287	-

NOTE: - indicates that this trait could not be measured in a sample.
n is the number of occurrences of a trait in a sample.

[a] The computed diversity figures for ceramic surface treatment and ceramic decorations for Or11 and Sk1a are from J. Wilson 1983, and for Or231 are from Davis 1985.

[b] This surface treatment diversity figure is for the Radford ceramic series, the dominant ceramic series recovered from the features at the Shannon Site (cf. Benthall 1969:115). The surface treatment diversity figure by surface treatment regardless of series for ceramics recovered from the features (cf. Benthall 1969:115) is 0.5632.

Lieberson's (1969) Formula is: $A_w = 1 - [(X_1)^2 + (X_2)^2 + ... + (X_n)^2]$.

trait diversity. The lowest within-group measure of diversity is exhibited by the the Upper Saratown-Locality 2 burial sample (.219), followed by the Wall site (.317), then the Shannon site (.358), and, finally, the Fredricks site (.408). That the late protohistoric/early contact period site of Upper Saratown- Locality 2 possesses the lowest within-group diversity is somewhat unexpected, although the mixing of the various Indian groups documented in the ethnohistoric record during historic times appears to post-date 1675.

The interpretation of the patterns of diversity produced using Lieberson's formula can be investigated further by incorporating the results of analyses conducted by J. Wilson (1983:501-503) and Wilson and Dickens (1984) of the relationship between changing diversity in ceramic surface finish and decoration, and culture change in general for the late Indian groups of the Carolina Piedmont. An explicit conclusion of their work is that change associated with the era of European contact manifests itself in the material remains of aboriginal culture, with culture being a plastic medium and material culture being readily more susceptible to non-structural change. For the Upper Saratown-Locality 2 ceramic assemblage, the surface finish diversity figure (derived using Lieberson's formula) is 0.7714 and the decoration diversity figure is 0.8287. These figures indicate that the cultural aspects of the Siouan Sara society were in a state of change, especially when compared with the ceramic diversity figures for the late prehistoric, presumably ancestral, ceramic collection from 31Rk1 (surface finish diversity = 0.3563 and decoration diversity = 0.7286).

Taken together, the diversity figures for the Upper Saratown ceramic attributes and the morphological traits appear to indicate that the Sara were experiencing changes in the structure of society that did not include the incorporation of other distinct Indian groups. This is consistent with the late protohistoric/early contact date favored here for the remains from Upper Saratown-Locality 2, a time when the Sara are still a viable entity largely unaffected as yet by the many stresses that accompanied contact with the Euro-Americans during the later portions of the seventeenth century.

The morphological trait diversity derived using Lieberson's formula for the Shannon site of Virginia, 0.358, is higher than that exhibited by the Sara at Upper Saratown-Locality 2 noted above. The diversity of surface finish for the Radford Series ceramics in the features of the Shannon site is 0.368, with Radford Series ceramics accounting for 79.2% of the pottery found in the features. For all three ceramic series recovered from the Shannon site features, the surface finish diversity is 0.563 by surface finish category (net impressed, cord-marked, plain, and fabric impressed). The ceramic diversity figure for the predominant Radford ceramic series (0.368) is consistent with what would be expected of a pre-contact population that is structurally stable (cf. J. Wilson 1983:501-503). The higher diversity figure determined for the entire collection of feature ceramics from the Shannon site (0.563) might indicate ongoing interaction among a number of groups at the site. This would not be unexpected, as the Shannon site lies near the Kanawha-New River route from western North Carolina and east

Tennessee into the upper Ohio River Valley (Benthall 1969:146). Likewise, the Shannon site could serve as a junction connecting the Atlantic Coast of Virginia and North Carolina to this route to the upper Ohio River Valley. Certainly, the quantities of marine shell ornaments recovered from the Shannon site (cf. Benthall 1969:104-113) attest to its connections with the coast. Also, the similarity in the style of certain shell gorgets from the Shannon site and the Wall site that has been noted by some researchers (Hammett 1987; Sizemore 1984) might be the result of trade and interaction between the inner Piedmont and the outer Piedmont and Coastal Plain. Thus, the higher ceramic surface finish diversity figures noted for the feature pottery assemblage, and that found in the morphological trait diversity figure of 0.358 (at least when compared with the Upper Saratown-Locality 2 morphological trait diversity figure of 0.219) may reflect the increased interaction that could be expected among a population on such a trade route along which both goods and presumably people were moving. The relatively high ceramic surface finish diversity figures could also be the result of multiple occupation over time at the site, a question that cannot be addressed here. However, it should be noted that the morphological trait diversity figure of 0.358 at the Shannon site is clearly indicative of a population with a stable cultural structure.

Turning to the earlier of the two easternmost sites in this study, the morphological trait diversity of the late prehistoric/early protohistoric Wall site is 0.317, which reflects more homogenity among the morphological traits in this burial sample when compared to the Shannon site figure. Examination of the Hillsboro Series ceramics recovered from excavation of features at the Wall site during the first four years' work at the site provides a surface finish diversity figure of 0.5526 and a decoration figure of 0.6381. Both of these Wall site figures are lower than those for the early/middle contact period ceramics from Upper Saratown-Locality 2 (0.7714 and 0.8287 respectively). This is not unexpected, as the increased stresses and interaction that occurred during contact are not present as yet in the late prehistoric/early protohistoric period of the Carolina Piedmont.

Comparison of the Wall site surface finish figure (0.5526) with the figure for the entire ceramic collection from the Shannon site (0.563), however, does suggest that the Wall site was not isolated. Indeed, the Wall site shares with the Shannon site the fact that both are on major routes from the coast to the interior. Routes from the Virginia Coast across the Roanoke River drainage and from the North Carolina Coast to the Carolina interior join in the vicinity of the Wall site (cf. Simpkins 1985:46-48, 53, 63-64, 85). Also, some researchers (cf. Davis 1987:214; J. Wilson 1983:187, 204-205, 369) suggest that the late prehistoric inhabitants of the section of the Neuse River containing the Wall site are related to the Iroquoian-speaking groups (i.e., the Meherrin, Neuse and Nottoway) of the Coastal Plain. Therefore, the relatively high surface finish diversity figure for the Wall site ceramics may be tied to the site's location at a trade route junction, and to the site's possibly being the western-most outpost of a non-Siouan Coastal Plain population. Both would account for an increase in the flow of ideas and for a greater diversity in the material culture of the Wall site. Still, the morphological trait diversity for the Wall site suggests that the resident population itself was stable.

For the middle contact period site located within sight of the Wall site at the Fredricks site, the morphological trait diversity is 0.408. The ceramic surface finish diversity for the Fredricks site is 0.660 (Davis 1984). These high figures suggest that both the resident population and the material culture possessed by the site's inhabitants were in flux, tied for the most part to the increased population movement and the miscegenation occurring in the area during the post-1676 contact period. Based on the figures, it is tempting to suggest that by this time (ca. 1700) the aboriginal material culture of the Occaneechi and associated Indian groups resident at the Fredricks site had experienced enormous change (H. Wilson 1984). Changes may have started to accelerate in other aspects of the culture, including social structure and the genetic/physical composition. Certainly, the morphological trait diversity is elevated over what is noted for each of the other three sites in this study.

A second formula devised by Lieberson to investigate the diversity exhibited by a sample of dichotomous variables was also utilized to determine the diversity of the genetic morphological traits possessed by each of the four study samples. This second equation is

$$A_w = ([X_1 - (X_1)^2] + [X_2 - (X_2)^2] \ldots\ldots + [X_n - (X_n)^2]) \, 2/N,$$

where A_w is the population diversity, X is the percentage of the population exhibiting a particular trait, and N is the number of dichotomous traits identified for the study. Table 3 presents the results of the application of this formula to the four study samples. Again, the scale for comparing the resulting diversity figures runs from 0 to 1, with 0 representing little diversity and 1 very high diversity.

As with the morphological trait diversity, the lowest diversity, 0.1960, is exhibited by the Upper Saratown-Locality 2 sample. The Wall site burial sample continues to possess the second lowest diversity index, 0.2592. The conclusions drawn earlier that both of these samples represent stable genetic groups are not contradicted.

However, the Fredricks site and the Shannon site have their relative positions reversed when the dichotomous diversity figures are compared, with the Fredricks site diversity being 0.3200 and the Shannon site 0.3468. Both figures are higher than the two more stable populations of Upper Saratown-Locality 2 and the Wall site. The Fredricks site figure does not run counter to the expectation for a higher morphological trait diversity given the increased interaction between groups and the admixture of groups during the middle contact period. The high figure for the Shannon site suggests that there was a greater degree of variability within the population than previously suspected.

Non-Metric Data and Population Distance

The section just completed has examined the within-population diversity for a select number of morphological traits and was primarily concerned with the question of the stability of the

TABLE 3.

Within Sample Measure of Divergence Determined Using Lieberson's Dichotomous Values Formula.

Shannon Site

(0.2211 + 0.1716 + 0.09 + 0.1275 + 0.245 + 0.0384 + 0.2464 + 0.1771 + 0.2436)
= (1.5608)

A_w = (1.5608) 2 /9 = 0.3468

Wall Site

(0.1875 + 0.25 + 0.1875 + 0 + 0 + 0.2244 + 0.1875 + 0) = (1.0369)

A_w = (1.0369) 2 /5 = 0.2592

Upper Saratown-Locality 2

(0.2176 + 0 + .2419 + 0 + 0 + 0.1344 + 0 + 0.1056 + 0.1824) = (0.8819)

A_w = (0.8819) 2 /5 = 0.1960

Fredricks Site

(0.2059 + 0.2356 + 0 + 0.2331 + 0.2451 + 0 + 0.24 + 0.1204) = (1.2801)

A_w = (1.2801) 2 /6 = 0.3200

The within sample diversity formula is

$$A_w = [(X_1 - (X_1)^2) + (X_2 - (X_2)^2) + \ldots + (X_n - (X_n)^2)]\ 2\ /N.$$

genetic pool that comprised the resident population. This section of the study moves to a more general level of analytical scale and considers the genetic distance between two samples. The broad questions to be examined here include the historical relationships of the study skeletal series, and the validity of the northern and southern divisions of Siouan Indians.

The technique used to conduct the biological distance studies required in this section has been used by Berry and Berry (1967) and Buikstra (1976) to study a number of human skeletal populations. The same nine morphological traits--asterionic bone, parietal notch bone, supraorbial foramen, multiple mental foramina, mylohyoid arch, divided hypoglossal canal, multiple zygomatic facial foramina, ossicle at lambda, and superior sagittal flexes right-- whose presence/ absence was coded for the study conducted in the previous section of this chapter are used here. Recall that these nine traits could be observed in a good portion of each study sample, and each trait has been shown to be unaffected by age, sex, trait intercorrelation, and cultural/environmental deformation (Buikstra 1976:49-51). The statistic used to investigate the biological distance between each of the study samples is the mean measure of divergence developed by C.A.B Smith, and utilized in the study of both rat (Berry 1963; Petras 1967) and human skeletal populations (Berry and Berry 1967; Buikstra 1976). The mean measure of divergence is a quantitative expression of the separation of two samples, called here sample 1 and sample 2. The formula for the mean measure of divergence (D_e) is

$$D_e = \sum [(\theta_1 - \theta_2)^2 - (1/n_1 + 1/n_2)] /N,$$

where $\theta = \sin_{-1}$ (1-2p) in radians with p being equal to the percentage of the population with a particular trait; n is the number of traits present in each population; and N is the total number of identified traits used in the study. In the actual comparison of two populations, the measure of divergence (D_e) is the mean of the squared differences between the angular value of each character $(\theta_1 - \theta_2)^2$, minus the variance (V) which is due to random sampling fluctuations ($V = 1/n_1 + 1/n_2$) (Petras 1967:582).

The variance V can also be calculated as

$$V = 4\ [(1/n_1 + 1/n_2)\ ((\theta_1 - \theta_2)^2 - (1/n_1 + 1/n_2))]\ /N.$$

Berry (1963:209-210), and Berry and Berry (1967:373) note that the square of the mean measure of divergence D_e (where $D_e = \theta_1 - \theta_2$) divided by the variance V, which can be written as $(\theta_1 - \theta_2)^2\ /V$, is distributed approximately "as chi-square with one degree of freedom, and is significant at the 0.05 probability level if it is greater than 3V and at the 0.01 level if it is greater than 6V." Petras (1967:582) explains that this means that if $D_e > 3V$, then the divergence (difference) between the two populations is significant at the 0.05 probability level, and if $D_e > 6V$, the divergence is significant at the 0.01 probability level. For this study, primarily because of the size of the various samples, the divergence between two populations is considered to be significant if $D_e > 3V$, that is a 0.05 probability level is used. This can also be interpreted so that if $D_e < 3V$, then the divergence between two populations may not be different, that is there may not be any significant difference in the genetic composition of the two populations. The variance V utilized here is calculated using the formula described at the beginning of this paragraph.

The results of applying the mean measure of divergence formula to the percentage occurrence of the nine cranial morphological traits are given in Table 4. The divergence (D_e), variance (V), and 3V are all listed. In all tests comparing each population with every other population the mean measure of divergence is greater than 3V, which means that each population shows significant divergence (difference) from the others at the 0.05 probability level.

Explicit in the studies conducted by Berry and Berry (1967) and Buikstra (1976) is the fact that the mean measure of divergence calculated among more than two populations can be interpreted by ranking each D_e from smallest to largest. This means that the smaller the D_e, the more similar the two populations used to calculate the D_e. Unfortunately, it is extremely difficult to evaluate the true meaning of the closeness or distance implied by comparison of the mean measure calculations for each sample. Ranking the computed mean measure of divergence for the study skeletal series in this manner suggests that the Shannon site and Fredricks site samples are the most similar. The next most similar sites are Upper Saratown-Locality 2 and the Fredricks site, followed closely by the Shannon site and Upper Saratown-Locality 2. The Wall site is least similar to the other three sites. Before proceeding further with this analysis, it should be noted that the small size of the Wall site sample may be responsible for it being more dissimilar to the other three sites.

TABLE 4.

Computation of the Mean Measure of Divergence between Samples for the Nine Morphological Traits.

SITE	Shannon Site	Wall Site	Upper Saratown-Locality 2	Fredricks Site
Shannon Site	-	1.1756[a] (0.2195)[b] [0.6585][c]	0.9050 (0.0351) [0.1053]	0.5330 (0.0492) [0.1476]
Wall Site	-	-	1.7576 (0.3195) [0.9585]	1.5865 (0.0949) [0.2847]
Upper Saratown-Locality 2	-	-	-	0.8010 (0.0949) [0.2847]
Fredricks Site	-	-	-	-

[a] A figure not enclosed within any symbol is a mean measure of diversity D_e.

[b] A figure enclosed within ( ) is the variance V.

[c] A figure enclosed within [ ] is equal to 3V.

Of special interest is the similarity (relative to the other populations) between the prehistoric Shannon site and the middle contact period Fredricks site, which are separated by approximately 150 years in time. Because of the temporal difference between the two sites, the relative closeness exhibited by the mean measure of divergence for the two sites is unexpected. One explanation for this relative closeness could have been interaction between the Shannon site inhabitants (and their ancestors and descendants) and the ancestors of the main population resident at the Fredricks site during the prehistoric period. This interaction would have been between populations resident within the Roanoke River drainage, and has been referred to earlier in this chapter. J. Wilson (1983:491-492, 573) has suggested that during the late prehistoric period interaction between groups would tend to be more common within the confines of discrete river drainages, a pattern similar to that proposed here.

An alternative explanation for the relative biological closeness may be the proposed northern and southern divisions of the Carolina and Virginia Siouans discussed earlier. Both the Tutelo, who are presumed to have inhabited the Shannon site in prehistoric times, and the Occaneechi, who were resident at the Fredricks site in 1700, are thought to have been members of the northern division of Siouans (Griffin 1945:321; Lewis 1951:10-11; Swanton 1936:379). When the Occaneechi inhabited the Fredricks site in 1700, the Tutelo were probably still resident in the mountains of western Virginia (J. Wilson 1983:190-197). Thus, the relative closeness of the Shannon site and Fredricks site populations does not appear to have been the result of Tutelo descendents being present at the Fredricks site among the Occaneechi, as the two groups did not amalgamate until 1712, when the Tutelo moved from the foot of the mountains to Fort Christanna in Virginia (J. Wilson 1983:192). The Occaneechi had moved to Fort Christanna from North Carolina (apparently) the previous year (J. Wilson 1983:192). Therefore, one explanation that must be considered for the closeness of the Shannon site and Fredricks site populations is that the two groups belong to a northern division of Siouan Indians that could be differentiated from the southern division in terms of linguistics and material culture by earlier researchers. The question that naturally arises is whether the differences between these two divisions are indicative of two distinct ethnic groups or of two related populations with a similar language and slightly different cultures as hypothesized by Lewis (1951). This will be considered further in Chapters VII and VIII.

Another question that can be considered here is that of the relationship of the Wall site to the Siouan populations of the Piedmont. Previously, we have seen that some researchers (Davis 1987:214; J. Wilson 1983:369) have indicated that the material remains at the Wall site may be indicative of a non-Siouan population. In this study of biological distance, we have seen that, although all of the study skeletal series show significant differences at the 0.05 probability level, the Siouan Upper Saratown-Locality 2 sample is closer to the Fredricks site and Shannon site samples than to the Wall site sample, and the differences between the Wall site and the other three are all 1.6 or greater. It does not appear that the Wall site sample is the ancestor of one of the southern Siouan division groups, given the relatively great mean measure of divergence present between it and the Sara occupation at Upper Saratown-Locality 2. Likewise, there does not appear to be a strong biological connection between the Wall site sample and the middle contact period Occaneechi sample resident at the Fredricks site, certainly not one that equals the supposed similarities in the material culture (i.e., ceramics) of the two (Davis 1987:214). Therefore, a conclusion that can be drawn is that the Wall site sample stands distinct from the Shannon site, the Fredricks site and Upper Saratown-Locality 2 samples based on genetic differences. However, this conclusion must be tempered by the fact that the sample from the Wall site is extremely small and may be biasing the results of this comparison. The question of a possible non-Siouan ethnic affiliation for the Wall site population has to remain an untested hypothesis at this time.

Metric Analyses and Between-Population Differences

Another dataset that can be used to compare the four study samples is the results of the metrical analysis of the skeletal series. Standard cranial and postcranial metrical indices calculated for the four skeletal series are presented in Tables 5 and 6. Standard deviations are also presented to give the range of variation of each index within each sample. As the samples available to produce each index are so small, no statistical tests of significance can be conducted when the samples are compared. The

TABLE 5.

Cranial Indices for the Males and Females from the Study Samples.

SITE	CI	CM	CLH	CBH	MBH	FPI	FGI
MALES							
Shannon Site	77.37 (3.76) [31]	152.73 (2.68) [24]	79.47 (3.86) [24]	103.06 (4.36) [24]	89.69 (3.55) [24]	68.87 (2.37) [28]	109.46 (7.38) [28]
Wall Site	88.05 (5.748) [3]	152.67 (4.839) [3]	83.78 (3.416) [3]	95.26 (2.738) [3]	89.09 (1.218) [3]	64.976 (0.834) [3]	- - [0]
Upper Saratown-Locality 2	80.138 (9.70) [4]	151.50 (0.71) [2]	73.357 (2.53) [2]	96.025 (15.634) [2]	82.777 (4.281) [2]	66.441 (4.461) [4]	110.661 (7.442) [3]
Fredricks Site	78.97 (4.88) [2]	156.66 (2.355) [2]	72.47 (0.848) [2]	90.22 (4.38) [2]	81.01 (1.258) [2]	68.145 (1.153) [2]	- - [0]
FEMALES							
Shannon Site	79.19 (4.21) [19]	146.35 (4.68) [14]	79.74 (3.26) [14]	100.95 (5.61) [14]	89.06 (3.89) 14]	68.48 (3.89) [16]	104.24 (6.91) [14]
Wall Site	- - [0]	- - [0]	- - [0]	- - [0]	- - [0]	- - [0]	- - [0]
Upper Saratown-Locality 2	78.122 (1.072) [3]	149.33 - [1]	78.857 - [1]	102.22 - [1]	89.032 - [1]	67.896 (2.665) [3]	99.361 (3.944) [3]
Fredricks Site	74.46 - [1]	152.67 - [1]	69.15 - [1]	92.86 - [1]	79.27 - [1]	- - [0]	- - [0]

CI: Cranial Index
CM: Cranial Module
CLH: Cranial Length-Height Index
CBH: Cranial Breadth-Height Index
MBH: Mean Basion-Height Index
FPI: Fronto-Parietal Index
FGI: Fronto-Gonial Index

Numbers enclosed within ( ) are standard deviations.
Numbers enclosed within [ ] are the numbers of individuals (n) measured.

TABLE 6.

Postcranial Indices for Males and Females from the Samples.

SITE	RI	RHI	CI	PI	PiI	FRI	PLI
MALES							
Shannon	18.65	77.69	14.46	76.80	114.82	11.99	63.92
Site	(1.905)	(1.987)	(1.041)	(6.364)	(11.144)	(0.918)	(8.501)
	[22]	[15]	[20]	[25]	[26]	[24]	[26]
Wall	18.45	-	-	81.54	111.293	11.06	64.53
Site	(1.56)	-	-	(12.84)	(4.742)	(0.511)	(6.651)
	[3]	[0]	[0]	[2]	[3]	[3]	[3]
Upper	18.84	74.10	16.52	83.05	117.24	12.44	61.20
Saratown-	(0.191)	(0.00)	(0.00)	(7.07	(8.402)	(0.176)	(6.838)
Locality 2	[2]	[1]	[1]	[8]	[8]	[3]	[7]
Fredricks	20.71	-	-	86.86	117.322	12.46	65.98
Site	(0.179)	-	-	(2.90)	(6.340)	(0.923)	(0.507)
	[2]	[0]	[0]	[4]	[4]	[4]	[3]
FEMALES							
Shannon	18.19	75.82	15.07	74.25	108.44	12.05	65.61
Site	(1.139)	(2.103)	(1.195)	(6.027)	(9.986)	(0.615)	(5.891)
	[16]	[9]	12]	[18]	[19]	[14]	[16]
Wall	-	-	-	-	-	-	-
Site	-	-	-	-	-	-	-
	[0]	[0]	[0]	[0]	[0]	[0]	[0]
Upper	16.89	-	13.36	78.66	112.80	12.05	65.48
Saratown-	(0.574)	-	(0.00)	(5.840)	(8.899)	(1.120)	(3.609)
Locality 2	[3]	[0]	[1]	[10]	[11]	[8]	[7]
Fredricks	16.98	-	-	92.86	121.74	10.74	-
Site	(0.00)	-	-	(0.00)	(0.00)	(0.00)	-
	[1]	[0]	[0]	[1]	[1]	[1]	[0]

RI: Humerus Robusticity Index
RHI: Radio-Humeral Index
CI: Ulna caliber Index
PI: Femur Platymeric Index
PiI: Femur Pilastic Index
FRI: Femur Robusticity Index
PLI: Tibia Platycnemic Index

Numbers enclosed within ( ) are standard deviations.
Numbers enclosed within [ ] are the numbers of individuals (n) measured.

observations offered here are, therefore, thematic and non-statistical in nature.

The cranial indices calculated for the males at each site (Table 5) indicate that the Wall site sample is least similar to the other three samples. The two most similar samples appear to be Upper Saratown-Locality 2 and the Fredricks site. The Shannon site seems to be slightly more similar to the Fredricks site sample than to the Upper Saratown-Locality 2 sample.

When the postcranial indices (Table 6) of the males are compared, a similar pattern emerges. The two samples that are the least similar in some postcranial indices are from the Wall and Fredricks sites. And the Upper Saratown-Locality 2 and Fredricks site samples appear to be the most similar.

Slightly different patterns emerge when the cranial and postcranial indices of the females in each sample are compared (Tables 5 and 6). It should be noted prior to proceeding further that no females are present in the Wall site sample, and the Fredricks site sample has only one female. Therefore, the following discussion is limited by the very biased nature of the study samples. Still, the females from the Shannon site and Upper Saratown-Locality 2 are most similar when the cranial and postcranial indices are examined. For only one post-cranial index, RI (Humerus Robusticity Index) (Table 6), is the measure for the Fredricks site female within the standard deviation noted for the female indices from the Shannon site and Upper Saratown-Locality 2. The indices of the Fredricks site female are least similar to those of the Shannon site females, and they are very different from those for the Upper Saratown-Locality 2 females. The dissimilarities in the female indices and the similarities in the male indices are possibly consistent with matrilocal residence for the study samples.

Although sample size is a critical factor that affects this comparison of morphometrical indices, some comments can be offered about the differing patterns for males and females at the sites. First, however, the apparent separation of the Wall site male sample from the other three sites based on differences in the cranial and postcranial indices mirrors the separation noted in the study of biological distance.

For the other three sites, some observations derived primarily from research using ethnohistoric accounts can be offered to account for the apparent differences in the relationships of males and females at the Shannon site, Upper Saratown-Locality 2, and the Fredricks site apparently documented in the patterns of cranial and postcranial indices. Most researchers agree that the Siouan and Iroquoian groups of the Carolinas and Virginia possessed matrilineal descent (Hudson 1976:185; Swanton 1946:654-655). This characterization is based in large part on John Lawson's (1967:57) observations concerning Keyauwee Jack,

> who is King of that People. He is a Congaree-Indian, and ran away when he was a boy. He got this Government by Marriage with the Queen; the Female Issue carrying the Heritage, for fear of Imposters;. . .

This passage suggests that descent among the Keyauwee, a presumed southern Siouan group, is matrilineal, residing in the female line. The implication of matrilocal residence is also present, although in ambiguous terms, with the Congaree-Indian resident at Keyauwee.

Another characteristic of the Siouan peoples, and indeed most of the Indian groups, of the Carolinas and Virginia is the fact that males' work consisted mainly of hunting, fishing, agriculture, construction, and conducting warfare and trade (Lewis 1951:139, 173), although some suggest that females were primarily responsible for agriculture (Hudson 1976:259). The women are thought to have collected wild foods, prepared food for storage and immediate use, gathered firewood, and manufactured pottery, clothing, mats and baskets (Lewis 1951:139). In his travels among the Siouan Indians of the Carolina Piedmont, John Lawson (1967:46, 48, 63) noted only Indian men conducting trade at villages other than their own. Both women (Lawson 1967:41-42, 47) and men (Lawson 1967:41-42, 46) conducted trade at their own villages.

From the information contained in these ethnohistoric accounts, a number of generalizations can be formulated. It is evident that males have a high degree of mobility in Indian society, being involved in trading and hunting. Also, matrilocal residence rules would possibly encourage the movement of males between villages of the various Piedmont Indian groups. The likelihood of males dying and being buried outside the location of their reproductive pool is greater than for females. Thus, the dissimilarity of the males from the Wall site to those of the other three sites is unexpected if the former are indeed Siouan. We have already seen that the Wall site population may be non-Siouan, with the likelihood that its population would interact in trade, hunting, and marriage with other similar non-Siouan groups. Also, the separation in time from the two contact period sites and in space from the prehistoric Shannon site would account, in part, for the distinctiveness of the Wall site (as indicated by the cranial and postcranial indices). In only a few instances do the mean cranial and postcranial indices of the Wall site males compare closely with the Fredricks site males, which is contrary to the close similarity noted in the material culture for the two sites (cf. Davis 1987:214). In addition to the temporal separation affecting these two sites, the admixture of Indian groups from outside the region in the Fredricks site population may be responsible for these morphometrical differences.

Considering the three sites with similar male cranial and postcranial indices, the temporal difference between the Shannon site, on the one hand, and Upper Saratown-Locality 2 and the Fredricks site on the other may be one reason for the latter two being more similar with each other. The Fredricks site and Upper Saratown-Locality 2 are separated by only decades, and not the one or more centuries that separate them from the Shannon site. However, the similarity between the Shannon site and the Fredicks site samples in cranial indices and some of the postcranial measurements may reflect the fact that the two populations resident at this site are part of the northern, and thus related, Siouan group. Alternately, this similarity may reflect a pattern of interaction by groups resident within the same river drainage in the past.

For the females, the separation of the one Fredricks site individual of that sex may reflect the disintegration of Siouan and Indian society in general that occurred in the post-1675 contact period. We have seen that the Occaneechi Indians who probably lived at the Fredricks site had incorporated amongst them a number of non-Siouan groups, most notably the Iroquoian Susquehannock. The Fredricks site female may be a member of this or some other Indian group from outside the Piedmont region. The biological evidence discussed previously may indicate that the Shannon site and Upper Saratown-Locality 2 populations were stable. The ethnohistoric record documents the disruption that had occurred among the Occaneechi Indians resident at the Fredricks site during the early and middle contact periods. The difference in cranial and postcranial indices between the Shannon site/Upper Saratown-Locality 2 and the Fredricks site females is apparently the result of this disruption, whether it took the form of admixture of disparate groups, of the break-up of the existing social structure, or both. This discussion is hampered of course by the fact that there is only one female in the middle-contact-period Fredricks site sample. However, future research that incorporates more data should be able to investigate this question more thoroughly.

Stature

Stature estimates calculated using tibias and femurs for the study samples using a regression formula developed by Genoves (1967) for Mesoamerican populations are presented in Table 7. Examining the male stature estimates for the four sites, it appears that the Shannon site (168.66 cm) and the Upper Saratown-Locality 2 (169.16cm) samples are similar. Likewise, the Fredricks site (172.81 cm) and the Wall site (173.41 cm) also are quite close. For females, stature estimates are available only for the Shannon site,

TABLE 7.

Average Stature Estimates Based on Femur and Tibia Lengths for Males and Females in the Study Samples.

	MALES		FEMALES	
Site	Femur	Tibia	Femur	Tibia
Shannon Site	168.66 (4.636)	168.61 (3.417)	156.31 (4.50)	156.23 (5.926)
Wall Site	173.406 (2.395)	- -	- -	- -
Upper Saratown-Locality 2	169.16 (3.911)	170.00 (1.736)	158.47 (4.473)	160.60 (2.910)
Fredricks Site	172.81 (3.420)	- -	171.47 (0.00)	- -

Standard Deviations are enclosed in ( ).

Upper Saratown-Locality 2, and the Fredricks site. As for the males from the Shannon site and Upper Saratown-Locality 2, the female numbers are quite close. The mean height for the Shannon site burial sample is 156.31 cm and for the Upper Saratown-Locality 2 sample it is 158.47 cm.

Among the three major physical types of Indians resident in North Carolina and Virginia, Siouan populations are generally described as being gracile and short in stature, whereas Iroquoian and Algonkian populations are considered to more robust and taller (Neumann 1952:34-36). This generalization is corroborated by the evidence of this study if the population at the Wall site is not Siouan as many have suspected, and if there are a number of Iroquoian Indians such as the Susquehannock incorporated with the Occaneechi Indians at the Fredricks site. That is, the presumed Siouan skeletal series from the Shannon site and Upper Saratown-Locality 2 are shorter than the Iroquoian burial sample from the Wall site and the Siouan/Iroquoian mixed sample at the Fredricks site. Likewise, the different environments occupied by the two sets of sites might be reflected in the division that can be made among the four population samples based on stature. This acknowledges that stature can be affected by differing environments and the resulting different diets, which includes the vitamins and minerals that occur naturally in the environment that a population has. In this study, both the Shannon site and Upper Saratown-Locality 2 are located in a mountainous area of the inner Piedmont and their resident populations share a similar stature. Likewise, a case can be made that the Fredricks and Wall sites were occupied by populations long resident within the outer portion of the Piedmont along the fall line immediately west of the inner Coastal Plain. For now, these observations are just that, and should be investigated in their own right in the future.

Summary

The examination of population diversity within and distance between the samples has considered information concerning biological distance, metric and non-metric morphological traits, and stature. The fact that the Wall site and Fredricks site samples are decidedly small has to be borne in mind at all times when any of the comments and propositions offered in this chapter are considered. Certainly, no clear pattern of relationships and differences emerges from this study. The three non-Sara samples stand apart from the the Upper Saratown-Locality 2 sample in some but not all of the datasets considered in this chapter. Also, the Wall site sample differs from the other three study samples in all but one instance. Only the male stature estimates for the Wall site are similar to those of the Fredricks site sample.

Although the computed values are statistically different, the Shannon site and Fredricks site samples share a closer biological distance than do any of the other sample combinations. Also the cranial indices of males of the Shannon site sample are more similar to the Fredricks site sample than that at Upper Saratown-Locality 2. Conversely, the female postcranial measurements for the Shannon site and the Fredricks site samples are most different.

Considering the Shannon site and Upper Saratown-Locality 2 samples, the two are noticably different according to the biological distance study. However, the female postcranial and stature measurements, and male stature measurements for the two are similar. Comparing the Upper Saratown-Locality 2 and Fredricks site samples, similarities are present in male cranial indices and male postcranial measurements. However, the postcranial measurements for females in these two samples are very different.

Finally, the Wall and Fredricks site samples stand distinct according to the biological distance study, and constitute the most distinct of all sample combinations considered in this study. Also, the male cranial indices for these two burial samples are quite different, and the male postcranial measurements for the two samples are the least similar in a few instances. Only the male stature measurements for the two are similar.

Considering the first question asked at the beginning of this chapter, the proposition that the Wall and Fredricks site inhabitants are the same or similar populations cannot be supported at this time, given the results of the population diversity studies. The question of the validity of northern and southern divisions among the Siouan Indians is given credence when the differences and similarities between the Shannon site burial sample (the presumed ancestors of the norther division Tutelo Indians) and the Upper Saratown-Locality 2 sample (the Sara Indians of the southern division) noted in this examination of population diversity are considered. Finally, the effects of the increase in movement and interaction among the Indian populations of the Virginia and northeastern North Carolina Piedmont during the contact period may be reflected in the absence of any clear patterns in the population diversity studies. Contributing to this problem are the interaction patterns of the Indian groups along the Roanoke River proper during the late prehistoric period.

Two observations that need further research are the relatively close similarity documented for the Shannon site and the Fredricks site samples by the mean measure of divergence, and the differences noted between the Wall site and Fredricks site samples by the mean measure of divergence and in the metrical indices considered here. Certainly, the differences and relationships noted here and elsewhere in this chapter require further consideration in future research that incorporates additional data from a number of sites of the region that span all the temporal periods covered by this study, including the sites that possess the study samples included in this investigation.

CHAPTER IV

DEMOGRAPHIC ANALYSES

The first question that must be considered in the study of the demography of any human society is the biological representativeness of the sample. Demographic details about archaeological societies are based on the assumption that the numbers, ages, and sexes of the skeletal sample accurately reflect the original population, and that all biases present can be recognized and considered during analysis. Sources of error that can result in inaccurate interpretations include differential disposal of particular segments of a population, such as infants; inadequate sampling of the overall mortuary complex; and differential preservation of the skeletons (Ubelaker 1978:91-92). In addition to these errors, there are problems unique to each analytical demographic technique utilized in the study of the biological aspects of burial data. Such problems will be covered when the appropriate technique is considered.

The first step in the demographic reconstruction of a population is to obtain the age at death and the sex of each individual. Usually, only adult remains are sexed, as individuals less than the age of 15 at the time of death cannot be accurately sexed (Ubelaker 1978:42). In this study, each skeleton in each sample was aged and sexed using the same set of techniques.

Unfortunately, some burials could not be aged and sexed using all the techniques available due to differential bone preservation.

Age of Subadults

The subadults were aged based on dental eruption and development (Ubelaker 1978:112-113), longbone length (Ubelaker 1978:48-49), and epiphyseal closure (Bass 1971). Where only fragments of the longbone or cranium were present for a subadult burial, the remains were compared with other subadults of known age from the same skeletal series and an age assigned on the basis of this comparison.

Subadults are those individuals who are aged less than 15 years at the time of death. Subadults comprise 33% (n=37) of the burial population at the Shannon site; 63% (n=5) at the Wall site; 83% (n=5) at Upper Saratown-Locality 1; 44% (n=41) at Upper Saratown-Locality 2; and 53.3% (n=8) at the Fredricks site.

Age and Sex of Adults

The criteria used to age the adult individuals from the sites were dental eruption of the third molar (Ubelaker 1978); dental attrition (Molnar 1971); endocranial suture closure (Krogman 1978); epiphyseal closure (Bass 1971); and erosion of the symphyseal face of the os pubis (McKern and Stewart 1957). With the exception of the symphyseal face of the os pubis, the skeletal elements required under these criteria to age a skeleton were present for all adult burials in each sample. The aged adult individuals were placed in five year categories.

The sex of the adult individuals was determined primarily from morphological data acquired from the cranium, mandible (Bass 1971; Krogman 1978), and pelvis (Bass 1971). Sex determinations based on metric data from each individual were also made, but only to corroborate (or refute) the result obtained from the morphological analyses. Metrical sexing techniques used included femur mid-shaft circumference (Black 1978), femur head diameter (Bass 1971), and humerus head diameter (Bass 1971). Appendix A contains the age and sex determined for each member of the study samples.

Examination of the age of all individuals in the sample and the sex of the adult members shows clearly that a biologically representative sample is not present at the Wall site, Upper Saratown-Locality 1, or the Fredricks site. This is not unexpected, given the small number of individuals that comprise the skeletal series from each of these three sites. At the Wall site, individuals that are very young or very old predominate in the burial sample. Only one individual is between the ages of 10 and 20 years, and none are between 25 and 45 years. Also, all the adults from the Wall site are males. Similar biases can also be seen in the burial sample from the Fredricks site, where a number of individuals aged 0-5 years are present, but few old adults are present. The group aged 20 to 45 years contains few individuals, and only two individuals are present in the 10-20 year age category. Also, a bias for males is evident at the Fredricks site, with five male adults being identified and only one female. At Upper Saratown-Locality 1 only a single adult (a female) is present, the other five burials are subadults.

Demographic Profiles

Because of the numerous stresses associated with early life, many researchers (cf. Buikstra 1976:22-23) consider most aboriginal populations to have had frequent deaths of infants. High infant mortality would be indicated by a large percentage of the burial sample being between 0 and 5 years of age at death. Because of the high death risk associated with childbearing, adult females aged 18 to 30 years at death should also be elevated over that of other age segments in the sample. This assumes that the sample is biologically representative, which is not the case for the Wall site, Upper Saratown-Locality 1, or the Fredricks site. Another age-sex group that should possess an elevated mortality rate for the prehistoric period, and a still higher rate after contact, are males aged 18 to 40 years. This is due to the stress associated with hunting and warfare, which increased in the late protohistoric/ period from the heightened competition associated with the skin trade and the increased animosity that marked the interaction between the Indians of the Northeast and those of the Virginia and Carolina Piedmont (cf. Lawson 1967:49-50).

The segment of the prehistoric skeletal series classified as old (aged 40 years and above), should be comprised mostly of males, as they are most likely to survive the stress years of 18 to 40. For late protohistoric/contact period samples, both males and females would endure increased stress derived from exposure to European diseases, increased warfare and competition, and disruption of the extant social system. Few of either sex would be likely to survive the stress years. Females, however, would probably have a better chance than males to survive to old age in the late protohistoric/contact period if there was a decrease in childbearing and its related stress from that of the prehistoric period.

Conversely, the presence of European diseases would probably result in an increase in the number of deaths in all age groups among Indian populations of the protohistoric and contact periods. Such would be marked in particular by an increase in the number of deaths in the 5-to-15 year age group. In a population that is not undergoing any extraordinary stresses, the 5-to-15 year age group usually sees a decline in mortality (Droessler 1981). Also, life expectancy at birth and for each age category should be lower for protohistoric/contact period samples when compared with prehistoric samples, given the increase in the types and intensity of stresses to which the former are subjected.

In summary, five general demographic trends should be evident when prehistoric, protohistoric and contact period burial samples are compared. These are:

1. Similar mortality profiles should be present for infants and females in all three.

2. Higher mortality for males aged 18 to 40 years at death should be found in late protohistoric/contact period samples.

3. More old individuals (those aged 40+ in years) should be evident in the prehistoric/early protohistoric period samples.

4. Higher mortality among individuals aged 10 to 20 years should be seen in late protohistoric/contact period samples.

5. Higher life expectancies for all age groups should be exhibited by prehistoric and early protohistoric period samples.

Basic Assumptions and Limitations of Demographic Analyses

To investigate these five propositions, burial data from all five sites are used to construct comparative demographic profiles. The demographic reconstruction of a population is based on three assumptions (Ubelaker 1974:59). First and foremost, it is assumed that the skeletal sample is complete, or fully representative of the living population. Of the five study samples, only the Fredricks site has almost been completely excavated. The other four sites have been partially excavated, which means that only a portion of the total burial population is present. Even for the Fredricks site it is possible that more burials, as yet uncovered, lie outside the confines of the palisade line which is the limit of the excavation conducted at the site. The presence of one or more additional cemetery areas at the Fredricks site is a distinct possibility, given that 13 of the 15 burials in the sample are from a supposed cemetery (see Figure 6) located outside the northeast section of palisade.

The second assumption of demographic reconstruction is that the age at death can be accurately determined. In this study a number of techniques that utilized morphological or metrical data were used to age individuals in each sample (see below). Also, because the author aged all five samples, any biases introduced in determining the age at death should affect each sample equally.

The final assumption of demographic reconstruction is that the size of the living population and its death rate remain constant during the occupation represented by the site's component under study. This assumption is problematic in regard to protohistoric/contact period samples where mortality probably fluctuated from year to year given the varying levels of stress induced by European disease, warfare, hunting and trade. Also, both Indians and Europeans took slaves for both groups (Lawson 1967:48, 64, 79-80, 208-212). This custom would also probably result in population fluctuations from year to year.

Given these three assumptions and the limitations imposed on the demographic reconstructions of the study samples, the results presented here can only be viewed as preliminary and as providing a basis for future investigations.

The first step in reconstructing the demographic characteristics was to construct mortality curves and life tables for the four samples with more than one adult individual. This eliminated Upper Saratown-Locality 1 from consideration here as it has only one adult individual. Mortality curves were also constructed for sexed individuals in order to investigate potential differences and similarities in the mortality of the two sexes for the prehistoric, protohistoric and historic contact periods.

Mortality Curves

Mortality curves allow one to examine the percentages of a population that died in particular age groups. Five-year age groups are used to compute the life tables for three of the four sites in the study. The Wall site sample is so small that only ten-year age groups could be constructed in the site's life table. Figure 7 shows the mortality curves reconstructed for all four samples.

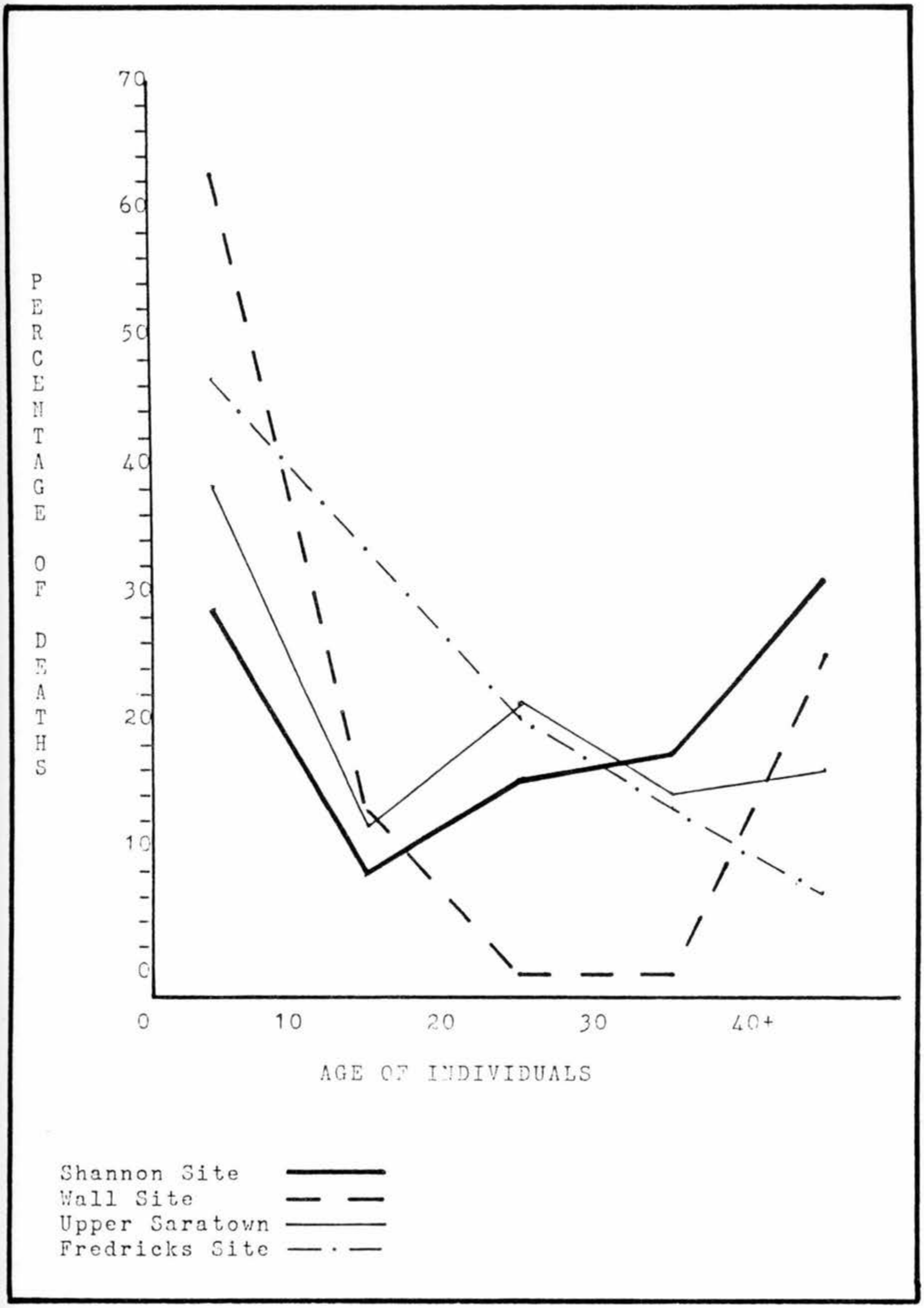

Figure 7. Mortality curves by 10-year age groups for four of the study samples.

Several similarities are immediately evident when the two profiles of the prehistoric/early protohistoric period sites are examined. There is a high frequency of death in the first 10 years of life, which is followed by a decline through childhood into adolescence as represented by the 10-20 year age category. At the Shannon site a gradual increase in number of deaths is present in the 20-30 year age group, with the increase continuing in the older age groups at the site. At the Wall site, because no individuals aged 20 to 40 years at death are present, little more can be said about the mortality among this segment of the late prehistoric/early protohistoric period sample. In both sample, the 40 and above age group shows a sharp increase in mortality over the younger groups. This pattern of high infant mortality, followed by lower childhood mortality, and a subsequent continuing rise in adult mortality at the Wall and Shannon sites is similar to United Nations mortality model curves computed from 158 censuses in 50 developing (non-industrialized) countries and published in 1955 (Buikstra 1976:22-23). A similar pattern was found by Buikstra in a Middle Woodland skeletal series from the Gibson and Klunk sites in Illinois. Such a pattern is considered to represent a normal mortality curve.

The late protohistoric/contact period Upper Saratown-Locality 2 and Fredricks site skeletal series also exhibit a pattern of high infant mortality and low childhood-adolescent mortality. However, mortality at Upper Saratown-Locality 2 increases in the 20-30 age group, while it remains constant at the Fredricks site. In the Upper Saratown-Locality 2 sample, mortality then decreases in the subsequent 30-40 age group before increasing slightly in the over 40 category. In contrast, the Fredricks site sample has a high mortality rate in the 30-40 age group followed by a decrease in the over 40 group. The general pattern of a high mortality rate between the ages of 20 and 40 years, with fewer people surviving in the over 40 age group, at the two later sites deviates from the United Nations model and that noted for the two samples of the late prehistoric/early protohistoric era.

From the earlier discussions concerning the problems of sample bias and sample size, it is evident that comparisons of mortality between the late prehistoric/early protohistoric and late protohistoric/contact periods in this study can involve only the relatively large samples from the Shannon site and Upper Saratown-Locality 2. The reconstructed mortality curves for these two samples are graphically detailed in Figure 7. In general, the two mortality curves are similar for the two samples until age 25-30 years. At Upper Saratown-Locality 2, this age segment comprises 19.3% of the sample, a large increase from the 2.2% of the sample that is within the 20-25 year age group. The Shannon site sample, on the other hand, exhibits a more modest rise, increasing from 7.1% in the 20-25 year group to 8.0% for the 25-30 year group. The mortality curves for both samples decrease for the 30-35 year age group, that is followed by an increase for both in the 35-40 year group. The Shannon site mortality curve then decreases to 6.2% for the 40-45 year age group, before increasing dramatically to 25.1% for the over-45-year age group. In contrast, the mortality curve for Upper Saratown-Locality 2 exhibits only a slight increase in the two oldest age groups.

The differences that can be observed by examining the mortality curves for the two study samples are taken to support two of the propositions stated earlier. First, there is a high rate of infant mortality in all of the samples. This pattern is not unexpected, conforming as it does to the infant mortality pattern that is typical of most modern-day Third World populations, who are considered by many researchers to provide the best comparative data for the study of past human populations (Droessler 1981:48). What is noticable about the infant mortality figures is the lower percentage of young infant deaths in the prehistoric period Shannon site sample in comparison with the late protohistoric/early contact period Upper Saratown-Locality 2 sample. The mean age of individuals in the 0-5 year age group in the Shannon site sample is 1.2 years. For the other early sample in this study, the Wall site, the mean age for the 0-5 year group is 1.26 years. In marked contrast, the mean age at late protohistoric/early contact period Upper Saratown-Locality 2 for this age group is 2.92 years. Likewise, the Fredricks site 0-5 year segment of the sample is aged 2.25 years. These figures indicate that neonates, that is, those individuals aged 0 to 12 months at death, might be underrepresented at both of the later sites. Among the possible explanations for this fact are that the neonates are buried in a location different from that of the other segments of the sample; they have been disposed of in a manner that did not involve formal burial; they survived longer in the late protohistoric/contact period populations; or some combination of two or more of these explanations.

The first two alternatives listed here cannot be addressed at this time because other data dealing with differential burial/burial customs are not available. The third proposition, however, can be examined using the twin concepts of "r-" and "K-" selection developed by population biologists to study group formation in animals (cf. Horn 1978: Pianka 1978). Basically, the r- and K-designations represent two poles on a continuum of strategies that populations utilize to insure their survival. In population biology, an r-strategy is denoted by large litters, small offspring, little parental care, low parental survival, and high survival of juveniles (Horn 1978:416). K-strategies represent the opposite end of the continuum, and are characterized by small litters, large young, much parental care, high parental survival, and low survival of the young (Horn 1978:418). Obviously, not all of the various characteristics listed for either r- or K-selection among animal groups need apply directly to human groups. Pianka (1978:120-125) considers r- and K-selection in terms of competition. Populations that are subjected to great fluctuations in the environment can be termed opportunistic populations (Pianka 1978:120). In contrast, populations that are usually in equilibrium with their resources, that inhabit a stable environment, can be called equilibrium populations (Pianka 1978:121). In a competitive vacuum, ". . .the best reproductive strategy is often to put maximal amounts of matter and energy into reproduction and to produce as many total progeny as possible as soon as possible." (Pianka 1978:121). Such a strategy approximates the r-selection strategy described by Horn. The K-selection strategy, on the other hand, is best in an environment where the "competition is keen, and the best strategy may often be to put more energy into competition and maintenance and to produce offspring with more substantial competitive abilities." (Pianka 1978:122). Because this strategy is "energetically more expensive, it means that fewer [offspring] can be produced." (Pianka 1978:122).

Because the skeletal series involved here comprise only two potentially biologically representative samples, all the implications of the r- and K-selection reproductive stragegy model for the investigation of the demographic changes between prehistoric/early protohistoric and late protohistoric/contact period populations have yet to be fully explored. However, the following proposition about the observed differences in the average age of the subadults in the study samples is offered to stimulate thought and serve as a basis for further research. In previous sections of this study, the late prehistoric/early protohistoric period, especially the prehistoric period, has been characterized as a time of reduced stress and competition when compared to the late protohistoric/contact period. Thus, late prehistoric/early protohistoric populations should tend to exhibit r-type reproductive strategies, given that stress and competition are low or stable. Such strategies would be marked in a population by numerous offspring found in the 0-2 year age group, and weaning would take place at an earlier age, say between 0 and 24 months, than in K-strategy populations. In contrast, the "best" reproductive strategy for the high stress and competition times of the late protohistoric/contact period would be a K-selection strategy. In these later populations, more energy would have to be put toward competition and maintenance of the social unit in the face of high levels of stress and competition. Energy expended on reproduction would be less, so that fewer offspring could be produced. To insure the survival of these fewer offspring, more energy (relative to r-selection populations) would be expended on each offspring, but the total energy expended on all the offspring would be less than in the earlier r-selection populations because there would be fewer offspring in the later, K-selection based populations. The K-selection strategy of high stress/competition late protohistoric/contact populations should manifest itself in the prolonged nursing of the individual offspring (delayed weaning) to insure its survival into childhood and adolescence. This scenario for the late protohistoric/contact period is reflected in an observation made by John Lawson (1967:196) to the effect that

> neither does the youngest Wife ever fail of proving so good a Nurse, as to bring her Child up free from Rickets and Disasters that proceed from the Teeth, with many other Distempers which attack our Infants in England, and Parts of Europe. They let their Children suck till they are well grown, unless they prove big with child sooner.

The second proposition supported by the mortality curves derived for the Shannon site and Upper Saratown-Locality 2 samples is that older individuals comprise a larger percentage of late prehistoric/early protohistoric period samples than of late protohistoric/contact period samples. At the Shannon site, 31.25% of the burial sample survived to the 40+ age group. In contrast, the late protohistoric/early contact period Upper Saratown-Locality 2 site had only 16.14% of the sample surviving past age 40. Mirroring this difference, 25.0% of the late prehistoric/early protohistoric period Wall site sample survived to the over-age-40 group, as opposed to only 6.67% of the middle contact period Fredricks site sample.

Related to the higher percentage of individuals aged over 40 years at the late prehistoric/early protohistoric sites is the fact that slightly more individuals between the ages of 20 and 40 years died at the late protohistoric/contact period sites. Within this age range, 35.48% of the Upper Saratown-Locality 2 sample died, and 33.33% of the Fredricks site. A smaller percentage of the sample, 32.1%, is aged between 20 and 40 years at death in the late prehistoric period Shannon site sample.

A third proposition, that more individuals would be found in the 10-to-20 year age category for the late protohistoric/contact period samples, is only marginally supported by examining the reconstructed mortality curves. The late protohistoric/contact period Upper Saratown-Locality 2 and Fredricks site samples have mortality levels of 10.75% and 13.33%, respectively, for this age segment. The percentage of the Shannon site's burial sample aged 10 to 20 years at death is 8.04%, while the percentage for the Wall site is 12.5%. The figure for the Wall site is misleading because of the extremely small size of the sample from the site. However, the figures do not seem to reflect an abrupt change, certainly not a dramatic increase, in adolescent mortality from the prehistoric/early protohistoric to the late protohistoric/contact periods.

Mortality Curves by Sex

Mortality curves by sex for the Shannon site and Upper Saratown-Locality 2 are depicted in Figure 8. No mortality curves by sex could be computed for the Wall and Fredricks sites because of the small sample sizes and the fact that no females are present in the Wall site sample. For the late prehistoric period Shannon site, 26% of the males and 22% of the females died between the ages of 20 and 30 years. In the 30-to-40 year age group at the Shannon site, males decline to 20% while females rose to 33%. Individuals over 40 comprise 54% of the Shannon site male sample. And 45% of the burial sample at the Shannon site is female. The figures for both sexes aged 40+ are quite larger than the preceding 30-40 age group.

To explore whether the number of males and females at the Shannon site in the two age categories 20-to-40 years and 40+ years were significantly different statistically, a Chi-square test was performed. The results of the analysis of the 2x2 contingency table, detailed in Table 8, show that $X^2 = 0.6903$, df = 1, and $p < 0.50$. This indicates that the differences noted for the two age groups by sex are not statistically significant.

At Upper Saratown-Locality 2, a slightly different pattern of age and sex distribution is present. A total of 37% of the males are aged 20 to 30 years, as opposed to only 27.5% of the females. In the 30-to-40 year age category, 29% of the males are found and 27.5% of the females. And in the 40+ age group, 34% of the males are found, and 45% of the females. A 2x2 contingency table (Table 8) with two age categories, one of 20 to 40 years and the other of 40+ years, was constructed to test whether the difference in age

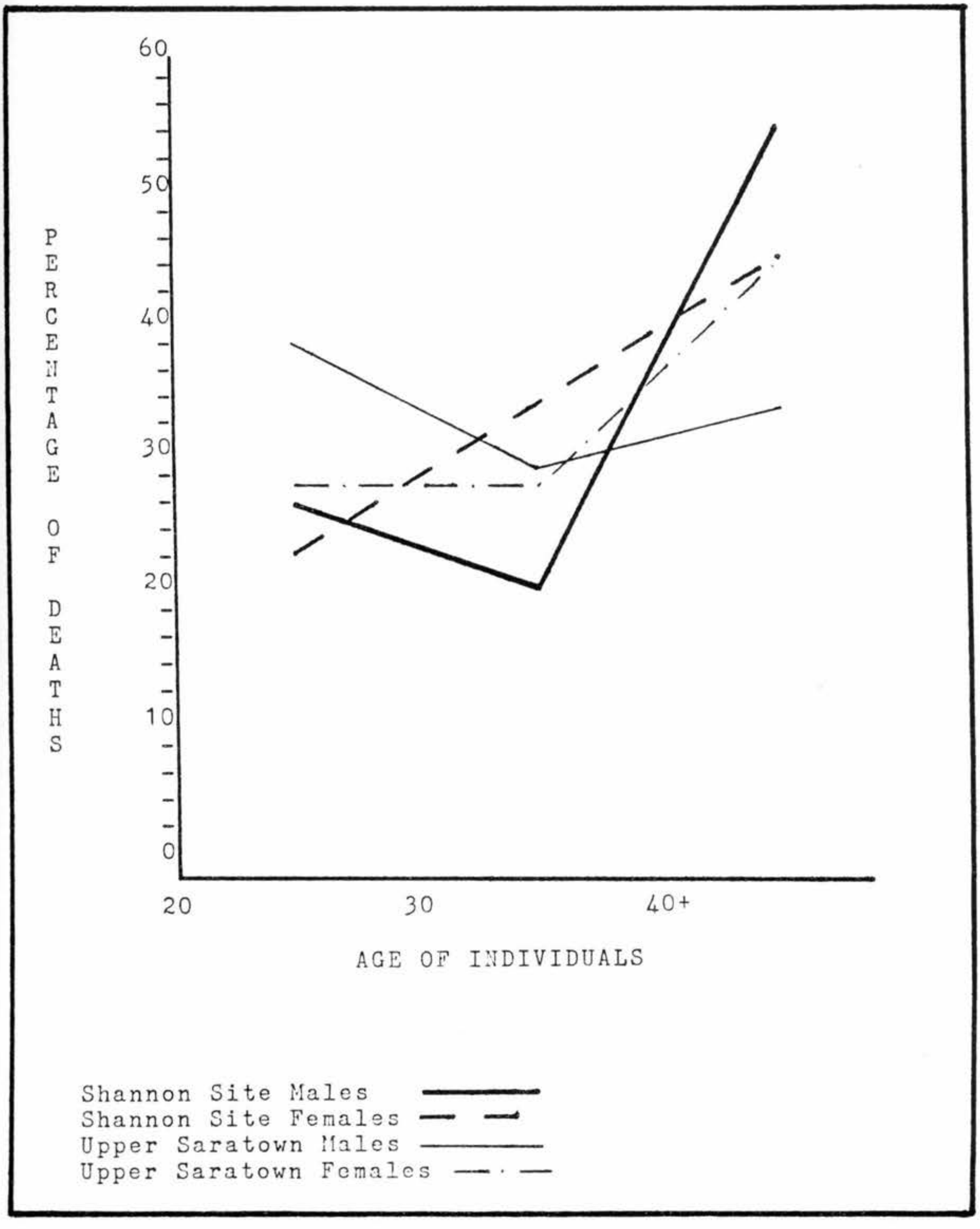

Figure 8. Mortality curves by sex for the Shannon site and Upper Saratown-Locality 2 site study samples.

TABLE 8.

Contingency Tables (2x2) for Chi-Square Test Comparing Males and Females from the Shannon Site and Upper Saratown-Locality 2.

SEX	NUMBER AGED 20-40 YEARS			NUMBER AGED 40+ YEARS			TOTAL
	Count	Expected	Percentage	Count	Expected	Percentage	
Shannon Site							
Males	16	(17.75)	46%	19	(17.25)	54%	35
Females	20	(18.25)	55%	16	(17.75)	45%	36
Total	36			36			71

$X^2 = 0.6903$, with df = 1, $p < 0.50$.

SEX	NUMBER AGED 20-40 YEARS			NUMBER AGED 40+ YEARS			TOTAL
	Count	Expected	Percentage	Count	Expected	Percentage	
Upper Saratown-Locality 2							
Males	16	(14.85)	67%	8	(9.15)	33%	24
Females	10	(11.15)	55%	8	(7.85)	45%	18
Total	26			16			42

$X^2 = 0.5206$, with df = 1, $p < 0.50$.

group distribution by sex was significant using the Chi-square statistic. The results are $X^2 = 0.5206$, df = 1, and $p < 0.50$. Again, the Chi-square statistic indicates that there is no significant difference between male and female mortality at late protohistoric/early contact period Upper Saratown-Locality 2.

The Chi-square test was also used to compare changes in male and female mortality through time. Using the same 20-to-30 and 40+ age categories, 2x2 and 2x3 contingency tables were constructed for the male data from the Shannon site and Upper Saratown-Locality 2. Table 9 shows the contingency tables and the result of the test, which is that $X^2 = 2.5128$, df = 1, and $p < 0.20$. Although this result is not statistically significant, it does indicate that study of a possible shift in the mortality pattern of males from the late prehistoric/early protohistoric period to the late protohistoric/early contact period using more data might prove useful. Examination of the raw figures (the percentages and counts listed in Table 9 and Figure 8) indicates that male mortality increased during the late protohistoric/early contact period with a higher percentage of individuals dying between the ages of 20 and 40 years than had in the prehistoric period.

The 2x2 and 2x3 contingency tables constructed for the comparison of the females from the Shannon site and Upper Saratown-Locality 2 are shown in Table 10. The figure computed for the 2x2 test is $X^2 = 0.0$, df = 1, and $p < 0.99$, and for the 2x3 test is $X^2 = 0.2695$, df = 2, and $p < 0.90$. Both results indicate that no statistically significant changes in female mortality occurred from

TABLE 9.

Contingency Tables (2x2 and 2x3) for Chi-Square Tests Comparing Males from the Shannon Site and Upper Saratown-Locality 2.

SITE	CHI-SQUARE TABLE						
	NUMBER AGED 20-40 YEARS			NUMBER AGED 40+ YEARS			TOTAL
	Count	Expected	Percentage	Count	Expected	Percentage	
Shannon Site	16	(18.98)	45%	19	(16.02)	54%	35
Upper Saratown-Locality 2	16	(13.02)	66%	8	(10.98)	34%	24
Total	32			27			59

$X^2 = 2.5128$, with df = 1, $p > 0.20$.

	NUMBER AGED 20-30			NUMBER AGED 30-40			NUMBER AGED 40+			TOTAL
	Count	Expected	%	Count	Expected	%	Count	Expected	%	
Shannon Site	9	(10.67)	26%	7	(8.30)	20%	19	(16.02)	54%	35
Upper Saratown-Locality 2	9	(7.33)	37%	7	(5.40)	29%	8	(10.98)	34%	24
Total	18			14			27			59

$X^2 = 2.505$, with df = 2, $p > 0.30$.

TABLE 10.

Contingency Tables (2x2 and 2x3) for Chi-Square Tests Comparing Females from the Shannon Site and Upper Saratown-Locality 2.

SITE	CHI-SQUARE TABLE						
	NUMBER AGED 20-40 YEARS			NUMBER AGED 40+ YEARS			TOTAL
	Count	Expected	Percentage	Count	Expected	Percentage	
Shannon Site	20	(20)	55%	16	(16)	45%	36
Upper Saratown-Locality 2	10	(10)	55%	8	(8)	45%	18
Total	30			24			54

$X^2 = 0$, df = 1, no difference.

	NUMBER AGED 20-30			NUMBER AGED 30-40			NUMBER AGED 40+			TOTAL
	Count	Expected	%	Count	Expected	%	Count	Expected	%	
Shannon	8	(8.66)	22%	12	(11.33)	33%	16	(16)	45%	36
Upper Saratown-Locality 2	5	(4.34)	28%	5	(5.67)	28%	8	(8)	44%	18
Total	13			17			24			54

$X^2 = 0.2695$, with df = 2, $p < 0.90$.

the late prehistoric period site to the late protohistoric/early contact period.

Based on the results of these Chi-square studies, the proposition that female mortality would remain relatively constant in late prehistoric, protohistoric and contact period samples is supported. Also, the proposition that higher mortality among males aged 20-to-40 years in the later samples is supported. Although little can be done at present to further test these propositions, examination of the small skeletal samples from the Wall and Fredricks sites corroborates the above proposition concerning males aged 20-to-40 years. For the late prehistoric/early protohistoric period Wall site male sample (n=3), one male is aged between 17 and 20 years, and two are aged 40+ years. This is similar to the ratio noted above for the Shannon site sample. In contrast, four of the five males found at the Fredricks site are aged 20-to-40 years at death, and only one is aged 40+, a pattern similar to that found among Upper Saratown-Locality 2 males.

Life Tables

Using the information on age at death for the study samples, life tables were constructed for the four sites (Tables 11-14). Such life tables are useful in the investigation of the proposition that the life expectancy of an individual would tend to be greater in late prehistoric/early protohistoric burial samples than in late protohistoric/contact period samples. Life tables were determined using the same formulae used by Ubelaker (1974:62) in his analysis of the Maryland Nanjemoy ossuaries. To compare the four sites, and

TABLE 11.

Life Tables with Ten-Year Age categories for the Entire Burial Sample from the Shannon Site, Wall Site, Upper Saratown-Locality 2, and Fredricks Site.

Age Interval (x)	No. of Deaths (Dx)	% of Deaths (dx)	Survivors Entering (1x)	Probability of Death (qx)	Total Years Lived Between X and X + 10 (Lx)	Total Years Lived After Lifetime (Tx)	Life Expectancy ($e^{o}x$)
Shannon Site							
0-10	32	28.57	100.00	0.2857	857.15	2642.80	26.42
11-20	9	8.04	71.43	0.1126	674.10	1785.65	24.99
21-30	17	15.18	63.39	0.2385	558.00	1111.55	17.53
31-40	19	16.96	48.21	0.3518	397.30	553.55	11.48
40+	35	31.25	31.25	1.0000	156.25	156.25	5.00
Total	112	100.00					
Wall Site							
0-10	5	62.50	100.00	0.6250	687.50	1625.00	16.25
11-20	1	12.50	37.50	0.3333	312.50	937.50	25.00
21-30	0	0	0	0	0	0	25.00
31-40	0	0	0	0	0	0	25.00
40+	2	25.00	25.00	1.0000	125.00	125.00	5.0
Total	8	100.00					
Upper Saratown-Locality 2							
0-10	35	37.63	100.00	0.3763	811.85	2102.50	21.02
10-20	10	10.75	62.37	0.1723	569.95	1290.65	20.69
21-30	20	21.50	51.62	0.4165	408.70	720.70	13.96
31-40	13	13.98	30.12	0.4641	231.30	312.00	10.36
40+	15	16.14	16.14	1.0000	80.70	80.70	5.00
Total	93	100.00					
Fredricks Site							
0-10	7	46.67	100.00	0.4667	766.65	1700.00	17.00
11-20	2	13.33	53.33	0.2499	466.65	933.35	17.50
21-30	3	20.00	40.00	0.5000	300.00	466.70	11.67
31-40	2	13.33	20.00	0.6665	133.35	166.70	8.33
40+	1	6.67	6.67	1.0520	33.35	33.35	5.00
Total	15	100.00					

TABLE 12.

Life Tables with Five-Year Age Categores for the Entire Burial Sample from the Shannon Site, Upper Saratown-Locality 2, and the Fredricks Site.

Age Interval (x)	No. of Deaths (Dx)	% of Deaths (dx)	Survivors Entering (1x)	Probability of Death (qx)	Total Years Lived Between X and X + 5 (Lx)	Total Years Lived After Lifetime (Tx)	Life Expectancy (e°x)
Shannon Site							
0-5	25	22.30	100.00	0.2230	444.25	2740.00	27.40
6-10	7	6.20	77.70	0.0798	373.00	2295.75	29.55
11-15	5	4.50	71.50	0.0629	346.25	1922.75	26.89
15-20	4	3.60	67.00	0.0537	326.00	1576.50	23.53
21-25	8	7.10	63.40	0.1199	299.25	1250.50	19.72
26-30	9	8.00	56.30	0.1421	261.50	951.25	16.90
31-35	6	5.40	48.30	0.1118	228.00	689.75	14.80
36-40	13	11.60	42.90	0.2704	185.50	461.75	10.76
41-45	7	6.20	31.30	0.1981	141.00	276.25	8.82
46-50	13	11.60	25.10	0.4621	96.50	135.25	5.39
51-55	14	12.50	13.50	0.9259	36.25	38.75	2.87
55+	1	1.00	1.0	1.0000	2.50	2.50	2.50
Total	112	100.00					
Upper Saratown-Locality 2							
0-5	24	25.80	100.00	0.2580	435.50	2109.50	21.09
6-10	11	11.80	74.20	0.1590	341.50	1674.00	22.56
11-15	6	6.50	62.40	0.1042	295.75	1332.50	21.35
15-20	4	4.30	55.90	0.0769	268.75	1036.75	18.55
21-25	2	2.20	51.60	0.0426	252.50	768.00	14.88
26-30	18	19.30	49.40	0.3907	198.75	515.50	10.43
31-35	6	6.50	30.10	0.2159	134.25	316.75	10.52
36-40	7	7.50	23.60	0.3178	99.25	182.50	7.73
41-45	7	7.50	16.10	0.4658	61.75	83.25	5.17
46-50	8	8.60	8.60	1.0000	21.50	21.50	2.50
Total	93	100.00					
Fredricks Site							
0-5	6	40.00	100.00	0.4000	400.00	1516.67	15.16
6-10	1	6.67	60.00	0.1112	283.32	1116.67	18.61
11-15	1	6.67	53.33	0.1251	249.97	833.35	15.62
15-20	1	6.67	46.66	0.1429	216.62	583.38	12.50
21-25	2	13.31	39.99	0.3328	166.67	366.76	9.17
26-30	1	6.67	26.68	0.2500	116.72	200.09	7.49
36-40	2	13.31	20.01	0.6651	66.70	83.37	4.16
41-45	1	6.67	6.67	1.0000	16.67	16.67	2.50
Total	15	100.00					

TABLE 13.

Male Life Tables with Five-Year Age Categories for the Burial Samples from the Shannon Site and Upper Saratown-Locality 2.

Age Interval (x)	No. of Deaths (Dx)	% of Deaths (dx)	Survivors Entering (1x)	Probability of Death (qx)	Total Years Lived Between X and X + 5 (Lx)	Total Years Lived After Lifetime (Tx)	Life Expectancy (e°x)
Shannon Site							
0-5	13	21.30	100.00	0.2130	446.75	2591.50	25.91
6-10	7	11.50	78.70	0.1461	364.75	2144.75	27.25
11-15	4	6.50	67.20	0.0967	319.75	1780.00	26.48
15-20	2	3.30	60.70	0.0544	295.25	1460.25	24.06
21-25	3	4.90	57.40	0.0854	274.75	1165.00	20.30
26-30	6	9.80	52.50	0.1867	238.00	890.25	16.96
31-35	3	4.90	42.70	0.1147	201.25	652.25	15.27
36-40	4	6.50	37.80	0.1719	172.75	451.00	11.93
41-45	3	4.90	31.30	0.1565	144.25	278.25	8.89
46-50	9	14.70	26.40	0.5568	95.25	134.00	5.07
51-55	6	9.80	11.70	0.8376	34.00	38.75	3.31
55+	1	1.90	1.90	1.0000	4.75	4.75	2.50
Total	61	100.0					
Upper Saratown-Locality 2							
0-5	12	27.83	100.00	0.2730	431.75	2170.00	21.70
6-10	5	11.14	72.70	0.1568	335.00	1738.25	23.91
11-15	3	6.80	61.30	0.1109	289.50	1403.25	22.89
15-20	0	-	54.50	0.0000	272.50	1113.75	20.43
21-25	1	2.20	54.50	0.0183	267.00	841.25	15.43
26-30	8	18.20	52.30	0.3480	216.00	514.25	10.98
31-35	3	6.80	34.10	0.1994	153.50	358.25	10.50
36-40	4	9.10	27.30	0.3333	113.75	204.75	7.50
41-45	4	9.10	18.20	0.5000	68.25	91.00	5.00
46-50	4	9.10	9.10	1.0000	22.75	22.75	2.50
51-55	-	-	-	-	-	-	-
55+	-	-	-	-	-	-	-
Total	44	100.0					

TABLE 14.

Female Life Tables with Five Year Age Categories for the Burial Samples from the Shannon Site and Upper Saratown-Locality 2.

Age Interval (x)	No. of Deaths (Dx)	% of Deaths (dx)	Survivors Entering (lx)	Probability of Death (qx)	Total Years Lived Between X and X + 5 (Lx)	Total Years Lived After Lifetime (Tx)	Life Expectancy (e°x)
Shannon Site							
0-5	13	21.00	100.00	0.2100	447.50	2550.75	25.50
6-10	7	11.30	79.00	0.1430	366.75	2103.27	26.62
11-15	4	6.40	67.70	0.0945	322.50	1736.52	25.65
15-20	2	3.20	61.30	0.0522	289.50	1414.02	23.07
21-25	5	8.10	58.10	0.1394	270.25	1115.52	19.20
26-30	3	4.80	50.00	0.0960	238.00	845.27	16.90
31-35	3	4.80	45.20	0.1062	214.00	607.27	13.43
36-40	9	14.50	40.40	0.3589	165.75	393.27	9.78
41-45	4	6.40	24.90	0.2471	113.50	227.52	8.78
46-50	4	6.40	19.50	0.3282	81.50	114.02	5.84
51-55	8	13.90	13.10	1.0000	32.50	32.50	2.48
55+	-	-	-	-	-	-	-
Total	62	100.00					
Upper Saratown-Locality 2							
0-5	12	28.60	100.00	0.2860	428.50	2010.99	20.10
6-10	5	11.90	71.40	0.1666	327.25	1582.49	22.16
11-15	3	7.15	59.50	0.1201	279.62	1255.24	21.10
15-20	4	9.50	52.35	0.1815	238.00	975.62	18.64
21-25	-	-	42.85	0.0000	214.25	737.62	17.21
26-30	5	11.90	42.85	0.2777	184.50	523.37	12.21
31-35	3	7.15	30.95	0.2310	136.87	338.87	10.95
36-40	2	4.80	23.80	0.2017	107.00	202.00	8.49
41-45	4	9.50	19.00	0.0526	71.25	95.00	5.00
46-50	4	9.50	9.50	1.0000	23.75	23.75	2.50
51-55	-	-	-	-	-	-	-
55+	-	-	-	-	-	-	-
Total	42	100.00					

primarily due to the small sample size of at least two of the study samples, 10 year age categories were computed. In addition, 5 year age categories could be constructed to compare the Shannon site and Upper Saratown-Locality 2 burial samples. Using 10 year categories, life expectancy at birth for the late prehistoric period Shannon site sample is 26.42 years (Table 11). If an individual reaches past the age of 10 years, the life expectancy is an additional 24.99 years (age at death is 34.99). After age 20 this figure decreases to 17.53 years. The Wall site burial sample possesses a life expectancy at birth of only 16.25 years (Table 11). This figure, which is extremely low when compared with the Shannon site and other prehistoric period skeletal series from the southeast (Table 15), is certainly an artifact of the small sample from the Wall site. Comparison of the life expectancy at ages 10 and 20 shows that the Wall site figures are consistently higher than those of the Shannon site.

Both of the later samples possess life expectancies at birth that are less than that noted for the Shannon site. Life expectancy at birth for Upper Saratown-Locality 2 (Table 11) using 10-year age categories is 21.02 years, at 10 years it is 30.69, and at 20 years it is 33.96. For the Fredricks site (Table 11), the life expectancy is 17.66 at birth, 28.75 years at age 10, and 33.33 years at age 20.

Using 5 year age intervals, the life expectancy at birth in the Shannon site (Table 12) is 27.4 years. At Upper Saratown-Locality 2, the life expectancy at birth based on 5 year age groups is 21.09 years (Table 12).

TABLE 15.

Comparison of Life Expectancy at Birth of the Four Study Samples with Selected Archaeological Burial Samples.

POPULATION	DATE	LIFE EXPECTANCY IN YEARS
Larson, South Dakota	A.D. 1750-1785	13.2
Fredricks Site, North Carolina	A.D. 1680-1712	15.16
Wall Site, North Carolina	A.D. 1547	16.3
Indian Knoll, Kentucky	3000 B.C.	18.6
McFayden Mound, (31Bw67), North Carolina	A.D. 1000-1500	19.9
Nanjemoy, Ossuary I, Maryland	A.D. 1500-1600	20.9
Upper Saratown-Locality 2, North Carolina	A.D. 1630-1665	21.0
Nanjemoy, Ossuary II, Maryland	A.D. 1500-1600	22.9
Shannon Site, Virginia	A.D. 1450-	26.4
Texas Indians	A.D. 850-1700	30.5

Modified from Owsley and Bass (1979:150) and H. Wilson (1982:154).

Comparing the life expectancies for males and females at the Shannon site and Upper Saratown-Locality 2 (Tables 13 and 14), it is evident that both sexes are quite similar to one another within their own burial samples. This changes when the life expectancies for both sexes between the sites are examined. Both sexes have a higher life expectancy in the late prehistoric period sample than in the late protohistoric/early contact period. For males, the life expectancy at birth in the prehistoric Shannon site sample is 25.91 years, and for females it is 25.50 years. At Upper Saratown-Locality 2, males have a life expectancy at birth of 21.70 years and females of 20.10 years.

As comparison of the data by skeletal series and by sex shows, life expectancies are generally higher for the late prehistoric period sample than for the late protohistoric/early contact period sample. The original poposition that there would be a general trend toward a longer life expectancy in the late prehistoric/early protohistoric samples when compared to the late protohistoric/contact period samples is supported. This observation is made with the information from the Wall and Fredricks sites being excluded because the population samples from these two sites are too small for reliable conclusions to be drawn from them.

Crude Mortality Rates

The crude mortalilty rate of a population represents the number of individuals per 1000 that die in a year. Assuming that the death rate is constant, the crude mortality rate of a population can be computed by dividing the life expectancy at birth into 1000

(Ubelaker 1978:96). For the Shannon site, a life expectancy at birth of 26.42 years yields a crude mortality rate of 37.85. A crude mortality rate of 61.73 is computed from the Wall site data. Of these two, the Shannon site estimate best represents the crude mortality rate for a pre-contact period population, given the problems with sample size and sample bias that plague the Wall site sample.

For the late protohistoric/contact period sites, Upper Saratown-Locality 2 has a crude mortality rate of 47.573, and the Fredricks site of 56.625. Therefore, as stated in our original list of propositions, there is an increase in the number of deaths per year per 1000 individuals from the prehistoric period (as represented by the Shannon site skeletal series) to the late protohistoric/contact period (as represented by Upper Saratown-Locality 2 and the Fredricks site).

Summary of the Demographic Studies

The information on age-specific mortality and life expectancy presented here has proved valuable in evaluating the overall health and fitness of the four Piedmont Indian burial samples. Several propositions were introduced and examined using techniques of demographic analysis. The relatively large skeletal samples from the late prehistoric period Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2 were used to develop "models" against which the small (and probably biased) samples from the late prehistoric/early protohistoric period Wall site and the middle contact period Fredricks site could be compared. Of the five propositions originally set forth in this section, four are supported by data from the Shannon site and Upper Saratown-Locality 2, with similar patterns being documented for the Wall and Fredricks sites. Support is provided for the propositions that there will be similar mortality profiles for infants and females at the late prehistoric, protohistoric and contact period sites; higher mortality for young males at the late protohistoric/contact period sites; more older individuals in the late prehistoric/early protohistoric period sites; and higher life expectencies for the late prehistoric/early protohistoric period burial samples. The fifth proposition, that higher mortality among individuals 10 to 20 years would exist in the late protohistoric/contact period samples, is not supported. Hopefully, larger and more representative samples from the Wall and Fredricks sites, and other prehistoric, protohistoric and contact period sites, will be forthcoming. This will permit a more thorough study of these propositions and suggest other patterns for investigation.

CHAPTER V

DIET, HEALTH, AND TRACE ELEMENT ANALYSIS

A major advance in the study of prehistoric human diet has been the ability to analyze the chemical content of bone samples, especially those analyses that examine the occurrence of certain trace elements. In this study, trace element analysis is used to consider questions pertinent to the diet and general health of the prehistoric, protohistoric, and contact period populations. Techniques that measure the relative concentrations of trace elements in human bone have come to be heavily relied upon by archaeaologists interested in reconstructing diet, studying disease states, and examining the general health of archaeological populations (Bahou 1975; Blakely and Beck 1981; Lambert et al. 1979).

Bahou (1975) attempted to study the relationship between disease states and trace element levels for the skeletal series from the Dickson Mounds in Illinois. Bahou (1975:15) hypothesized that zinc would be correlated with infectious disease states. Because of zinc's ability to enhance wound closure, with an assumed accompanying lower susceptibility to infection, there should be a relationship between zinc levels and the presence and severity of infectious disease states in the skeletal sample. However, no definite correlation between infectious severity and zinc concentrations was uncovered by Bahou, although zinc was present in the bone samples. Still, Bahou (1975:15) concluded that the possibility of discerning disease states using trace element analysis was high, given the important intersection of culture and biology. Although Bahou's study did not produce the intended results, it did show that trace element studies offered a way in which disease states in archaeological populations could be studied.

In their study, Blakely and Beck (1981:429) stress that more than one trace element should be used to assess dietary stress in a population. Copper, zinc, magnesium, and strontium are the recommended trace elements because of their sensitivity to dietary intake. Blakely and Beck used trace element analysis to test the hypothesis that skeletons representing the subordinate and superordinate classes at Etowah, a Mississippian ceremonial center and mound complex in Georgia, would contain different concentrations of trace elements. The four elements used in the analysis were zinc, copper, strontium, and magnesium. Zinc and copper are usually found in high levels in meat resources, while strontium and magnesium are usually found in high concentrations in plant resources. Blakely and Beck compared the levels of these four elements for two Etowah skeletal samples, one from a village in the area and the other from a mound in the ceremonial complex. Results suggested that no statistically significant differences were present for the trace element levels from the two samples. This was taken to indicate that status was achieved rather than ascribed in Etowah society (Blakely and Beck 1981:420).

Lambert, Szpunar, and Buikstra (1979) used trace element analysis to compare the diets of a Middle Woodland skeletal series from the Gibson site and a Late Woodland skeletal sample from the Lederer site in Illinois. It was found that strontium, zinc, magnesium, calcium, sodium, and copper in bone were unaffected by soil contamination, and therefore could be used in the study of human bone samples (Lambert et al. 1979:127). Differences between the two skeletal series were noted in the levels of strontium, manganese, and magnesium. These differences were interpreted to reflect the change from a hunting-gathering form of subsistence dependent on locally gathered wild plants employed at the earlier Gibson site, to a subsistence dependant on maize agriculture (Lambert et al. 1979:127-128).

Another use of trace element analysis has been for determining the relative contributions of meat and plant food resources to the diets of various segments of a population, and how such patterns relate to status (Brown 1974; Hatch and Geidel 1983; Schoeninger 1979). In one of the earliest considerations of this use of trace element analysis, Brown (1974) convincingly argued that individuals in a population with preferential access to meat resources could be identified by lower strontium levels in the bone samples. This hypothesis was tested using skeletal series from the site of Huitzo in the Valley of Oaxaca, Mexico. Eleven bone samples were assayed for strontium, and differing levels of this trace element were noted. Brown concluded that strontium levels could be used as a dietary indicator of status differences between and within populations. Also, she suggested that the assay of strontium levels in the bone samples could be used to monitor changes in diet through time at a site. Such changes in diet could reflect alterations in subsistence behavior, or changes in access by population segments to food resources (Brown 1974:48).

In addition to trace elements, the levels of other elements, such as lead, in the bone samples can be analyzed. For the contact period, an inquiry into the lead content of bone may prove rewarding. Research has shown that elevated levels of lead in human tissue usually arise from association with some form of lead manufacturing or utilization (Aufderheide et al. 1981). Given the introduction of lead into aboriginal society in the form of pewter artifacts, lead metal artifacts (especially lead shot), lead-based paint, and lead-glazed pottery, bone lead content from earlier to later contact period sites could be compared. The presence of increased lead levels in contact period aboriginal populations could indicate the use of lead artifacts such as pots, shot, and pipes in traditional European fashion. Also, elevated lead levels in the environment could have contributed to decreased birth rates and increased poor health for contact period populations.

Food Resources and Trace Element Analysis

For trace element analysis to be informative, it is essential that the food resources available to a population be reconstructed from the archaeological record. Information is available concerning the faunal food resources utilized at each site included in this study. A list of the major animal species represented in the archaeological remains from the Shannon site is provided by Benthall (1969:143-144). For the Upper Saratown sites J. Wilson (1983:513-

545) provides an analysis of the faunal remains. Holm (1987) gives the results of the analysis of faunal collections from the Fredricks and Wall sites. In all cases deer (*Odocoileus virginianus*), turkey (*Meleagris gallapavo*), passenger pigeon (*Ectopistes migratorius*), and turtle (*Terrapene carolina*) were the prominent meat resources. Small mammals, such as the raccoon (*Procyon lotor*) and opossum (*Didelphis virginiana*), other birds, such as the bobwhite quail (*Colinus virginianus*), and fish were also utilized by the study populations.

The relative diversity of the faunal resources used by each study population (except for the Shannon site) as indicated by the pounds of meat percentage contributed by each animal species was examined using Lieberson's (1969) Diversity Index formula (which was discussed earlier in Chapter III). Information for another prehistoric site of the Roanoke River drainage in the inner Virginia Piedmont, the Reedy Creek site (44Ha22), was used instead of the Shannon site information, which did not have any lists from which the pounds of meat contributed by each species to the site total could be calculated. It is recognized here that the use of the data from 44Ha22 skews any conclusions that might be reached in the following analysis. However, it is used here because it is the best example of the faunal resource usage at a late prehistoric site in the inner Piedmont of Virginia, and it is felt that it can serve as an approximation of the general structure of faunal utilization at the Shannon site. Also, both the Shannon site and the Reedy Creek site possess similar ceramics of the Clarkesville series. Information for 44Ha22 and the Upper Saratown sites are from J.

Wilson (1983:522-540), and data for the Fredricks and Wall sites are from Holm (1987:254). Table 16 shows the results of applying Lieberson's diversity formula to the meat weight totals from the five sites.

Comparison of the diversity computed for meat yield for each species indicates that there is an increase in the diversity of species utilized through time. The lowest index, 0.2422, is from the late prehistoric period Reedy Creek site. The highest index of 0.6253 is also from the latest site included in this study, the middle contact period Fredricks site.

J. Wilson (1983:542-544) suggests that the apparent increasing diversity noted in the use of faunal resources after the late prehistoric period reflects the increasing use of habitats, primarily the deciduous forest habitat, other than those favored by deer. This slight shift may have been tied to a need to expand the hunting range for skin- and fur-bearing animals used in trade with the Europeans.

For whatever reason, the apparent increase in the diversity of animal resources utilized beginning in the protohistoric period is important in interpreting the results of the trace element analyses of a skeletal sample. This is especially true when those elements related to protein intake, such as zinc, are considered. If more protein foods are available to the entire population, one might expect an increase in the percentage of zinc identified in late protohistoric/contact period skeletal series over that of late prehistoric/early protohistoric period skeletal series. Conversely, there may be little change, or a decrease, in zinc if the increased

TABLE 16.

Changing Measure of Niche Width for Faunal Resources through Time Using Lieberson's Diversity Formula and Pounds of Meat Contributed by each Species.

SITE	PERIOD	NICHE WIDTH
Reedy Creek (44Ha22)	Late Prehistoric	.2422
Wall Site (31Or11)	Late Prehistoric/ Early Protohistoric	.3135
Upper Saratown-Locality 1 (31Sk1)	Protohistoric	.4518
Upper Saratown-Locality 2 (31Sk1a)	Late Protohistoric/ Early Contact	.5231
Fredricks Site (31Or231)	Middle Contact	.6253

Lieberson's Diversity Formula is

$$_{Aw} = 1\text{-}S = 1\text{-}[(X_1)^2 + (X_2)^2 + \ldots\ldots.(X_n)^2]$$

where Aw is the diversity within the sample population, X_n is the percentage occurrence of the pounds of meat yield for a particular species. S is the summed total of the squared percentage meat yield for all faunal species in the study. Subtracting S from 1 gives the probability that two randomly paired traits (in this case percentage meat yields) within the sample population will be different.

The Reedy Creek sample consists of 18 species/taxa categories and a minimum number of individuals count of 85 (J. Wilson 1983).

The Wall site sample consists of 25 species/taxa categories with a minimum number of individuals count of 264 (Holm 1987).

The Upper Saratown-Locality 1 sample has 19 species/taxa categories and a minimum number of individuals count of 156 (Holm 1987).

The Upper Saratown-Locality 2 sample has 14 species/taxa categories and a minimum number of individuals count of 67 (J. Wilson 1983).

The Fredricks site sample has 27 species/taxa categories and a minimum number of individuals count of 133 (Holm 1987).

diversity of faunal resources available reflects an attempt to cover an overall decline in the total amount of protein derived from animals.

For the other major food resource that comprised the Indian's subsistence, plant foods, information is available for the Shannon site in the form of an unquantified general list (Benthall 1969:143), the Wall and Fredricks sites (Gremillion 1987:259), and Upper Saratown-Locality 2 (31Sk1a) (J. Wilson 1983:545-561). Major plant food resources identified for all four sites include corn (Zea mays), beans (Phaseolus vulgaris), hickory nuts (Carya sp.), acorn (Quercus sp.), and, to a lesser extent, walnut (Juglens nigra).

Gremillion's (1987) study of the plant remains from the late prehistoric/early protohistoric Wall site and the middle contact Fredricks site suggests relatively little change in plant food utilization between the two sites. The peach is the only European-derived plant food recovered from the Fredricks site. Also, the relative and actual amounts of acorn and hickory nut differ between the two sites. At the Wall site, acorns, and the other nuts in general, are all present in greater quantities. In contrast, there is less acorn present in the archaeological remains from the later Fredricks site, where hickory nut predominates. Differences in the contribution of maize to the overall subsistence is also suspected, with slightly larger amounts of this cereal being present at the Fredricks site (Gremillion 1987:271).

Gremillion (1987:271) compares the results of her analysis of the Fredricks site archaeobotanical sample with the data compiled by J. Wilson (1977, 1983) in his analysis of botanical samples from

Upper Saratown-Locality 2 (31Sk1a). Gremillion notes that the plant food assemblages are similiar in several respects. The percentage of hickory nut shell at Upper Saratown-Locality 2 (51.6%) and the Fredricks site (52.4%) are similar. However, when ratios of acorn-to-hickory nut shell are computed, Upper Saratown-Locality 2 has a 0.94 ratio and the Fredricks site has only a 0.17 ratio according analysis of materials recovered using 1/16 inch mesh screen. Flotation samples from the Fredricks site have an acorn-to-hickory ratio of 1.67. No comparable flotation sample analyses are available from Upper Saratown-Locality 2. It is possible that such analyses would also indicate that acorn was more important at Upper Saratown-Locality 2. For now, the question of acorn being more important at Upper Saratown-Locality 2 than at the later Fredricks site has to be set aside until more studies involving flotation samples from the former site are conducted. Other nut resources, including walnut and hazelnut, are apparently present in greater quantities at Upper Saratown-Locality 2, based on the analysis of 1/16 inch mesh screenings.

In addition to the differences noted in the nuts, Gremillion (1987:271) also suspects that there is a greater percentage of corn in the total plant food sample from Upper Saratown-Locality 2 when compared with the Fredricks site. She admits that this higher percentage is possibly due to the greater variety of archaeological features that produced the floral sample analyzed from Upper Saratown-Locality 2.

Computing diversity indices for the the two sites, Upper Saratown-Locality 2 was found to measure 0.8876 and the Fredricks site 0.8812 (Gremillion 1987:271). These figures indicate a broad-based or diverse use of plant foods by both populations for subsistence.

Trace Element Analysis and Related Problems

A number of propositions concerning possible changes in diet can be tested by identifying the relative and absolute amounts of zinc, copper, magnesium, strontium, and vanadium present in the skeletal series. Of the trace elements commonly utilized in the analysis of diet, zinc is one of the most important for archaeological studies. Zinc is necessary for proper mineralization of the bone as well as endocrine functions, wound healing, disease resistance, and growth. Adequate amounts of zinc for human diets can be obtained from both animal and plant food sources. In healthy human bone, zinc is present in approximately 181 ppm (parts per million) (Gilbert 1977:92).

Copper is one of the most crucial minerals for the survival of both plants and animals. Healthy human bone has an average of 19.63 ppm for copper. Copper deficiencies that occur in humans are usually associated with hypoproteinia. Severe chronic health disorders and anemia also cause levels of copper to increase. Copper deficiences in general can contribute to increased stress within a population (Gilbert 1977:92-93).

Strontium is available in a number of different foods, for example plant foods and molluscs. Usually, human diets are not deficient in strontium. Healthy bone contains about 114 ppm of strontium. However, levels of strontium increase with age, and variable levels of strontium in bone samples can be created by the amount of plant foods consumed (Gilbert 1977:33).

Magnesium levels in healthy human bone averages 1,100 ppm. Over the first ten years of life, as age increases, concentrations of magnesium decrease. After this initial decrease the amount of magnesium remains consistent in the bone. Deficiencies in magnesium are caused by protein-caloric malnutrition and by prolonged alcohol use. Magnesium is found primarily in plant foods, especially grains (Gilbert 1977:93). Changes in the importance of maize among the study samples could be indicated by changes in magnesium levels.

In contrast to the promise held by the use of trace element analysis in the reconstruction of diet, the analytical technique itself is fraught with difficulties. Although trace elements can usually be associated with either plants or animals, only a few can be directly correlated with a particular plant or animal food resource. Nuts are a good example of this problem, because, like meat resources, nuts are a good source of zinc. Another problem encountered in the use of trace element analysis is the antagonistic relationship of zinc and copper. When levels of zinc decrease, levels of copper will increase (Gilbert 1977:89-90). Also, the interpretation of the levels of zinc present in bone samples is uncertain because zinc levels also decrease in the presence of increasing amounts of phytate (an acid salt), a component of grains (Gilbert 1977; Sever 1974). Finally, hyperexidroxis (excessive sweating) and parasite infection can also decrease the levels of zinc in the body (Sever 1974).

Recently, a number of studies (Lambert et al. 1985; Schoeninger and Peebles 1981; Sillen 1981, 1985; Sillen and Kavanaugh 1982) have noted a variety of potential general problems with using trace element levels from human bones to reconstruct diet. First, strontium levels in human bone can be influenced by the consumption of shellfish (Schoeninger and Peebles 1981). Marine food resources generally are enriched with strontium, and populations that have access to marine food resources will usually have higher strontium levels than populations that do not have access. Thus, strontium levels among segments of a population that relied to a degree on marine food resources would be similar to the levels exhibited by people with a vegetarian diet (Schoeninger and Peebles 1981). In addition to this problem, strontium levels also differ from geographic region to region (Schoeninger 1979). Given this problem, comparisons of strontium levels should be restricted to sample populations within a single river drainage within a region and to being within a single skeletal series. To check the variabililty of strontium in a study, bone samples from known herbivores and carnivores should also be assayed (Price and Kavanaugh 1982).

Another problem with trace element analysis is the question of whether the levels present in the skeletal samples have changed after burial, a process known as diagenesis. Trace-elements can be leached from bone and can be absorbed by bone from the surrounding soil and groundwater (Ambrose 1987:91). When bone is exposed to aqueous solutions containing moderately high concentrations of trace elements, absorption by the bone of strontium, zinc, lead, and magnesium can occur within 24 houts (Lambert et al. 1985). One way to test for diagenesis is to assay the soil matrix surrounding the bone. Higher levels of a trace element in the bone when compared to the soil may indicate contamination of the bone sample for that trace element (Lambert et al. 1983).

A final problem with trace element assays concerns the treatment of the human bone prior to the analysis. Bones are ultrasonically cleaned and washed in distilled water prior to ashing. Substances that are absorbed and crystalized into the bone from groundwater are not always removed by this process. If these minerals are not removed then the trace element levels will be distorted (Ambrose 1987:92).

When possible a number of precautions should be exercised to control for these problems that can afflict trace element analyses. First, strontium levels should be compared for samples within the same river drainage within a region and within samples. Bone samples from known herbivores and carnivores should be assayed for strontium levels to check for diagenesis, and the possibility that molluscs were a part of the diet of a population sample. Soil samples from around the bone should also be assayed as an additional check for diagenesis. And caution should be practiced in the interpretation of trace element analyses given the potential for contaminates not being removed from bone samples during the cleaning stage of preparing the bone for analysis. Sillen (1986:312-317) has recently conducted experiments on the chemical removal of posthumous strontium contaminations from herbivore, omnivore and carnivore bone samples that prove promising.

For this study, all of these precautions could not be followed. First, there were no subsoil samples from any of the sites that could be analyzed as a check of possible diagenesis. And although bone samples from a known herbivore (white-tailed deer) were assayed for trace elements, there were no known carnivore bone samples available for study. Therefore, a known omnivore, raccoon, was used instead of a carnivore as a check on diagenesis and mollusc consumption, although molluscs are a common constituent of a raccoon's diet. As noted throughout this study, extreme care has been exercised in the interpretation and comparison of results between and within samples.

A number of propositions about possible changes in diet for the study samples can be examined by identifying the relative and absolute levels of zinc, copper, magnesium, strontium, and vanadium present in the skeletal series. These propositions are based primarily on the potential sources of the various trace elements. As noted zinc and copper are found predominantly in meats, seafood, and nuts. Grains and nuts all provide good sources for vanadium, strontium, and magnesium (Gilbert 1977). As noted earlier, molluscs also provide very high quantities of strontium (Schoeninger and Peebles 1981).

The central proposition about diet to be considered here is that if there is little difference in the relative amounts of the food resources that are sources of the trace elements then the levels of trace elements within each study sample should be similar. For example, if more meat resources are available at late protohistoric/contact period sites as a consequence of increased hunting tied to the European fur and skin trade, then it is expected that quantities of zinc and copper will be higher in these later samples when compared to the late prehistoric/early protohistoric period skeletal samples. This increase might possibly be associated with a decrease in the levels of the other three elements--strontium, vanadium and magnesium.

Before continuing, the problem noted previously with the comparison of strontium levels between sites presents a special case that is not encountered for the other four trace elements considered in this study. To review, the problem is that different environments can contain differing amounts of strontium (Schoeninger 1979). Therefore, comparing information about strontium for sites from different locales would produce distorted results. In this study, intersite comparison of strontium levels can only be conducted between the Wall and Fredricks sites located on the Eno River, and the two Upper Saratown localities found on the Dan River. These two groups of sites are the only ones that share a similar environmental setting, being located within 300 meters of one another within the same river drainage.

Trace Element Assay Technique

A bone sample weighing 1.5 grams was taken from each burial assayed. Rib fragments were used from the prehistoric period Shannon site because of restrictions placed by the institution housing the collection from this site, the Museum of Natural History of the Smithsonian Institution in Washington, D.C., on the use and number of burials that could be analyzed. Fortunately, ribs were well preserved in the Shannon site burials and samples could be obtained for each of the adults present. A total of 51 Shannon site individuals of known age and sex were assayed. Of this total, 24 are female and 27 are male. Also, each adult age category is represented for both sexes.

For the skeletal series from the other four sites used in this study, cortical bone from the femurs was used for the assay samples. Trace element analysis could be conducted for four individuals from the Wall site, 12 individuals from the Fredricks site, five individuals from Upper Saratown-Locality 1, and 50 individuals from Upper Saratown-Locality 2. Only the two samples from the Shannon site and Upper Saratown-Locality 2 are considered large enough for valid conclusions to be drawn from the comparison of trace element levels. The smaller samples, however, do provide additional information on general trends in diet change over time.

The use of ribs from one site and the cortical tissue of femurs from the other four sites should not distort the comparison of the results of the trace element analyses within and between the study samples. Lambert et al. (1979) compared the results of assay determinations based on rib and femur samples from the same individuals. Their findings showed no recognizable difference between the two bone sources in the levels of trace elements found. This was also found to be true for the five trace elements considered in this study--zinc, stontium, magnesium, copper, and vanadium--and also for the heavy metal lead.

All bone samples were assayed for the levels of five trace elements and lead at the Horticulture Laboratory of the University of Georgia at Athens using "inductively coupled argon plasma emission spectrometry" or ICP. Studies have shown that the ICP technique is preferable to the commonly used atomic absorption analysis because ICP reduces the potential for ion interference (Price and Kavanagh 1982), and a number of trace elements can be assayed at the same time (Gilbert 1977:95).

For the ICP analysis each bone sample is prepared as follows. After cleaning the bone sample is weighed and placed in a beaker. Each sample is muffled at 500° for eight hours. The resulting residue is dissolved in aqua regia and dried on a hotplate. The sample is then taken up in 50 ml of acid. Of this final solution, 20 ml is assayed on a plasma emission spectrometer (Jones, personal communication, 1986).

In addition to the human bone, bone samples from a known herbivore, white-tailed deer, and an omnivore, raccoon, obtained from the recovered archaeological assemblage was assayed for the Wall site, the Fredricks site, and Upper Saratown-Locality 2. Also, deer bone samples from the Shannon site and Upper Saratown-Locality 1 were also assayed. The results of the deer and raccoon assays were used to provide a scale for comparing the human bone assays. The deer sample results provide a check on the reliability of the human strontium assays. Because deer are herbivores, levels of strontium in the deer samples should be higher than the human (omnivore) samples. If the human bone samples contain levels of strontium that are higher than the deer, then one or more of the following factors may be at work. Molluscs, which Schoeninger and Peebles (1981) have shown to be high in strontium content, may have been a very important food resource. Large quantities of mollusc shell in the archaeological assemblage would support this interpretation. Also, if only some of the human bone samples at a site are higher than the deer samples, it may be that these individuals are from other geographic areas where strontium levels are naturally higher in the environment. This situation would not be unexpected at contact period sites because of the increased movement between villages and regions that apparently occurred after European contact (cf. Merrell 1987:25; Simpkins 1985:29-48, 95-108).

Results of the Trace Element Analysis

Comparison of the results of the trace element analysis for the five skeletal series are made across four broad categories: 1) the adult samples as a whole; 2) age categories; 3) sex categories (males and females); and 4) age and sex categories. The differences and similarities between the study samples noted in these four areas of inquiry are used to provide insights into diet changes through time.

The Adult and Subadult Populations: Diet Elements

Table 17 lists the adult means, standard deviation and variance for the six elements--strontium, magnesium, zinc, copper, vanadium, and lead--analyzed for each sample. Table 18 provides the same information for the subadults in four of the study samples with no assays being available for the Shannon site subadults. All five adult skeletal series contain strontium in levels well above the 114 ppm average usually considered healthy in human bone. The strontium means for each sample are lower than the deer assays from each respective site.

TABLE 17.

Mean Trace Element Assays for the Adults in the Five Study Samples.

ELEMENT	n=	MEAN	STANDARD DEVIATION	DEER	RACCOON
			SHANNON SITE		
Strontium	51	360.980	59.784	444.800	*
Magnesium	51	1200.039	260.810	796.000	*
Zinc	51	204.509	70.487	81.000	*
Copper	51	8.333	15.684	-	*
Vanadium	51	28.627	49.381	-	*
Lead	6	309.500	114.627	-	*
			WALL SITE		
Strontium	3	860.666	113.160	1268.000	844.000
Magnesium	3	877.000	129.039	695.200	1126.000
Zinc	3	174.333	32.624	154.900	231.000
Copper	0	-	-	-	-
Vanadium	2	3.000	2.828	9.900	3.000
Lead	0	-	-	-	-
			UPPER SARATOWN-LOCALITY 1 (31Sk1)		
Strontium	1	410.000	0.0	1472.000	*
Magnesium	1	817.000	0.0	988.000	*
Zinc	1.	341.000	0.0	167.000	*
Copper	0	-	-	-	*
Vanadium	1	10.000	0.0	25.000	*
Lead	1	22.000	0.0	38.000	*
			UPPER SARATOWN-LOCALITY 2 (31Sk1a)		
Strontium	42	788.428	160.031	1061.000	927.000
Magnesium	42	1099.404	255.535	122.000	153.000
Zinc	42	376.000	214.651	181.000	334.000
Copper	1	1.000	0.0	-	-
Vanadium	42	33.857	12.241	42.000	54.000
Lead	42	77.167	26.234	71.000	71.000
			FREDRICKS SITE		
Strontium	7	820.143	60.859	1190.000	1138.000
Magnesium	7	513.428	118.564	1013.200	871.000
Zinc	7	287.428	113.468	159.500	185.000
Copper	0	-	-	-	-
Vanadium	3	13.000	3.464	-	-
Lead	2	60.000	65.053	-	-

TRACE ELEMENT LEVELS IN NORMAL BONE: Strontium, 114.0 ppm; Magnesium, 1100.0 ppm; Zinc, 181.0 ppm; and Copper, 19.63 ppm.

Figures for Mean, Standard Deviation, Deer and Raccoon are in parts per million (ppm).
n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.
A "*" indicates that the bone sample for that category at a site was not assayed.

TABLE 18.

Mean Trace Element Assays for Subadults in Four of the Study Samples.

ELEMENT	n=	MEAN	STANDARD DEVIATION	DEER	RACCOON
			WALL SITE		
Strontium	1	824.000	0.0	1268.000	844.000
Magnesium	1	518.000	0.0	695.200	1126.000
Zinc	1	179.000	0.0	154.900	231.000
Copper	0	-	-	-	-
Vanadium	0	-	-	9.900	3.000
Lead	0	-	-	-	-
			UPPER SARATOWN-LOCALITY 1 (31Sk1)		
Strontium	5	822.400	283.132	1472.000	*
Magnesium	5	856.400	142.280	988.000	*
Zinc	5	288.400	114.532	167.000	*
Copper	0	-	-	-	*
Vanadium	5	28.200	14.923	25.000	*
Lead	5	83.000	28.792	38.000	*
			UPPER SARATOWN-LOCALITY 2 (31Sk1a)		
Strontium	8	829.250	288.832	1061.000	927.000
Magnesium	8	1223.500	604.949	122.000	153.000
Zinc	8	427.375	217.219	181.000	334.000
Copper	1	63.000	0.0	-	-
Vanadium	8	39.250	15.989	42.000	54.000
Lead	8	75.250	44.252	71.000	71.000
			FREDRICKS SITE		
Strontium	4	865.500	287.963	1190.000	1138.000
Magnesium	4	653.000	150.685	1013.200	871.000
Zinc	4	1659.500	1830.596	159.500	185.000
Copper	4	50.500	56.003	-	-
Vanadium	3	6.333	4.509	-	-
Lead	2	38.000	48.083	-	-

Figures for the Mean, Standard Deviation, Deer and Raccoon are in parts per million (ppm).

n is the number of individuals with a detected level of a trace element.

A "-" means that the level of that trace element was too low to measure.

A "*" indicates that the bone sample for that category at a site was not assayed.

No subadult bone samples from the Shannon site could be taken for analysis.

At the two sites with burial samples large enough to provide valid insights into questions concerning diet and status, the Shannon site and Upper Saratown-Locality 2, a number of individuals with strontium levels higher than the deer assays are present. Of the five individuals (Burials 3, 23, 55, 56, and 82) from the prehistoric Shannon site with elevated strontium levels, all but one (Burial 55) are male. These elevated strontium levels may be due to these five individuals having had a diet rich in molluscs, the remains of which are quite common in the features at the Shannon site (Benthall 1969:144).

Moving forward in time, the late protohistoric/early contact period site at Upper Saratown-Locality 2 has two males (Burials 62 and 74) with levels of strontium higher than the deer assay for the site. Also, both burials possess cranial deformation, a rare cultural trait (n=5) within this sample. Taken together, these two attributes strongly suggest that these two males are from regions other than the Dan River area. Although the problem with molluscs noted above remains, the presence of cranial deformation for Burials 62 and 74 generally supports this proposition. The cranial deformation and elevated levels of strontium may indicate these males are from another region, that they are distinct individuals, or that diagenesis has skewed the results. There are no females with elevated strontium levels (in combination with other physiological traits) indicative of extra-Dan River origins.

Examining the mean magnesium levels within the five samples, only the prehistoric Shannon site skeletal series mean (1200.039 ppm) is greater than the 1,100 ppm average considered healthy. Of the other four samples, only the late protohistoric/early contact period Upper Saratown-Locality 2 mean (1099.404 ppm) is close to the healthy average for normal bone. The lowest magnesium comes from the middle contact period Fredricks site (513.428 ppm), the latest of the five samples.

The extremely low magnesium means at the Fredricks site could be attributed to one or more of a number of factors. If corn, a cereal crop rich in magnesium, was less important as a food resource at the Fredricks site, than at the slightly earlier Upper Saratown-Locality 2 site, the low means is not unexpected. Contributing to this possible decline in the importance of corn in the diet could be the expenditure of more time and energy by both men and women on the skin and fur trade, with men spending more time hunting and engaging in trade, and women spending more time processing skins and furs obtained for trade with the Europeans. One example of the extra energy the Indians of the interior were required to expend was in serving as pack-animals for the traders. Abraham Woods (Alvord and Bidgood 1912:210-266; Sainesbury 1889:604-607) noted in his account of the murder of James Arthur by an Occaneechi Indian in 1674 that an argument over an Indian porter letting his burden slip into the water as the trading party crossed the "Sarrah" River precipitated Arthur's demise. Also, it was not until 1716 that the Commissioners of South Carolina trade consented to buy horses as replacements for Indian porters, this following repeated complaints by the Indians at this ill-use (McDowell 1955:272).

Another major factor derived from European contact that may have contributed to lower magnesium levels at the Fredricks site is the possible availability of alcohol to the site's inhabitants. John Lawson (1967:18, 184, 211, 240) noted that the Indians would sell all of their goods to traders in exchange for rum. Once acquired, an Indian would not stop drinking until completely intoxicated. As noted earlier, excessive alcohol consumption can cause magnesium levels to drop (Gilbert 1977).

In all of the samples except for the Wall site, where the mean for adults is 174.333 ppm, zinc levels exceed the mean for healthy bone of 181 ppm. The highest zinc levels are present at Upper Saratown-Locality 2 (376 ppm), then Upper Saratown-Locality 1 (341 ppm), and finally, the Fredricks site (287 ppm). These higher levels of zinc in the three later sites may reflect an increase in animal protein in the diet that perhaps occurred with the increased emphasis on hunting skin- and fur-bearing animals for trade directly or indirectly with the Europeans. It should be noted that the small sample sizes for the Wall, Upper Saratown-Locality 1 and the Fredricks sites obviously affect the interpretation of the zinc and other trace element levels. Still, the high zinc assay for the Upper Saratown-Locality 2 sample indicates that the trend for the later skeletal samples to have higher zinc levels than earlier samples may be valid.

Considering the trace element copper, only two samples have levels high enough to be detected and both have levels below the 19.63 ppm average found in healthy bone. This may be the result of the antagonistic effect of the relatively high zinc levels noted for the skeletal series. The Shannon site had the highest average concentration of copper at 8.333 ppm.

Vanadium levels were examined in order to assess whether animal protein or protein from nuts was contributing to the levels of zinc noted for the study sample. Hatch and Geidal (1983) used vanadium in just this manner in their study of a number of Dallas phase sites in eastern Tennessee. Of the samples in this study the highest levels of vanadium are present at the Shannon site and Upper Saratown-Locality 2, with average assays of 28.627 ppm and 33.857 ppm respectively. The vanadium level at the Fredricks site is 13.000 ppm. The higher levels of vanadium at the Shannon site and Upper Saratown-Locality 2 could be due to a greater reliance on nut resources as food when compared to the other samples. Certainly, the greater quantity of nut resources present in the archaeobotanical remains from Upper Saratown-Locality 2 over that at either the Wall or Fredricks sites noted by Gremillion (1987) tentatively supports this supposition.

These conclusions derived from the vanadium levels assayed for the sites must be tempered by a major problem that is inherent in the interpretation of vanadium levels. This problem is the fact that vanadium is subject to diagenesis, or contamination from the soil (Lambert et al. 1979). This means that the vanadium that occurs naturally in the surrounding soil matrix can be absorbed by bone after it is buried. Given this factor, the conclusions reached above concerning the relationship of the vanadium levels to nut food resources in the study samples have to remain tentative.

By comparing the levels of trace elements that provide information relevant to diet--strontium, magnesium, zinc, copper, and vanadium--between samples, the following changes in diet can be proposed. The propositions that immediately follow are based on the data from the two largest samples, the late prehistoric period Shannon site (n=51 individuals) and the late protohistoric/early contact period Upper Saratown-Locality 2 site (n=42 individuals). In both cases a mixed diet of plant and animal food is present, as strontium levels are lower than those for the deer control samples at each respective site. Maize apparently continued to be an important cereal at both sites, although it may have declined somewhat in importance at the later Upper Saratown-Locality 2 site given the decline in magnesium levels from a 1200.039 ppm average at Shannon to 1099.404 ppm at Upper Saratown-Locality 2. Also, there appears to have been an increase in the meat protein in the diet of the Upper Saratown-Locality 2 sample, where the zinc level average of 376 ppm is almost double the 204.509 ppm average present in the earlier Shannon site sample. The lower copper levels present at Upper Saratown-Locality 2 reflect the higher level of zinc present at this site. The small increase in the level of vanadium at Upper Saratown-Locality 2 over that present at the Shannon site (33.857 ppm to 28.627 ppm) could indicate that nut resources were somewhat more important in the subsistence base of the former population. However, this small increase is not enough to account for the large difference in zinc levels between the two sites, indicating that animal protein was more readily available to the Upper Saratown-Locality 2 population as a whole. Meanwhile, the problem of vanadium diagnesis prohibits any substantial conclusions to be drawn from the assays of this trace element.

A general observation that concerns diet is that there is more variability in the levels of strontium and zinc for the Upper Saratown-Locality 2 sample than for the earlier Shannon sample. This variability can be seen in the standard deviations listed in Table 17 for these two trace elements. Likewise, the Fredricks site sample also exhibits more variation in the levels of zinc, but less in strontium, when compared to the Wall Site. This increase in variation of zinc levels may be indicative of differential access to meat resources by various segments of the Upper Saratown-Locality 2 and Fredricks samples. This question will be considered in greater detail later in this chapter and in Chapter VII.

The changes in diet through time for the study samples can be examined at a more basic level when trace element data from the Wall and Fredricks sites are compared. These two sites are located within 200 yards of each other on the Eno River. This enables one to assume that the naturally occurring levels of trace elements in the environment are the same for the two populations although they differ temporally. Any differences in the trace element levels found in the human bone samples from the two study skeletal series should, therefore, reflect dietary differences (or, regretfully, sampling bias).

The levels of strontium, magnesium, and zinc present in the adult bone samples from the Wall (n=3) and Fredricks (n=7) sites does indicate that the two resident populations possessed different diets. The higher levels of magnesium (877.000 ppm) and strontium (860.666 ppm) coupled with the lower levels of zinc (174.333 ppm) at the earlier Wall site are indicative of a diet that contained more and grains. The higher zinc level (287.428 ppm) and lower magnesium (513.428 ppm) and strontium (820.143 ppm) levels present at the later Fredricks site reflects a diet composed of more animal protein. The increased vanadium levels at the Fredricks (13.00 ppm) as compared with the Wall (3.00 ppm) tentatively support an increase in the amount of protein-rich nut resources, especially hickory nuts, utilized by the later Fredricks populations as hypothesized by Gremillion (1987:271).

Adult Skeletal Samples and Lead

The interpretation of the levels of lead present in bone can be a rewarding endeavor although there are a number of problems associated with the occurrence of this metal. In the soil, lead is firmly bound to organic molecules, and is freely mobile when soil ph is low, that is, in conditions that would not favor good bone preservation. Waldron (1981:395) argues that lead assays on archaeological burial samples can be assumed to reflect the exposure of that individual to lead during its life. However, the presence of certain conditions, such as lead-lined or lead coffins, as well as burial artifacts which contain lead, do provide environments whereby lead is absorbed in the bone after deposition in the archaeological context (Waldron 1981:396). Before bone lead concentrations can be used in a study confidently, a thorough survey of lead levels present in the soil and the surrounding environment must be made. Where overall lead levels are high, it is deemed unwise to give much credence to the results of bone lead assays. Modern levels of lead in bone would rarely be expected to exceed 60 ppm in people with no occupational exposure to lead (Waldron 1981:395-397).

Research (Carnes 1987; H. Wilson 1984) has shown that during contact Europeans introduced a number of lead-bearing artifacts such as lead shot, vermillion (a lead-based red body paint), and pewter utensils into the aboriginal cultures of the Carolinas, Virginia and the rest of eastern North America. It is expected that the presence and use of these artifacts would be reflected by the occurrence of higher lead levels in the late protohistoric/contact period sites. Also, there should be a higher level of lead in later contact period sites than in protohistoric and early contact period sites, as the number of lead-bearing artifacts present increases and as they come to be used in a manner more similar to European ways of use. For example, pewter utensils such as bowls or spoons may be used as decorative items by earlier populations, as at Upper Saratown-Locality 2 (cf. J. Wilson 1983:209-220), and as bowls or spoons at later contact period sites such as the Fredricks site as acculturation proceeds. The latter use of lead bearing artifacts would result in a greater likelihood of lead being absorbed by individuals in a population.

At the late prehistoric period Shannon site Burials 85, 89, 91, 92, and 97 had measurable levels of bone lead, with a range from 103 ppm to 378 ppm. The mean for these five burials is 309.5 ppm. The unusually high levels of lead for these five burials are probably the result of contamination while the bones were buried, or after the bones were excavated. In the late prehistoric/early protohistoric period sample from the Wall site no measurable traces of lead are present. Also, the deer bone control samples from both sites contain no measurable trace of lead.

At the protohistoric period Upper Saratown-Locality 1 site, the deer bone control sample contains 38 ppm of lead. All six burials from this site also have measurable levels of lead, with assays ranging from 22 ppm to 103 ppm. The assay for the one adult from the site is 22 ppm.

Measurable lead levels are also present in the human bone samples and the deer bone control sample at the late protohistoric/early contact period Upper Saratown-Locality 2 site. The deer bone sample measures 71 ppm. All the burials from the site have measurable lead. The lead level in adults averages 77.167 ppm, and ranges from 38 ppm to 137 ppm.

At the middle contact period Fredricks site, the deer bone control sample contained no measurable trace of lead. Also, only two subadults, Burials 1 and 2, and two adults, Burials 4 and 6, have detectable levels of lead. For the two adults, the mean lead level is 60.000 ppm, with one having 14 ppm and the other 106 ppm.

Before proceeding to the results of the lead analysis, it should be emphasized again that the loose molecular structure of lead and its ability to bond with organic molecules inhibits the interpretation of the lead assay data. However, because the deer bone control samples from the two Upper Saratown sites both contain lead, it is possible that the environment contains higher levels of lead than do the regions around the other study sites. Only a few artifacts containing lead, including a small quantity of lead shot and a few pewter spoons, have been recovered from the Upper Saratown sites (Jack Wilson 1987, Personal Communication). In general, however, there is definitely an increase in the amount of lead present in the contact period samples when compared to the earlier prehistoric/protohistoric samples. Also, the general increase in lead levels among the contact period samples is supported by the lead assays from the two Upper Saratown sites. However, this general trend of increase through time is apparently contradicted by the results from the middle contact period Fredricks sample, where a decrease from the lead levels noted at the early contact Upper Saratown-Locality 2 site occurs. Obviously, consideration of the results of the lead assays is complicated by sample size problems and the nature of lead itself. Until these problems can be rectified, only the general argument that lead levels increased in the contact period over those present in the prehistoric/protohistoric period can be supported.

Analysis of Trace Elements by Age Categories

In addition to general questions about change in diet among the study samples through time, a number of questions can be investigated that rely on intersite differences in the occurrence of trace elements. One such question is whether certain age groups within a population have differential access to selected food resources, and how this pattern changes over time, if at all. Tables 19 through 23 present the trace element data for each group by site.

Unfortunately, no distinct pattern of decrease or increase in any trace element with age group can be discerned for any of the

TABLE 19.

Mean Trace Element and Lead Assays for the Shannon Site by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
16-20	2	369.500 (9.192)	1170.500 (99.702)	133.500 (72.831)	4.500 (6.364)	23.000 (32.527)	- (-)
21-25	4	367.500 (39.433)	1193.500 (205.687)	182.500 (24.228)	3.000 (6.000)	14.250 (28.500)	- (-)
26-30	6	344.667 (59.882)	1335.000 (606.839)	200.000 (46.600)	- (-)	4.333 (9.223)	- (-)
31-35	5	359.200 (47.183)	1086.400 (123.395)	139.000 (51.546)	- (-)	- (-)	- (-)
36-40	8	360.500 (43.710)	1155.875 (113.908)	260.750 (84.990)	22.500 (23.839)	74.875 (70.337)	83.875 (160.736)
41-45	3	357.667 (32.064)	1139.000 (81.000)	243.667 (5.773)	- (-)	- (-)	- (-)
46+	22	362.636 (78.070)	1214.727 (223.350)	203.864 (70.621)	8.045 (13.723)	26.227 (43.194)	36.727 (104.823)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

No information is included for groups under the age of 16 because human bone samples could not be taken from the Shannon site subadult burials.

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 20.

Mean Trace Element and Lead Assays for the Wall Site by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
3-5	1	824.000 (0.0)	518.000 (0.0)	179.000 (0.0)	- (-)	- (-)	- (-)
21-25	1	982.000 0.0	952.000 (0.0)	167.000 (0.0)	- (-)	1.000 (0.0)	- (-)
46+	2	800.000 (59.397)	839.500 (157.685)	178.000 (45.254)	- (-)	5.000 (-)	- (-)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

The Vanadium assay for the 46+ year age group is based on one individual.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 21.

Mean Trace Element and Lead Assays for Upper Saratown-Locality 1 by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
3-5	1	1228.000 (0.0)	1033.000 (0.0)	191.000 (0.0)	- (-)	19.000 (0.0)	38.000 (0.0)
6-10	3	789.000 (172.522)	866.000 (60.506)	348.667 (112.100)	- (-)	37.333 (10.599)	91.667 (18.770)
11-15	1	517.000 (0.0)	651.000 (0.0)	205.000 (0.0)	- (-)	10.000 (0.0)	102.000 (0.0)
26-30	1	410.000 (0.0)	817.000 (0.0)	347.000 (0.0)	- (-)	10.000 (0.0)	22.000 (0.0)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 22.

Mean Trace Element and Lead Assays for Upper Saratown-Locality 2
by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
3-5	2	812.500	985.500	392.500	-	57.000	36.500
		(282.136)	(11.016)	(127.986)	(-)	(14.142)	(6.364)
6-10	5	896.600	1404.800	480.800	63.000	37.800	96.400
		(311.915)	(722.228)	(254.091)	(0.0)	(6.140)	(43.673)
11-15	1	526.000	793.000	230.000	-	11.000	47.000
		(0.0)	(0.0)	(0.0)	(-)	(0.0)	(0.0)
16-20	5	813.200	1020.800	254.800	-	31.400	74.000
		(125.360)	(180.107)	(52.232)	(-)	(18.284)	(23.054)
26-30	11	784.000	1001.909	331.545	-	31.818	81.273
		(161.629)	(139.918)	(84.180)	(-)	(8.010)	(10.030)
31-35	5	884.400	1053.400	313.800	-	39.400	73.800
		(144.232)	(218.810)	(75.337)	(-)	(19.982)	(40.127)
36-40	7	684.571	1081.428	272.000	-	30.857	69.857
		(229.636)	(76.848)	(53.529)	(-)	(10.431)	(28.252)
41-45	4	765.500	1222.750	537.000	-	34.750	64.250
		(142.498)	(244.855)	(292.466)	(-)	(12.764)	(9.251)
46+	9	829.444	1257.667	560.889	1.000	37.222	84.444
		(118.418)	(433.161)	(331.464)	(0.0)	(11.144)	(31.950)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

The Copper assays for the 6-10 and 46+ year age groups are based on one individual each.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 23.

Mean Trace Element and Lead Assays for the Fredricks Site by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
3-5	3	792.667 (304.231)	596.333 (121.624)	2142.333 (1903.677)	66.667 (56.003)	6.500 (6.363)	72.000 (0.0)
6-10	1	1084.000 (0.0)	823.000 (0.0)	209.000 (0.0)	2.000 (0.0)	6.000 (0.0)	4.000 (0.0)
11-15	0	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
16-20	1	848.000 (0.0)	400.000 (0.0)	229.000 (0.0)	- (-)	- (-)	- (-)
21-25	2	786.500 (19.092)	465.500 (41.719)	328.000 (209.304)	- (-)	15.000 (0.0)	14.000 (0.0)
26-30	1	889.000 (0.0)	498.000 (0.0)	216.000 (0.0)	- (-)	15.000 (0.0)	106.000 (0.0)
30-35	0	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
36-40	2	765.000 (38.184)	501.000 (48.083)	356.000 (62.225)	- (-)	- (-)	- (-)
46+	1	901.00 (0.0)	763.000 (0.0)	196.000 (0.0)	- (-)	9.000 (0.0)	- (-)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

The Vanadium assay for the 3-5 year age group is based on two individuals and for the 6-10 year age group on one individual.

The Lead assays for the 3-5 year age group and the 6-10 age group are based on one individual.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

study samples. However, there are some special circumstances that can be discussed.

At the late prehistoric period Shannon site, the age categories begin at 16 years at death (Table 19), because bone samples for trace element analysis could not be taken for the subadults. Strontium levels appear very similar across each age category with little variation for each category. Magnesium levels also are relatively uniform, except for the age 26-30 category. For this age group, magnesium levels are somewhat higher than for the others. The standard deviation of 606.839 ppm for this age category indicates that there is considerable variation within the group. This age group also has the lowest strontium levels for individuals from the Shannon site, and zinc levels show a general increase over that of the previous age group. The following age group, 31-35 years, show a decrease in zinc before the 36-40 age group has an increase in the zinc assay. Although no significant patterns of possible diet change by age group are indicated for the Shannon site, the differing levels of strontium, magnesium, and zinc for the 26-30 year age group may indicate that these individuals had a slightly different diet from that of the other age segments in the sample.

The trace element levels at the late protohistoric/early contact period Upper Saratown-Locality 2 site, shown in Table 22, indicate a greater variability in the levels of strontium and zinc when compared with the Shannon site. At Upper Saratown-Locality 2, strontium levels are lowest for age 11-15 years (526 ppm) and age 36-40 (684.571 ppm). Zinc levels are highest for ages 3-10 years

(392.500 ppm for ages 3-5 years and 480.800 ppm for ages 6-10 years) and ages 41+ (537.000 ppm for age 41-45 and 560.889 ppm for age 46+). Magnesium (1404.800 ppm) and strontium (896.006 ppm) levels are also highest for the 6-10 year age group. Comparison of the strontium, magnesium, and zinc levels of the 3-5 and 6-10 year age groups of Upper Saratown-Locality 2 with that for similar age groups from Upper Saratown-Locality 1 (Table 21) and the Fredricks site (Table 23), indicates that the diet of subadults appear to change around age 6 years. Higher levels of strontium and magnesium are found in this age group at the Fredricks site than in the 3-5 or 11-15 age groups, while zinc is less than in either of these two age groups. The Upper Saratown-Locality 1 levels of strontium and magnesium decrease in the 6-10 year age group from the 3-5 year age group, but are higher than those of the 11-15 year age group. In contrast, zinc is higher in the 6-10 year age group than in either the 3-5 or 11-15 year age group. The 6-10 year age group at Upper Saratown-Locality 2 differs from that at both of these two sites with the levels of strontium, magnesium, and zinc being higher in that age category than in either the 3-5 or 11-15 year age group. Although the pattern differs in details, it does appear that there is a change in diet among subadults for these three samples. It is suspected that these results indicate that weaning occurred between 3 and 5 years in the protohistoric period Upper Saratown-Locality 1 population, and between the age of 6 and 10 years in the late protohistoric/early contact period Upper Saratown-Locality 2 and the middle contact Fredricks site. The diet of the sample segments to the age of weaning at these three sites was probably nursing supplemented by plant and meat food resources.

Among the adults at Upper Saratown-Locality 2, the highest levels of zinc occur in the age groups 41-45 (537.000 ppm) and 46+ (560.889 ppm). Both of these age groups also exhibit more variation in zinc levels than do the other age groups (standard deviations of 292.466 ppm and 331.464 ppm respectively), and both have higher magnesium levels as well. Strontium levels for these two age groups were close to the mean of 788.428 ppm for the adult sample as a whole at Upper Saratown-Locality 2. The high zinc levels present in these two age groups may reflect a diet high in meat protein for some of the older individuals, which may in turn indicate differential status categories in the sample. A more detailed consideration of diet and status can be found in Chapter VII.

Due to the small sizes of the samples from the Wall site (Table 20), Upper Saratown-Locality 1 (Table 21), and the Fredricks site (Table 23), little can be said about the relationship of trace element assays and age groups.

In summary, no general patterns of diet change by age category through time can be noted for the study population. However, several observations about diet could be discerned. There is more variability in the levels of the trace elements strontium and zinc in the contact period sites than in the prehistoric/protohistoric period sites. This may reflect differential access to plant foods and animal protein by different segments of the samples. Certainly, the individuals age 41 years and older at Upper Saratown-Locality 2 may have had preferential access to animal protein given the very high zinc levels of certain of these individuals relative to the other age segments of the adult sample. A further consideration of the relationship of possible differential diets to status will be addressed in Chapter VII.

In addition to these observations, there appears to have been a shift in the age at which subadults were weaned. Individuals may have been weaned between the ages of 3 and 5 years in the protohistoric period, and between the ages of 6 and 10 years in the late protohistoric/early contact and middle contact periods. More trace element data concerning larger samples for the prehistoric and contact periods are needed to more completely examine this generalization, as well as others concerning the relationship of diet and age.

Sex and the Trace Element Analysis

The next logical step in investigating the levels of the various trace elements assayed for the skeletal series is to compare the results by sex. For this study only the samples from the late prehistoric period Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2 site are used (Table 24), because the other population samples do not have representative numbers of the two sexes. The results of both intra-site and inter-site comparisons are presented in the following discussion.

At the Shannon site only slight differences can be seen in the trace element levels between males and females. Males have slightly higher levels of strontium, magnesium, and zinc, while females have slightly higher levels of copper and vanadium. Variation in the

TABLE 24.

Mean Trace Element and Lead Assays for the Shannon Site and Upper Saratown-Locality 2 by Sex.

SHANNON SITE

SEX	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
Males	27	373.629	1221.629	208.296	7.407	24.407	25.481
		(68.645)	(336.578)	(74.063)	(15.143)	(44.684)	(80.041)
Females	24	346.750	1175.750	200.250	9.375	33.375	48.708
		(45.209)	(136.566)	(67.560)	(16.534)	(54.768)	(131.777)

UPPER SARATOWN-LOCALITY 2

SEX	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
Males	23	787.739	1082.000	346.956	1.000	34.913	73.130
		(172.363)	(181.595)	(169.348)	(0.0)	(13.048)	(25.809)
Females	18	795.166	1127.000	422.777	-	32.833	80.944
		(150.384)	(336.222)	(262.240)	(-)	(11.678)	(26.914)

Figures for the trace elements and lead are in parts per million (ppm).

After each Sex, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

The mean assay for Copper in the Male Sex Category at Upper Saratown-Locality 2 is based on one individual.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

level of each trace element is similar for both sexes, with the exception of magnesium. Males have more variation in magnesium levels, with a standard deviation of 336.578 ppm, than do females, who have a standard deviation of 136.566 ppm. This may indicate that males had greater variation in the quantity of cereal foods that comprised their diet than did females.

At Upper Saratown-Locality 2, females have higher average levels of strontium, magnesium, and zinc than do males. Both sexes have similar variation in the strontium levels (the male standard deviation is 172.363 ppm, and the female standard deviation is 150.384 ppm). However, females show greater variability in the mean levels of magnesium (336.222 ppm) and zinc (262.240 ppm) than do males (181.595 ppm and 169.348 ppm, respectively). For vanadium, the levels are similar for both sexes (males=34.913 ppm and females=32.833 ppm), with males having only slightly higher mean. Also, the standard deviations are similar for the sexes (13.048 ppm for males and 11.678 ppm for females), with the female figure being slightly smaller. These results appear to indicate that overall females possessed slightly different diets from the males at Upper Saratown, and perhaps even had a better overall diet than did males. However, the standard deviations for the magnesium, zinc and vanadium assays apparently indicate that different segments of the female population enjoyed differential access to cereal and protein rich (nuts and animal protein) food resources.

Comparing the trace element assays for the two sites the following statements can be made concerning dietary changes that occurred after European contact. During the prehistoric period, as represented by the Shannon site population, males and females probably had similar access to plant foods and animal protein. More variability in access to cereal foods within the male segment of the population is indicated, however. After contact, as represented by the data from Upper Saratown-Locality 2, males and females continue to have a similar access to plant food resources, particularly cereal foods, but animal protein becomes more accessible to females as a whole. During the late protohistoric/contact period, variability within each sex in their access to food resources is quite high, but this is markedly so for magnesium and zinc (representing cereal and animal protein resources) among females. This increased variability could reflect status differences, and will be given more attention in Chapter VII.

Trace Element Levels by Age and Sex Categories

This final consideration of trace element levels by identifiable age and sex categories utilizes only the two samples that have semblances of being representative for the adult sexes--the late prehistoric period Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2. The purpose of this analysis is to examine whether diet changed with age in either sex, and whether different age categories exhibit significantly different trace element levels that perhaps suggest different diets by sex. In order to test the significance of trace element levels by age and sex, comparison of mean F tests were run on strontium, magnesium and zinc assays using the SAS General Linear Model (GLM) Procedure (SAS Institute 1985:434-506). This SAS procedure is used in unbalanced situations where there are unequal numbers of observations for the different combinations of variables being analyzed. For example, GLM would be used in a 2x2 factorial model where three of the four cells have two observations each, but the fourth cell has only one observation (SAS Institute 1985:437). In this study, there are some age groups with no trace element readings, and there are a different number of readings for most age groups. This situation precludes the use of ANOVA for the analysis of variance, and the GLM procedure is used instead (SAS Institute 1985:113-126, 437-438).

Table 25 summarizes the strontium, magnesium, zinc, copper vanadium and lead levels by age for Shannon site males, and Table 26 does likewise for the Shannon site females. Among males, strontium levels appear to increase with age, with the lowest levels occurring among the 21-25 year age group (333.000 ppm) and the highest in the 46+ year age group (383.461 ppm). The level of strontium among females fluctuates with the lowest levels being in the 26-30 year age category (329.500 ppm) and the highest in the 21-25 year age category (379.000 ppm). These results appear to indicate that there is a slight increase in plant foods in the diet of males as they grow older. As females grow older, the suggestion is that plant foods decrease somewhat in the diet after the age of 25 years. The F test results, given in Table 27, indicate however, that there is no significant difference in the strontium levels along the lines of age and sex at the Shannon site.

Examining the magnesium levels for the Shannon site population, the assays between the two sexes by age are relatively similar.

TABLE 25.

Mean Trace Element and Lead Assays for the Shannon Site Males by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
21-25	1	333.000 (0.0)	1017.000 (0.0)	147.000 (0.0)	- (-)	- (-)	- (-)
26-30	4	352.250 (74.598)	1491.750 (717.240)	194.750 (50.208)	- (-)	0.750 (1.500)	- (-)
31-35	3	367.000 (53.777)	1064.667 (157.988)	113.000 (38.509)	- (-)	- (-)	- (-)
36-40	4	377.250 (56.079)	1172.75 (109.015)	244.000 (77.335)	23.500 (24.906)	72.500 (65.312)	64.500 (129.000)
41-45	2	375.500 (12.021)	1139.000 (114.551)	242.000 (7.071)	- (-)	- (-)	- (-)
46+	13	383.461 (84.420)	1218.231 (269.630)	223.000 (77.557)	8.154 (14.462)	28.154 (44.594)	33.077 (92.788)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 26.

Mean Trace Element and Lead Assays for the Shannon Site Females by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
16-20	2	369.500	1170.500	133.500	4.500	23.000	-
		(9.190)	(99.702)	(72.832)	(6.364)	(32.527)	(-)
21-25	3	379.000	1252.333	194.333	4.000	19.000	-
		(39.230)	(206.621)	(6.351)	(6.928)	(32.909)	(-)
26-30	2	329.500	1021.500	210.500	-	11.500	-
		(23.334)	(55.861)	(54.447)	(-)	(16.263)	(-)
31-35	2	347.500	1119.000	178.000	-	-	-
		(51.619)	(86.267)	(50.912)	(-)	(-)	(-)
36-40	4	343.750	1139.000	277.500	21.500	77.250	103.250
		(23.768)	(132.783)	(100.626)	(26.514)	(85.223)	(206.500)
41-45	1	322.000	1139.000	247.000	-	-	-
		(0.0)	(0.0)	(0.0)	(-)	(-)	(-)
46+	9	332.555	1209.667	176.222	7.889	23.444	42.000
		(59.873)	(147.816)	(51.132)	(13.439)	(43.586)	(126.000)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 27.

Comparison of Means F Test Results for Three Trace Elements by Sex and Age Group at the Shannon Site and Upper Saratown-Locality 2.

SHANNON SITE

TRACE ELEMENT	DF	F VALUE	PR>F
Strontium	11	0.48	0.9054
Magnesium	11	0.63	0.7894
Zinc	11	1.54	0.1602

UPPER SARATOWN-LOCALITY 2

TRACE ELEMENT	DF	F VALUE	PR>F
Strontium	9	0.68	0.7184
Magnesium	9	0.95	0.5030
Zinc	9	2.15	0.0612*

* Significant at the 0.10 level.

These comparison of means F Test results were obtained using the SAS General Linear Models (GLM) Procedure (SAS Institute, Inc. 1986:433-506).

There does appear to be more variability in the levels of magnesium for males when compared with females. However, the F test results again show that there is no significant difference between any age - sex category for males and females in the magnesium levels.

For zinc, the levels for males are overall lower than for females except in the 46+ year age group. The lowest zinc level for males is in the 31-35 year age category (113.000 ppm) and the highest is in the 36-40 year group (244.000 ppm). Females exhibit the lowest zinc levels in the 16-20 (133.500 ppm) age group and the highest in the 36-40 year age group (277.500 ppm). Again, the F tests indicate that there are no significant differences in the levels of zinc between the two sexes in any age category.

Considering the information from Upper Saratown-Locality 2, more variability is shown in the levels of the three major trace elements by age and sex (Tables 28 and 29). For strontium, the levels are different between males and females. Males have the lowest strontium levels in the 16-20 year age category (687.000 ppm) and the 26-30 year age category (772.000 ppm), with no individuals being present for the 21-25 year age group. The highest male strontium levels are seen in the 31-35 year age group (906.667 ppm). For females, the lowest strontium levels are from age 36-40 years (579.500 ppm), and the highest at 16-20 years (844.750 ppm) and 26-30 years (805.000 ppm), again with no female individuals aged 21-25 years. There also appears to be more fluctuation in the strontium levels by age category among males than among females. However, the F test calculations indicate that there are no significant differences in the strontium levels by age and sex.

TABLE 28.

Mean Trace Element and Lead Assays for the Upper Saratown-Locality 2 Males by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
16-20	1	687.000 (0.0)	1262.000 (0.0)	203.000 (0.0)	- (-)	56.000 (0.0)	- (-)
26-30	7	772.000 (178.801)	980.857 (140.393)	320.360 (95.360)	- (-)	29.857 (9.547)	82.714 (22.801)
31-35	3	906.667 (107.342)	1089.000 (299.511)	292.667 (68.603)	- (-)	43.000 (27.221)	70.000 (38.000)
36-40	5	726.600 (254.814)	1082.200 (92.221)	273.000 (62.789)	- (-)	32.200 (9.444)	69.800 (32.935)
41-45	3	748.000 (169.177)	1103.000 (62.378)	400.667 (129.554)	- (-)	29.667 (9.452)	66.333 (10.116)
46+	4	857.500 (90.497)	1192.750 (277.771)	522.250 (328.743)	1.000 (0.0)	39.750 (7.041)	71.250 (31.889)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

The Mean Assay for Copper in the 46+ year age group is based on one individual.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

TABLE 29.

Mean Trace Element and Lead Assays for the Upper Saratown-Locality 2 Females by Age Group.

AGE GROUP	n=	STRONTIUM	MAGNESIUM	ZINC	COPPER	VANADIUM	LEAD
16-20	4	844.750	960.500	267.750	-	25.250	77.500
		(119.656)	(137.880)	(50.195)	(-)	(13.913)	(25.040)
26-30	4	805.000	1038.750	351.000	-	35.250	78.750
		(149.052)	(151.634)	(68.122)	(-)	(2.530)	(16.860)
31-35	2	851.000	1000.000	345.500	-	34.000	79.500
		(237.588)	(50.912)	(99.702)	(-)	(4.243)	(58.690)
36-40	2	579.500	1079.500	269.500	-	27.500	70.000
		(160.513)	(37.477)	(37.477)	(-)	(16.263)	(21.213)
41-45	1	818.000	1582.000	946.000	-	50.000	50.000
		(0.0)	(0.0)	(0.0)	(-)	(0.0)	(0.0)
46+	5	807.000	1309.600	591.800	-	35.200	95.000
		(143.131)	(556.600)	(368.776)	(-)	(14.131)	(31.072)

Age Group categories are in years.

Figures for the trace elements and lead are in parts per million (ppm).

After each Age Group category, the first line contains the Mean for that trace element or lead, and the Standard Deviation for that trace element or lead is enclosed in parentheses immediately underneath the Mean.

n is the number of individuals with a detected level of a trace element.
A "-" means that the level of that trace element was too low to measure.

The magnesium assays show even more variability than does strontium. Females aged 16-20 years at death have the lowest magnesium levels (960.500 ppm), while females aged 41-45 years have the highest (1582.000 ppm) and females aged 46+ years have the second highest level (1309.60 ppm). This suggests that for females magnesium levels increase with age, indicating that cereal food resources increase in a female's diet with age. Conversely, males have the highest magnesium levels in the 16-20 year age category (1262.000 ppm) and the lowest in the 26-30 year age group (980.857 ppm). The male magnesium levels then increase slightly and remain relatively stable in the age categories older than 30 years. The F test results again show that the differences in magnesium levels by age category for the two sexes are not significant.

In contrast to the other two trace elements, zinc levels for males and females show a similar pattern. Males have the lowest zinc level in the 16-20 year age group (203.000), with fluctuating levels from age 26 to 40 years, and then increasing levels after age 41. The highest male zinc level is seen in the 46+ year age category. Females exhibit a similar pattern, with the lowest zinc level occurring at age 16-20 years. Again, the zinc assays fluctuate between the ages of 26 and 40, and the highest levels are in the 41-45 year and 46+ age categories. As a whole, variability within each age group for both sexes is similar. The F test shows that there is a significant difference between the two sexes by age group in the zinc levels. This difference is probably due in part to the big difference between the sexes in the zinc levels for the 41-45 year age group, where the male mean (n=3) is 400.667 ppm and the female mean (n=1) is 946.000 ppm. Still, excluding this age group from the analysis, the female mean zinc level is higher than the male for the age groups between the ages of 16 and 35, and for the 41+ age group. The female mean zinc level is only slightly lower than the male for the 36-40 age group. The implication is that females at Upper Saratown-Locality 2 in general have better access to animal protein than do males, especially for females of childbearing age (16-35 years) and old females aged greater than 40 years. Once again, however, these statements are tempered by the fact that the sample size is small for the Upper Saratown-Locality 2 adult males and females, and sample bias may be influencing the interpretations.

Still, a number of general proposals can be set forth concerning the changes in diet between males and females from the prehistoric to the late protohistoric/contact period. In the late protohistoric/contact period, both males and females tend to have higher levels of zinc as documented by the Upper Saratown-Locality 2 sample when compared with the late prehistoric period Shannon site. However, females from both sites at most age groups appear to have higher levels of zinc than do males. Magnesium levels appear to remain relatively similar for the sexes by age category over time. Strontium levels are more constant for males and females by age category at the Shannon site than at Upper Saratown-Locality 2, with the latter exhibiting greater variability. However, the only significant change appears to be that males and females at Upper Saratown-Locality 2 have higher overall levels of zinc than do the Shannon site males and females. This overall increase probably reflects the increased availability of animal protein during the late protohistoric/contact period due in part to the posited increased hunting tied to the skin and fur trade with Europeans.

Conclusions

Levels of trace element were compared within and between the five skeletal series for the adult and subadult segments of each sample, age categories, sex, and age and sex categories. In general, there is an increase in levels of zinc found in the populations of the late protohistoric/contact period over those of the late prehistoric/early protohistoric periods. This increase is considered to be in part due to the increased availability of animal protein during the contact period as a result of increased emphasis on hunting animals for the European fur and skin trade.

The late protohistoric/contact period samples also appear to possess more variability in the levels of trace element present than do the earlier samples. This may be associated with changes in the access of certain segments of the sample to certain food resources, which may in turn reflect changes in status among the samples over time. This question will be given greater consideration in Chapter VII. For now, comparison of the sexes does appear to indicate that females may have had greater accessibility to animal protein during the late protohistoric/contact period than earlier. This is strongly suggested by the zinc analysis for the Upper Saratown-Locality 2 sample. This and the other general patterns discussed in this chapter do serve as a guide for future research, because it is admitted that more extensive research with better population samples is needed to properly interpret the results of the trace element analyses of the aboriginal populations of the Carolina and Virginia Piedmont.

CHAPTER VI

PATHOLOGIES

In Chapter IV the demographic analyses conducted on the prehistoric, protohistoric and contact period burial samples appeared to indicate that European contact created a more stressful environment for the aboriginal populations. This is illustrated demographically by higher male mortality and lower life expectancies at the contact period sites. By examining the skeletal remains for pathological conditions, information can be gathered about the susceptibility of a population to stress and disease. Data concerning changes in diet can also be collected. By comparing the data on pathologies from several sites the question of stress-related and disease-related changes in behavior can be addressed.

Most diseases, including those of Old World origin, do not affect the skeletal structure of the body, and specific diseases can not always be associated with a specific pathology (Buikstra and Cook 1980:439-444). Therefore, as is usually the case when studying archaeological remains, there are only a few diseases of the many that existed that can be examined directly using skeletal samples. This study will begin with a general survey that relies heavily on ethnographic information concerning the endemic and European-derived diseases that possibly afflicted the native populations in the Piedmont during the protohistoric and contact periods.

Epidemic Diseases in the Southeast, 1520-1710

Diseases introduced from Europe caused numerous epidemics of lethal pathogens in the New World between A.D. 1520 and 1710 (Dobyns 1983:8). The most destructive of these Old World pathogens for native Americans was smallpox. With European contact smallpox spread rapidly throughout the southeast affecting aboriginal populations that possessed no immunity to the disease (Dobyns 1983:11). The earliest recorded smallpox epidemic lasted from 1520 until 1524 and was more deadly than any of the later outbreaks. Between 1665 and 1667, a second major epidemic struck the southeast from Florida to Virginia. Another smallpox epidemic, dating to 1696, decimated the interior Southeastern and Gulf Coast chiefdoms before it ended in 1699 (Dobyns 1983:15).

John Lawson (1967) makes note of the smallpox epidemic of 1696-1699 in his record of his travels through the Carolinas in the winter of 1701. Lawson (1967:231-232) recalls that "The Small-Pox has been fatal to them; they do not often escape, when they are seiz'd with that Distemper, which is a contary Fever to what they ever knew." Lawson (1967:232) went on to speculate that smallpox was new to the Native Americans as "it destroy'd whole Towns, without leaving one Indian alive."

Another known European disease that may have been fatal to Indian groups of the Carolinas and Virgina is influenza. Dobyns (1983:18-19) suggests that the effects of influenza on Native American populations are probably underestimated because outbreaks of this disease are not reported in any of the historic records, given that influenza symptoms are not easily recognized. After smallpox, influenza may have been the second most lethal disease respectively among aboriginal populations. Lawson (1967:17) does not identify influenza as being present among the Indians with whom he had contact, but he does describe several medicines made of roots, herbs, and/or snake skins that the Indians used to treat generic "fevers". A high fever is one symptom commonly associated with both influenza and smallpox.

Another disease that has a high fever as a symptom is measles. However, there is no historical evidence to support the presence of measles in the Carolinas and Virginia between 1520 and 1710.

Syphilis is a disease that can definitely be identified as affecting Indian populations of the southeast. The major question that surrounds this disease is whether syphilis originated in the Old World or the New World, with a number of theories based on biological, environmental, and paleopathological evidence having been proposed to explain its origin and presence in the New World (cf. Steinbock 1976:87-97). Whatever its origin, syphilis is considered to have been one of the major diseases responsible for population decline among Native Americans after 1520 (Dobyns 1983:35). Lawson (1967:25, 231) in his journey through the Carolinas notes a number of individuals who were afflicted with the "Pox" (syphilis) and had lost their noses. He also records in his journal that yaws, as well as syphilis (both of which are classed together as treponemal infections), is present among the aboriginal populations and that the two diseases exhibit similar symptoms.

> Yawes...is...attended with nocturnal Pains in the Limbs, and commonly makes such a Progress, as to vent part of the Matter by Botches, and several Ulcers in the Body and other Parts; oftentimes

> Death ensuing. I have known mercurial Unguents and Remedies work a Cure, following the same Methods as in the Pox. (Lawson 1967:231).

Using only skeletal remains it is difficult to differentiate yaws from syphilis postively because the osteological indicators of the two diseases are similar. These indicators include cranial lesions, nasal destruction, and lesions on, and swelling of, the lower limbs (Steinbock 1976:102-105).

In summary, four diseases--smallpox, measles, influenza, and treponemal infections (yaws and syphilis)--may have affected the Indian groups of the Carolina and Virginia Piedmont during the protohistoric and contact periods. The effects of these diseases on the skeletal remains varies from almost none (influenza) to extreme (yaws and syphilis), which can create problems when attempting to determine if one of these diseases is present in a skeletal series. Because influenza and measles do not affect bone, the two diseases cannot be identified positively using only skeletal remains. Treponemal infections, however, have been observed in a number of archaeological skeletal populations by the presence of lesions on cranial and postcranial remains (cf. Bullen 1972; Steinbock 1976:86-106).

Smallpox (variola osteomyelitis) does deform the bone, usually of the upper extremities, especially in the area of the elbow, but any joint in the skeleton can be affected (Ortner and Putshar 1981:227-228). At the Grimsby site in Ontario, Canada, deformities of the elbow joint in a number of burials were identified as having been caused by variola osteomyelitis (Jackes 1983). This Neutral

Indian cemetery dates to about 1650, and provides the first archaeological evidence of smallpox in the New World.

In this study, none of the four samples considered here possesses lesions caused by treponemal infections, and no protohistoric or contact period population shows evidence of having been affected by smallpox. Given this negative evidence, the presence of these three diseases (yaws, syphilis, and smallpox) as additional biological stresses during European contact can be inferred only from ethnohistorical descriptions of their occurrance, and not from any evidence derived from the skeletal remains available for analysis in this study.

Study of the Pathologies within the Sample Populations

The ultimate goal of this study of the skeletal pathologies observed is the comparison by burial sample of the frequency of the differing types of pathologies that are present. Six major categories of skeletal pathologies are used in this analysis: 1) traumatic or violent pathologies; 2) degenerative pathologies; 3) tumors; 4) general stress-related pathologies; 5) pathologies associated with dietary stress; and 6) general infectious pathologies. Table 30 summarizes the various pathologies present by percentage of occurrence in the sample and by percentage of the total pathologies present.

Traumatic/Violent Pathologies

Pathologies that are generally considered to be evidence of trauma or violence can be placed into four broad categories--bone fractures, bone damage due to possible blows to the head, cuts, and

TABLE 30.

Summary of the Disease Categories by Percentage of Afflicted Individuals and by Percentage of Total Pathologies in the Four Study Samples.

	Shannon Site		Wall Site		Upper Saratown-Locality 2		Fredricks Site	
DISEASE	%pop.	%path.	%pop.	%path.	%pop.	%path.	%pop.	%path
Traumatic	12.3	3.6	12.5	3.8	3.3	1.4	15.4	5.7
Degenerative	48.4	14.1	25.0	11.4	22.2	9.7	15.4	3.8
Tumors	20.6	9.3	0.0	0.0	7.7	3.9	15.4	3.8
Schmorl's Node	5.1	1.5	25.0	7.6	3.3	1.4	30.8	7.5
Enamel Hypoplasia	56.7	16.5	75.0	23.0	62.2	27.0	85.0	20.7
Cribra Orbitalia	12.3	3.6	25.0	7.6	5.5	2.4	40.0	7.5
Spongy Hyperostosis	0.0	0.0	12.5	3.8	1.1	0.48	7.7	1.9
Periodontal Disease	62.9	18.3	37.5	11.5	38.9	16.9	46.0	11.3
Caries	73.2	21.2	62.5	19.2	71.1	31.0	85.0	20.7
Osteitis	41.2	12.0	37.5	11.5	13.3	5.8	69.0	17.0
	n=97	100	n=8	100	n=90	100	n=13	100

n is the number of analyzed individuals for each sample.

piercing wounds. The basic hypothesis concerning such pathologies is that there would be an increase in traumatic/violent injuries from the late prehistoric into the contact period, given the increased warfare documented for the contact period (cf. Lawson 1967:49-50, 233) and the probable increased occurrence of accidents tied to the growing importance of hunting animals to procure skins and furs for trade with the Euro-Americans.

At the prehistoric Shannon site, traumatic/violent pathologies affected 12.3% (n=12) of the sample and accounted for 3.6% of the total pathologies present. Of these traumatic/violent pathologies, 53.7% were fractures of limb bones (15.3% lower limbs and 38.4% upper limbs), 23.1% were identified as resulting from blows to the head, and 23.1% were puncture wounds. Of the males, 22.8% exhibit traumatic/violent injuries, while only 13.8% of the females have such injuries.

For females at the Shannon site, 60% of the total traumatic violent pathologies are breaks, 20% consist of possible head blows, and 20% of piercing wounds. Among males, 50% of the total traumatic/violent pathologies are breaks, 25% are possible head blows, and 25% represent piercing or cut wounds. The male piercing wound category contains one individual with a small chipped stone projectile point imbedded in the 6th rib.

The limb bones most commonly broken are the radius, then the humerus, then fibula, and last the ulna. At the Shannon site, the overall fracture rate for the major long bones is 1.19% (3 out of 252 possible bone occurrences) for females and 1.63% (4 of 245 bone occurrences) for males.

At the late prehistoric/protohistoric Wall site, only one traumatic/violent pathology is present in the sample, a healed fracture of the left humerus of a male 45 years old (Plate I). This one example accounts for 3.8% of all the pathologies at the Wall site, where 12.5% of the sample possesses evidence of one pathology or another.

In the Upper Saratown-Locality 2 sample, which dates to the late protohistoric/early contact period, only three adults have traumatic/violent pathologies. This represents 3.3% of the segment of the burial sample that shows evidence of any pathology, and 1.4% of the total number of pathologies present. None of these injuries is from fractures or breaks. A chipped stone projectile point is embedded in the left femur midshaft of an adult male. An adult female (Burial 17) shows evidence of a blow to the head--dents on the right parietal. Another male (Burial 73) also has evidence of a blow to the head in the form of dents on the frontal bone. The percentage of Upper Saratown-Locality 2 males affected by traumatic/violent injuries is 8.3, while 5.5% of the females are affected.

At the middle contact period Fredricks site, 15.4% (n=2) of the sample shows evidence of traumatic/violent pathologies. This cataegory accounts for 5.7% of the total number of pathologies present in the skeletal series. Both of the identified traumatic/violent pathologies are puncture wounds. A female aged 35 to 40 years has a possible pierce wound of the left fibula that may represent a gunshot wound (a lead shot was found <u>in situ</u> on this individual's fibula). Although the fibula is extremely fragmented,

Plate I. Healed left humerus (top) compared with normal right humerus (bottom) of Burial 1 from 31Or231, the Wall site.

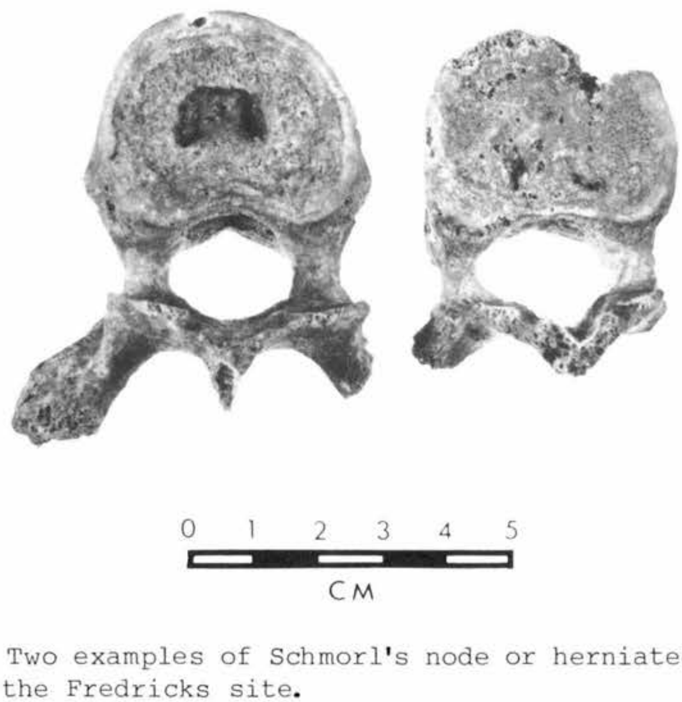

Plate II. Two examples of Schmorl's node or herniated disc from 31Or231, the Fredricks site.

there is no evidence of bone reconstruction or osteitis, which indicates that the woman died shortly after incurring the injury.

The other individual in the Fredricks site sample that evidences a traumatic/violent pathology may also have been a victim of warfare. This male, aged 25 to 30 years at death, has cut marks that extend from the right parietal to the right temporal. The depth of the cuts through the periosteal layer of the cranium suggests that a very sharp weapon used with great force inflicted the injury. Although it is possible that these marks are evidence of scalping, the irregular nature of the cuts is not consistent with the usual pattern of scalping whereby the frontal region is cut and the scalp pulled toward the back of the head where it then is cut away, sometimes with part of the skull (cf. Lawson 1967:207). An alternative explanation of these wounds is that the individual was struck repeatedly about the head with a sharp weapon such as a sword. Also, this burial is unique at the Fredricks site in that it had been interred as a disarticulated bundle. The individual died as a result of the identified cuts on the head (and possibly other unidentified wounds), probably at a locale some distance away from the village. The body was not returned to the Fredricks site for burial until some time after death had occurred, certainly after decomposition was well advanced (which would account for this burial being a bundle-type interment). It does appear that this male had been a victim of warfare or some other violent act. A similar pattern of treatment of war victims, i.e., the retrieval and subsequent interment of human remains sometime after a war-like encounter, is documented among the Choctaw and Creek Indians by Adair (Williams 1930).

> Thus all numerous nations of Indians perform the like friendly office to every deceased person of their respective tribe, in so much that those who lose their people at war, if they have not corrupted their primitive customs, are so observant of this kindred duty as to appropriate some time to collect the bones of their relations, which they call bone gathering...(Williams 1930:181-182).

It can be suggested that this burial had been exposed to the elements for at least several weeks before the remains were returned and buried at the Fredricks site. No defleshing marks, which would indicate intentional disarticulation and secondary burial, are present on this individual's bone. Also, there is no documentary evidence to suggest that intentional disarticulation and secondary burial was ever practiced by the late prehistoric or historic period Indian groups of the Piedmont.

This study of the occurrence of the traumatic/violent pathologies in the burial samples does not completely support the original hypothesis that there would be a general increase in the incidence of such injuries over time. Comparing the two samples that are the most representative, those from the Shannon site and from Upper Saratown-Locality 2, there is a dramatic decrease, not the expected increase. Also, at the Shannon site, 46.2% of all the traumatic/violent injuries are other than broken bones. In contrast, the Upper Saratown-Locality 2 sample has all of the traumatic/violent pathologies (n=3) other than broken bones. A similar pattern of decrease in the occurrence in broken bones in the contact period is also exhibited when the Wall and Fredricks site samples are compared to each other. No explanation for this trend can be given now, although it is suspected that changes in the behavior patterns associated with hunting and warfare may account in part for these patterns.

Degenerative Pathologies

Degenerative pathologies are those that are associated with age and physical activity, i.e., those that are tied to the gradual deterioration of the body. Arthritis and osteoporosis are degenerative pathologies noted in the study samples. The guiding hypothesis of this analysis is that because more individuals survive to old age in the late prehistoric/early protohistoric samples at the Shannon site and the Wall site than in the late protohistoric/contact period samples represented by Upper Saratown-Locality 2 and the Fredricks site (see Chapter III), there should be more degenerative pathologies present in the earlier burial samples when compared to those of the contact period.

Arthritis is present in all four of the skeletal series, with osteoporosis occurring only in the Shannon and Wall site samples. At the Shannon site, 14.2% of the total pathologies present, affecting 48.4% (n=47) of the sample, are degenerative. For the Wall site, 25% (n=3) of the burial sample is afflicted by degenerative pathologies, which comprise 11.4% of the total pathologies. For the late protohistoric/contact period sites, degenerative pathologies affect 22.2% (n=20) of the Upper Saratown-Locality 2 sample, accounting for 9.7% of the total number of pathologies, and 15.4% (n=2) of the Fredricks site sample (3.8% of the total pathologies identified).

Comparing the larger and more representative samples from the late prehistoric Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2 shows a decrease of over 50% from the former to the latter in the number of individuals affected by degenerative pathologies. Also, there is a 30% decrease in the percentage of total pathologies present in the late protohistoric/early contact period from what is present in the late prehistoric period. Similar patterns can be defined when the small burial samples from the Wall site and the Fredricks site are compared. Thus, as expected, there is a decrease in the occurrence of degenerative pathologies in the contact period from the level noted for the prehistoric period.

Tumors

Tumors and tumor-like pathologies are only rarely associated with just human bone. Instead, tumors are the result of unchecked growth of the osteogenic mesenchyme, which includes the bone, cartilage, fibrous tissue, and blood vessels. Tumors can be classified as being benign or malignant. If growth is localized and consists of mature tissue, the tumor is considered to be benign. If growth spreads to other parts of the body and affects immature tissue, it is classified as malignant (Ortner and Putshcar 1981:365). The tumors identified in the study populations consist of ear extosis, button osteomas, and cartilagenous exostosis, all of which appear to be benign in nature. As with the other categories of pathologies considered in this section, it is hypothesized that the incidence of tumors in the study samples should show an increase through time from the late prehistoric period to the later contact period, given the generally more stressful and less healthy time that the contact period is generally considered to have been.

At the Shannon site, 20.6% (n=20) of the burial sample has some form of a tumor-like lesion, with 31 total occurrences (9.3% of all pathologies) being identified. Of these 31 occurrences, 19 are examples of ear extosis, two of button osteomas, and one is an instance of osteochondroma (cartilagenous exostosis) of the right ilium. In the other pre-contact skeletal series from the Wall site, no tumor-like lesions are present.

For Upper Saratown-Locality 2, only 7.7% (n=7) of the burial sample evidences tumor-like lesions, which account for 3.9% of the total pathologies. Ear extosis accounts for four of these tumors, multiple cartilageneous exostosis of long bones for three, cartilageneous exostosis of the basion area for one, and button osteoma for one.

The incidence of tumors at the Fredricks site doubles to 15.4% (n=2) of the sample over that noted for Upper Saratown-Locality 2. However, tumor-like lesions still account for only 3.8% of the total pathologies identified in the skeletal series. These tumor-like lesions are tentatively identified as osteomas located on the mandibles of two individuals.

Comparing the percentage of occurrence of tumors in the study samples from the late prehistoric Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2, the increase expected according to the hypothesis guiding this analysis is not corroborated. Again, the Upper Saratown-Locality 2 sample exhibits a more healthy pattern than does its late prehistoric counterpart. Examining the percentages for the unrepresentative late prehistoric/early protohistoric Wall site and the middle contact period Fredricks site, the expected increase in the incidence of tumors is found. However, the percentage occurrence of tumors at the Fredricks site is still lower than that for the late prehistoric Shannon site, although it is higher than the figure for the earlier Upper Saratown-Locality 2 skeletal series.

Mechanical and General Stress

The two pathologies that are indicative of general or mechanical stress are Schmorl's nodes (intervertebral disc hernia) and dental hypoplasia. Schmorl's nodes are caused by pressure from tension on the spine. Trauma induced by mechanical stress can cause the centrum of the vertebra to collapse, resulting in the formation of Schmorl's nodes (Plate II). This can occur in individuals of any age. Also, Schmorl's nodes can appear as a result of degenerative changes associated with the aging process (Schmorl 1971:158-166).

Given the factors that cause Schmorl's nodes, it is postulated that this pathology will affect a greater percentage of the burial population between the ages of 20 and 40 at the late protohistoric/contact period sites. This prediction is based primarily on an increase of mechanical stress during this period related to obtaining, dressing, and transporting furs and skins for trade with Euro-Americans, and an increased participation in warfare and hunting. Conversely, because young adults in the prehistoric/early protohistoric period samples would presumably have experienced less mechanical and general stress, this segment of the burial sample at the Shannon and Wall sites should exhibit a low incidence of Schmorl's nodes. In these early burial samples, this pathology would be expected to occur primarily among older adults as a result of degenerative processes. Because of the predicted presence of both mechanical and degenerative stress, those individuals that survive to old age at the late protohistoric/contact period sites should also evidence a high incidence of Schmorl's nodes.

At the prehistoric Shannon site, five individuals possess Schmorl's nodes. Three of these individuals are males aged 50+ years, and the other two are females, one aged 40 to 45 years and the other 50+ years. The mean age for these five Shannon site individuals with Schmorl's nodes is 48 years. At the Shannon site 5.1% of the skeletal series is affected by Schmorl's nodes, where the pathology accounts for 1.5% of the total pathologies noted at the site.

In the late prehistoric/early protohistoric Wall site burial sample, two old males aged 50+ have Schmorl's nodes. These two individuals comprise 25% of the sample. Schmorl's nodes represent 7.6% of the total pathologies present at the site. At both the Wall site and the earlier Shannon site, arthritic lipping of the lumbar and thoracic vertebrae is present, indicating that the herniated discs are probably degenerative in nature and not the direct result of mechanical stress. Certainly, the absence of young adults with Schmorl's nodes, especially at the Shannon site, suggests the absence of extraordinary mechanical stress levels in these two societies.

For the late protohistoric/early contact period Upper Saratown-Locality 2 burial sample, only three individuals have Schmorl's nodes. The mean age of these three is 35.8 years. Two of these individuals are females, one aged 30 to 35 years and the other 45 to 50 years. The third individual is a male 25 to 30 years old. All three individuals also possess arthritic lipping. These three individuals comprise only 3.3% of the Upper Saratown-Locality 2 sample, and only 1.4% of the total pathologies present are of this type. It seems unlikely that degenerative stress related to aging would have been the cause of the Schmorl's nodes in the male, who was aged using the os pubis. Instead it appears that mechanical stress contributed to his pathological condition. The oldest female fits the pattern of Schmorl's nodes being the result of degenerative stress. The status of the female aged 30 to 35 years is more equivocal, with both mechanical and degenerative stress possibly contributing to the development of the pathology. Unfortunately, the analysis of Schmorl's nodes in the Upper Saratown-Locality 2 sample is affected detrimentally by the poor preservation state of the vertebra in the site's burials.

At the middle contact period Fredricks site four adults, with a mean age of 36.2 years, have Schmorl's nodes. This pathology is present in 30.8% of the Fredricks site burial sample, and totals 7.5% of the pathologies identified at the site. Three of the four adults with Schmorl's nodes are males, one aged 50, one aged 25 to 35, and one aged 25 to 30 years. One female aged 35 to 40 years completes the sample. Here it appears that both degenerative stress and mechanical stress are afflicting the adults in the burial sample as a whole, resulting in the occurrence of Schmorl's nodes in both the younger and older adults.

In summary, and as originally postulated, the occurrence of Schmorl's nodes in the late prehistoric/early protohistoric period burial samples is generally associated with older individuals, probably as the result of degenerative stress. Younger adult individuals at the late protohistoric/contact period sites exhibit Schmorl's nodes more frequently than do their prehistoric/early protohistoric counterparts. In fact there are no individuals with Schmorl's nodes that are aged less than 40 years at either the Shannon site or the Wall site. Considering the second aspect of the original hypothesis concerning Schmorl's nodes, there is a general increase in the percentage of the sample affected by Schmorl's nodes when the earliest skeletal series from the Shannon site is compared to the latest skeletal series from the Fredricks site. The late prehistoric/early protohisoric period Wall site also adheres to the general pattern. However, the late protohistoric/early contact period Upper Saratown-Locality 2 burial sample does not, as far as the percentage and number of individuals afflicted with Schmorl's nodes is concerned. For the Upper Saratown-Locality 2 sample, the problem noted earlier with the poor preservation of the vertebral remains from the burials may be affecting this analysis. Although the samples tend to reflect a trend for more younger individuals to possess Schmorl's nodes in the late protohistoric/contact period samples and for more older individuals (by count and percentage of the sample) to be affected in the prehistoric/early protohistoric samples, additional burial samples from other sites of all periods will need to be examined before this question can be addressed in full.

The other indicator of general stress in a population that will be considered in this study is enamel hypoplasia. This pathology is an indicator of physiological stress derived from the effects of disease or diet. Enamel hypoplasia is defined as a deficiency in enamel thickness resulting from the slowing of enamel formation due to stress (Huss-Ashmore et al. 1982:441). Transverse lines or rings form as distortions on the enamel when the stress terminates and normal development resumes. These rings are not altered or affected by later events in life (except extreme dental wear). The rings thus serve as a record of stress that occurs during a person's years of development (Huss-Ashmore et al. 1982:441). Episodes of non-specific developmental stress can be initiated by a number of diverse stimuli, including weaning, malnutrition, infection, and psychological stress. Therefore, the precise cause of a specific transverse line on the teeth cannot be determined. Instead, only the age of an individual at the time of each ring formation can be calculated by comparison of the ring location on the tooth crown with standardized charts of dental development (Goodman, Armelagos and Rose 1980).

For each skeletal series, all undamaged permanent incisors and canines were examined under a 10x magnification microscope. Each tooth was scored for three levels of dental hypoplasia severity, and the age when stress occurred was recorded. Positive cases of enamel hypoplasia were noted only in those instances where lesions were observed on two or more teeth in the dentition from an individual burial.

The general hypothesis that guides this study of enamel hypoplasia is that there should be a general increase in its occurrence from the late prehistoric to the contact period, given the general increase in the amount and severity of the stress to which the late protohistoric/contact period populations were subjected. A corollary of this is that the age at which the earliest onset of enamel hypoplasia appears in an individual should increase in the late protohistoric/contact period population over that noted for an individual from a late prehistoric/early protohistoric population. This corollary derives from the discussion of r- and K- selection initiated in Chapter IV of this study. To summarize this argument, there should be more parental investment in caring for individual offspring during the high-stress contact period over that given offspring from the lower stress earlier periods. This would translate to mean that delayed weaning would occur among the late protohistoric/contact period burial samples, resulting in a delay in the formation of the earliest enamel hypoplasia tooth rings over that identified for the prehistoric/early protohistoric samples. Weaning would certainly be a period of stress common to infants and young children of both periods, and probably the earliest ordinary stress affecting this segment of any population of any period.

Examination of the teeth from the four burial samples shows that over 55% of each is affected by enamel hypoplasia. At the Shannon site, 56.7% (n=55) of the sample exhibits episodes of general stress, with dental hypoplasia representing 16.5% of the total pathologies present. For the Wall site, 75% (n=6) of the sample is afflicted by the pathology and 23% of the total number of pathologies are dental hypoplasia. The two late protohistoric/contact period sites, Upper Saratown-Locality 2 and the Fredricks site, show occurrence rates of 62.2% (n=56) and 85% (n=11) respectively for each sample. Also, in both cases enamel hypoplasia comprises a large proportion of the total number of pathologies present, 27.0% for Upper Saratown-Locality 2 and 20.7% for the Fredricks site.

Comparing the two sites that have the best samples, the Shannon site and Upper Saratown-Locality 2, both the percentage of the population affected and the percentage incidence of dental hypoplasia increase through time from the late prehistoric to the late protohistoric/contact period. When the two sites with poorer samples are compared to each other, the same pattern is found. Therefore, the first portion of the original hypothesis concerning the increase in general stress, and thus dental hypoplasia, through time is tentatively supported.

The corollary of this hypothesis that there will be an increase through time in the age at which dental hypoplasia first appears is also supported. Only the burial samples from the Shannon site and Upper Saratown-Locality 2 were used in this analysis, the other two samples being woefully inadequate. The mean age calculated for the the occurrence of hypoplasia lesions at the Shannon site is 3.9 years, and at Upper Saratown-Locality 2 it is 4.4 years. This slight increase in the mean age of hypoplasia rings at Upper

Saratown-Locality 2 is taken to indicate that weaning may have been delayed in this late protohistoric/early contact period site beyond the age at which weaning occurred at late prehistoric period sites.

In addition to documenting the incidence of this pathology in the the Shannon site and Upper Saratown-Locality 2 samples, the severity of each case of enamel hypoplasia can also be determined. Of the 44 individuals at the Shannon site with enamel hypoplasia, 70.5% (n=31) display lesions that can be classified as mild, 15.9% (n=7) mild to moderate lesions, and 13.6% (n=6) moderate lesions. No examples of severe lesions are present in the Shannon site sample. In the late protohistoric/contact period Upper Saratown-Locality 2 burial sample, where 56 individuals evidence enamel hypoplasia, 50% (n=28) have mild lesions, 15.8% (n=9) have mild to moderate lesions, and 34.2% (n=19) have moderate lesions. As with the Shannon site, no instances of severe lesions are present in the Upper Saratown-Locality 2 sample. Comparing the percentages for the two sites shows that there is a general increase in the late protohistoric/contact period Upper Saratown-Locality 2 sample in the lesions that can be classified as moderate in some manner, 50% to 29.5% for the late prehistoric Shannon site sample. This increase in the percentage of the burial sample exhibiting the more severe moderate dental hypoplasia lesions probably reflects the more stressful environment that characterized the contact period. Factors contributing to this increase may include weaning as a child from a protein-rich diet to one less able to meet the physiological needs of the individual, and greater exposure to environmental pathogens, particularly European introduced diseases like influenza and measles that do not leave evidence of their presence on the bone.

Dietary Pathologies

Pathologies identified in the four skeletal series that are related to diet include cribra orbitalia, spongy hyperostosis, periodontal disease, and caries. I have previously hypothesized (H. Wilson 1983b:29) that nutritional stress will be less common in the late prehistoric and early protohistoric burial samples given the general social stability present, and the presence of low levels of stress and competition relative to late protohistoric/contact period samples. In contrast, diet-related diseases would be expected to increase during the later periods because of the increase in the incidence or amount of disease, stress, competition, and social disruption.

Two pathologies related to diet that affect the cranium are cribra orbitalia and spongy hyperostosis. Evidence of cribra orbitalia is manifest by porotic lesions afflicting the roof of the eye orbit. Although cribra orbitalia can have a number of different causes, it is usually attributed to some type of nutritional stress related to iron deficiency anemia (Steinbock 1976: 244-246). Spongy hyperostosis is generally found on the parietal and occipital bones of the cranium, and its occurrence is also usually attributed to iron deficiency anemia (Steinbock 1976:230).

At the Shannon site, 12 instances of cribra orbitalia are present, affecting 12.3% of the burial sample and accounting for 3.6% of the pathologies present in the sample. This includes nine (75%) subadults and three (25%) adults. The adults are a female aged 30 to 35 years, a male aged 20 to 25 years and a second male aged 30 to 35 years. No evidence of spongy hyperostosis is present in this skeletal series.

For the Wall site, cribra orbitalia afflicts only two individuals in the burial sample, a subadult and a male aged 16 to 20 years. Also, one subadult is affected by spongy hyperostosis. Cribra orbitalia and spongy hyperostosis are present on 25% and 12.5% of the Wall site sample respectively, and account for only 7.6% and 3.8% of the total pathologies at the site respectively.

In the burial sample at Upper Saratown-Locality 2, only five individuals, representing 5.5% of the sample, evidence cribra orbitalia. This pathology comprises only 2.4% of the total number of pathologies present at the site. Four of the individuals are subadults, and one is an adult female aged 30 to 35 years. Also, one subadult, 1.1% of the sample, is afflicted with spongy hyperostosis, which totals 0.48% of the total pathologies.

The contact period Fredricks site skeletal series has 40% (n=4) of its members affected by cribra orbitalia, which accounts for 7.5% of the total pathologies present at the site. Of these four individuals, three are subadults and one is an unsexed adult aged 20 to 25 years. One male aged 35 to 40 years, or 7.7% of the sample, has spongy hyperostosis. This single occurrence represents 1.9% of the total pathologies identified for the sample.

Comparing the percentage occurrence of the anemia-related pathologies of cribra orbitalia and spongy hyperostosis at the late prehistoric Shannon site with that at the late protohistoric/early contact period Upper Saratown-Locality 2, it appears that more individuals at the late prehistoric site are affected than at the later site. This runs contrary to the trend expected from the hypothesis stated at the beginning of this section. It may be that there is an increase in the animal protein available at the later Upper Saratown-Locality 2 site over that present at the Shannon site, a trend tentatively confirmed by the results of the trace element analyses conducted in Chapter V. This increase would have been the result of the increased hunting being done by the Upper Saratown-Locality 2 population to procure furs and skins for trade with the Europeans. This increased hunting activity would presumably have resulted in more meat being present as a protein resource. Also, the delayed weaning that may have characterized the burial sample at Upper Saratown-Locality 2 might have contributed to the low incidence of anemia-related pathologies at this late protohistoric/early contact period site.

Comparing the information from the middle contact period Fredricks site with that from the Shannon site, the Wall site, and Upper Saratown-Locality 2, there is an increase in the percentage of the burial sample affected by anemia-related pathologies, and anemia-related pathologies comprise a greater percentage of the total number of pathologies present. Although the samples at the Wall site and the Fredricks site are too small to support any but the most general of conclusions, the expected general pattern of increase over time given in the original hypothesis is supported. The anomaly that is Upper Saratown-Locality 2 appears to reflect a population that dates to the late protohistoric/early contact period during a lull in the occurrence of epidemics of European introduced diseases, and is a time before the dramatic increase in warfare that characterized the Piedmont in the late seventeenth and early eighteenth centuries. Certainly the presumed 1700 Occaneechi occupation at the Fredricks site is a time of extensive warfare (J. Wilson 1983), and of a known outbreak of smallpox from 1696 to 1699 (Dobyns 1983:15; Lawson 1967:231-232). Also, by 1700 the Piedmont Indian groups had a greatly diminished role in the European fur and skin trade, which may have resulted in a decreased access by the population resident at the Fredricks site to animal protein. All of these factors would have contributed to more stress at the Fredricks site, and possibly to an increased incidence in anemia-related pathologies in the population.

The other two pathologies that can be related to diet are caries and periodontal disease, which affect the teeth and jaw of an individual. The dentition of an Indian was subject to a number of stresses above those usually associated with eating. Teeth were commonly used as tools in the working of rawhide, the manufacture of thongs, and sewing (cf. Graham 1973). For the era under consideration in this study, the late contact period (and to a lesser extent the protohistoric period) is characterized by the introduction of a whole array of European goods and foods that helped change the existing Native American lifestyles. Two of these new European foods, the peach (Gremillion 1987:269; Lawson 1967:115-116) and rum (Lawson 1967:232-233), would have contributed to a dramatic increase in the amount of sugar in the diet of late protohistoric/contact period populations over that present in late prehistoric or early protohistoric period populations. It is hypothesized that this increase in sugar in the diet could have contributed to an increase in the incidence of dental caries and periodontal disease during the late protohistoric/contact period.

Dental caries are defined by Pindborg (1970:256) as a transmissable infectious disease in which the enamel of the tooth is destroyed by microbial activity on the tooth surface. Lytic activity by bacteria generally results in the formation of caries. Studies (Cassidy 1972; Cook and Buikstra 1979; Turner 1979) have shown that the frequency of carious occurrence is noticeably lower among hunter-gathers, with 2 or 3 lesions per mouth than agriculturalists, where the incidence is more than twice as high. This increase in caries among agriculturalists has been attributed to the adverse effects of malnutrition on tooth development and a higher proportion of carbohydrates in the diet (Brothwell 1981:274).

In studying dental caries, two general problems are encountered. First, there is usually post-mortem damage and loss of dentition in archaeological skeletal series. Post-mortem loss is usually seen among anterior teeth, which are smaller than the other teeth. Also, other causes of post-mortem loss include the excavation process, and disturbance by vermin and human looters. Another general problem is that tooth attrition in a living individual may cause the dentition to become exposed and, thus, subject to infection. Extreme examples of tooth abcess may be caused by tooth attrition rather than carious lesion. This makes the identification of caries as a cause of more serious dental disease questionable (Ortner and Putschar 1981:439). In studying the dentition and dental pathologies of archaeological burial samples, the potential difficulties posed by these two problems have to be considered and allowances made for the effects of these difficulties.

The most obvious manifestation of the problem of post-mortem tooth loss is found at Upper Saratown-Locality 2, where relic hunters have disturbed a number of the burials included in the sample. Although all burials were examined for the presence and absence of dental caries, only the dentition of undisturbed burials were assayed as to the degree each was afflicted by caries to control for the problem of postmortem tooth loss. At each site, the number of teeth were inventoried for each burial, the number of caries for each individual was noted, and the number of teeth with caries was recorded.

At the Shannon site, 73.2% (n=71) of the burial sample has carious lesions, which comprises 21.2% of the total pathologies at the site. The Wall site sample has caries in 62.5% (n=5) of its members, which accounts for 19.2% of the site's total pathologies. In the Upper Saratown-Locality 2 burial sample, 71.1% (n=64) of the sample has caries, which totals 31% of the total pathologies present. In the Fredricks site sample, 85% (n=11) have caries, and this disease accounts for 20.7% of the site's total pathologies.

Comparing the prehistoric Shannon site and the late protohistoric/early contact period burial sample from Upper Saratown-Locality 2, there appears to be little difference in the percentage of the sample afflicted by dental caries. However, there is an increase of 10 percentage points from the Shannon site to Upper Saratown-Locality 2 in the portion of the total pathologies present for which dental caries is responsible. Comparing the Wall and Fredricks site figures shows that while over 20% more of the Fredricks site sample has dental caries, the percentage of the total number of pathologies present at each site identified as dental caries is similar for both sites. This pattern illustrates the small sizes of the Wall and Fredricks site samples.

The next step in the study of dental caries is the calculation of the mean number of carious lesions per individual. This analysis is intended to investigate the possible effects of the introduction of peaches and rum on adult and subadult segments of each skeletal series.

At the Shannon site, adults possess an average of 7.9 carious lesions in the permanent teeth, and subadults average 5.3 carious lesions in permanent teeth and 1.25 lesions in deciduous teeth. Adults at the Wall site average 15.6 lesions per individual and subadults have 6.3 carious lesions in the deciduous dentition per individual. In the Upper Saratown-Locality 2 burial sample, the permanent dentition of an adult individual averages 9.4 carious lesions, while subadults have no carious lesions in their permanent teeth. The Fredricks site adults have 14.8 lesions per individual, and the subadult's 14.25 lesions in their deciduous teeth.

Comparing the Shannon site with Upper Saratown-Locality 2, a slight increase in the number of caries per adult individual can be seen at the late protohistoric/contact period site. Conversely, the subadults show a decrease in the permanent dentition afflicted by lesions. Comparing the Wall and Fredricks sites a slight decrease in the number of caries per individual adult is seen in the latter contact period sample. For the subadult deciduous dentition at these two sites, there are almost as many lesions per individual at the later Fredricks site as at the Wall site.

The relatively small increase of 1.5 carious lesion per adult individual from the Shannon site to the Upper Saratown-Locality 2 sample suggests that European introduced foods may have had some, but almost an inconsequential, effect on the incidence of dental caries. This may reflect sample bias due to the number of burials from Upper Saratown-Locality 2 that had to be excluded from the study because of relic hunter disturbance. However, the results of the Shannon Site and Upper Saratown-Locality 2 comparison may be indicative of the earlier date in the contact period of the Upper Saratown-Locality 2 sample, before intense and continued interaction with the European, primarily British, traders which resulted in the widespread availability of rum. Also, the delay in weaning at the late protohistoric/early contact period Upper Saratown-Locality 2 may contribute to the decreased incidence of caries in the subadults. Sample bias is certainly skewing the results when the Wall and Fredricks sites are considered, which limits further discussion of the comparison of the two samples.

The other pathology that can be linked to diet is periodontal diseases, which involves an inflammatory response to one or more conditions. Generally, the alveolar bone is resorbed when periodontal disease develops, and severe degrees of this pathology can cause tooth loosening and eventual loss of dentition. Various factors that contribute to alveolar resorption include poor hygiene, calculus, dental attrition, and lowered tissue stability due to a poor diet (Brothwell 1981:154). Each individual burial at each site was examined for the presence of periodontal disease. The severity of the disease in each case was rated with "1" indicating only a slight case of the disease, "2 " a medium onset, and "3" a severe or considerable case.

Periodontal disease is present in all four burial samples. In the Shannon site sample, 62.9% (n=61) of the individuals exhibit some instance of periodontal disease, which comprises 18.3% of the total number of instances of all diseases at the site. The average severity for adults is 1.8, or slight to medium. A total of three individuals, 37.5% of the sample, at the Wall site have periodontal disease, with an average severity of 2.3, medium to considerable. Periodontal disease comprises 11.5% of the total number of instances of all pathologies in the sample. At Upper Saratown-Locality 2, 38.9% (n=35) of the sample have periodontal disease, with an average rating of 1.7, or slight to medium. Periodontal disease accounts for 16.9% of the total number of instances of all pathologies at this site. Finally, 46% (n=6) of the Fredricks site sample have some instance of periodontal disease, and an average of 2.3, medium to considerable. Periodontal diseases comprise 20.7% of the total number of instances of all diseases at the Fredricks site.

Comparison of the prehistoric period Shannon site sample with the late protohistoric/early contact Upper Saratown-Locality 2 sample shows that although more individuals were afflicted with periodontal disease at the Shannon site, the percentage of the total pathologies that periodontal disease comprise is similar. Also, the average severity rating of periodontal disease is similar for both sites. However, because there are more older individuals at the Shannon site than at Upper Saratown-Locality 2, there are more younger individuals at the later site that are afflicted with this disease. A similar trend of periodontal disease affecting younger individuals at the later contact period sites can also be discerned when less representative samples from the Wall and Fredricks sites are compared. Again, the average severities of the periodontal disease present in the Wall and Fredricks site burial samples resemble each other, medium to considerable in this case.

All four types of dietary pathologies considered in this study--cribra orbitalia, spongy hyperostosis, dental caries, and periodontal disease--are found in each of the samples. When comparing the larger and more representative samples from the late prehistoric Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2, there is a decrease in the number of individuals affected by anemia-related diseases (cribra orbitalia and spongy hyperostosis), periodontal disease, and caries at the later site. It is possible that the unexpected decrease in anemia-related diseases is due to an increase in the zinc available to the Upper Saratown-Locality 2 burial sample as a result of more animal protein being present in the diet. This would be due to increased amounts of meat being available as a direct result of increased hunting designed to acquire furs and skins for trade with the Europeans. The decrease in the incidence of periodontal disease and dental caries from the late prehistoric to the historic period sample is also not expected. It may be that the increased animal protein present in the diet of the late protohistoric/early contact period Upper Saratown-Locality 2 burial sample may contribute to this unexpected decrease.

When the two unrepresentative samples from the late prehistoric/early protohistoric period Wall site and the middle contact period Fredricks site are compared, there are slight to moderate increases in the incidence of anemia-related pathologies, dental caries, and periodontal disease. Unfortunately, this support for the original hypotheses expecting general increases in these pathologies through time that were set forth originally is not valid, given the small size of the burial samples available for study from the Wall and Fredricks site.

Considering the overall results of this analysis of diet-related pathologies, two general observations can be made. The decreases noted in the incidence of anemia-related diseases between the two good burial samples from the Shannon site and Upper Saratown-Locality 2 might be indicative of one of the following situations. The sample at Upper Saratown-Locality 2 dates to a time in the contact period before A.D. 1676, when interaction with the British traders became more intense and prolonged. This era would have been one where there was less stress from the competition in the form of warfare and hunting pressures that characterized the later contact period after 1676. Also, this earlier late protohistoric/early contact period would have a lessened likelihood that European diseases would afflict the Piedmont Indians, given the lessened interaction with Europeans and other Indians that would have occurred. Conversely, the unexplained divergences from the original hypotheses could indicate that the Indian groups being compared, already defined as being representative of larger Northern and Southern Siouan groups, may be less closely related than previously thought. This line of reasoning is based on the supposition that populations with differing sociocultural structures would react to and be affected by contact in differing manners. This suspicion will be given a fuller consideration in the analyses considered in Chapter VII of this study.

Osteitis

Osteitis is an inflammation of the bone caused by trauma, infection or disease (Steinbock 1976:60). Because these three conditions--trauma, infection, and disease--would be expected to generally increase from the prehistoric period to the contact period due to the presence of European diseases and increased stress and competition, there should be an increase in the incidence of osteitic lesions during this time also.

In the prehistoric Shannon site burial sample, 41.2% (n=40) of the individuals show evidence of osteitis. This decreases to 37.5% (n=3) in the Wall site sample. The late protohistoric/early contact period burial sample at Upper Saratown-Locality 2 has the lowest incidence of osteitis of the four samples 13.3% (n=12). Conversely, the later contact period burial sample from the Fredricks site has the highest rate of osteitis, with 69% (n=9) of the individuals being afflicted.

When the two biologically representative burial samples from the Shannon site and Upper Saratown-Locality 2 are compared, the dramatic decrease in the incidence of osteitis is directly counter to the expected increase as set forth in the hypothesis at the beginning of this section. Considering the data from the Wall and Fredricks sites, the expected increase in the occurrence of osteitis is documented but the sample bias present for these two populations precludes the use of this information in this analysis.

Reasons for the divergence from the expected fall under the following three general categories. The poorer preservation of the skeletal material at Upper Saratown-Locality 2 might be masking the true (and higher) incidence of osteitis in the sample. Also, the samples from the Shannon site and Upper Saratown-Locality 2 being compared might represent different groups with different sociocultural organizations. Or the environment inhabited by the Upper Saratown-Locality 2 Indians may have been more healthy overall than that of the late prehistoric Shannon site inhabitants (and of the Wall site and Fredricks site inhabitants). For now no one actual explanation can be offered to explain the decrease in the incidence of osteitis from the Shannon site burial sample to the Upper Saratown-Locality 2 sample.

Summary of the Analysis of the Pathologies

The skeletal series from the four sites were examined for the incidence of a number of pathologies to determine whether there was a decrease through time from the late prehistoric to the contact period in the overall health of the people. The middle contact period Fredricks site appears to be the least healthy of the four samples. The time between A.D. 1680 and 1710, when the Fredricks site was apparently occupied by the Occaneechi Indians, was a period of intense stress among the Indians of the Southeastern United

States. This heightened stress load derived from the numerous epidemics of European-introduced diseases documented in the historic record (cf. Dobyns 1983), and the increased warfare and conflict between Indian groups and between Indian groups and Europeans (cf. Lawson 1967; Swanton 1946; J. Wilson 1983). Unfortunately, the small size of the Fredricks site burial sample prevents any observation based on the site's data from being more than a general observation that can confirm general patterns derived from the investigation of more representative populations.

The Wall site skeletal series is also not adequate as a biologically representative sample. The site dates to A.D. 1545 (Dickens et al. 1987:6), based on a radiocarbon assay, which is the end of the late prehistoric period and the beginning of the early protohistoric period. The burial sample at the Wall site is generally more healthy than that of the Fredricks site, but not as healthy as the late prehistoric Shannon site or the Upper Saratown-Locality 2 samples. Thus, the information derived from the Wall site can be used only to corroborate general trends derived from the study of representative burial samples.

Comparison of the late prehistoric Shannon site and the late protohistoric/early contact period Upper Saratown-Locality 2 samples shows that there is a decrease from early to late in the percentage of all pathologies except for enamel hypoplasia and dental caries. At the Shannon site, 43.1% of the total pathologies are diet-related, and 50.34% of all pathologies at Upper Saratown-Locality 2 are diet-related. This increase is represented primarily by dental caries, with there being an increase in caries per adult individual in the Upper Saratown-Locality 2 skeletal series. This may indicate that the introduction of such European foods as the peach and watermelon, the remains of which have been found in the archaeological collection from Upper Saratown-Locality 2 (J. Wilson 1977), and to a lesser extent rum, may have had a detrimental effect on the late protohistoric/early contact period adult population.

Conversely, because of the increased percentage of occurrences of diet-related pathologies, for which dental caries is primarily responsible, there is a decrease in the percentage incidence of the other pathologies from the late prehistoric period Shannon site sample to the late protohistoric/early contact period Upper Saratown-Locality 2 sample. Overall then, the late protohistoric/early contact period sample at Upper Saratown-Locality 2 is in many ways more healthy than the earlier sample. This is not the expected outcome, given the hypotheses proposed for the study of the pathologies in this section, nor given the generally accepted view of the contact period being a time of intense stress (cf. Dobyns 1983).

Perhaps the results obtained in this study of pathologies is biased by the relatively poor preservation of the skeletal material from Upper Saratown-Localtiy 2, which prevents a more detailed examination of the bone remains. Other factors have also been alluded to earlier in this chapter, including the questions of whether there are differences in the sociocultural organization of the study populations not previously recognized, and whether the Upper Saratown-Locality 2 site dates to the earlier portion of the contact period before the onset of intense and prolonged interaction between the Indians of the Piedmont and the British populations of the coastal regions. These questions will be addressed in more depth in the analysis of grave associations in Chapter VII that immediately follows.

CHAPTER VII

MORTUARY VARIABILITY

This section of the study uses the biological data concerning each of the skeletal series presented in Chapters III-VI and the grave associations of each burial to investigate possible changes in the social systems of those groups affected by European contact during the seventeenth and early eighteenth centuries. The overall design of this investigation and the techniques utilized to study this question follow the analysis conducted by O'Shea (1984) of the mortuary customs and social structure of three Plains Indians groups--the Arikara, Pawnee and Omaha.

O'Shea's (1984:50) work is centered around three aspects of mortuary variability that occur in an archaeological context. First, mortuary differentiation should reflect the social differentiation within the living society responsible for the mortuary complex. This assumes that there is a particular pattern of behavior within each society that dictates burial treatment and that the characteristics of a person's burial reflect the individual's place in the living society. The major problem with this assumption is that the total range of the culturally determined behavior patterns may not be observed in the burial sample. Also, gradual change in burial patterns may be difficult to distinguish from the "norm" (O'Shea 1984:38).

The second aspect of the study of mortuary variability involves identifying changes in the funerary treatment that coincided with European contact. Here emphasis will be placed on the differences between the mortuary complexes identified at the Shannon site (of the late prehistoric period) and Upper Saratown-Locality 2, the latter being assumed to have been in contact with Europeans (Dickens et al. 1987:5). These two sites also possess the only biological representative sample available for comparison in this study.

The third level of this inquiry is to determine the possible ethnic affiliations of the samples. Both archaeological and ethnohistorical data will be used to refine the currently defined historic geography of the Virginia and North Carolina Piedmont.

Method and Theory

Numerous studies of funerary patterns have been attempted over the years in an effort to delineate the patterns of social organization that characterized extinct societies resident at archaeological sites. The most common type of such studies are those that look at social differentiation among individuals at single sites. Classic examples of this kind of study include work by Brown (1971), Gruber (1971), Peebles and Kus (1977), Rothschild (1979), Saxe (1971), and Tainter (1973). These studies incorporate a varied array of investigative techniques and stress the importance of funerary data to the study of archaeological sites (O'Shea 1984:2).

Other studies focus more on the social system represented by a collection of sites rather than single sites. These studies include

Brown (1974), Hatch (1976), Larson (1971), Peebles (1971), and Tainter (1977). Social organization and social complexity are the focus of these studies, which use a variety of archaeological contexts to investigate their propositions (O'Shea 1984:2).

Despite the rather large number of studies that have been done in the past, a comprehensive archaeological theory of mortuary variability and a comprehensive methodology designed to study mortuary variability has yet to be defined. O'Shea (1984:21-22) criticizes the current body of general archaeological theory on these grounds, and notes that mortuary studies have uncovered a number of behavioral correlates which integrate social organization with mortuary treatment. These studies provide numerous hypotheses that attempt to predict correlation between behavior, social organization, and mortuary treatment. According to O'Shea (1984:22), these studies fail to address the process of archaeological context formation and the constraints which are necessary for the transformation of the mortuary complex to an archaeological context to occur.

O'Shea (1984) follows the lead of Binford and Bertram (1977:77) in advocating the need to link past cultural behavior to archaeological remains. Three basic relationships which enable this correlation between past cultural behavior and present archaeological observation are defined by O'Shea (1984:23): 1) the amount of patterning and/or structure in a society's mortuary behavior; 2) the formation processes of mortuary practices that are observable by archaeologists; and 3) the limitations and problems present in the detection and recognition of variability within the archaeological record. Each of these relationships is important in understanding the funerary remains in an archaeological context.

Archaeological Burial Patterns and Social Organization

As noted earlier, a number of investigators have attempted to understand social organization and social structure through the analysis of mortuary data. Both single-site and multi-site investigations have been done. The results of a select sample of each type of study will be examined before proceeding with the analytical strategy used in this work.

James Hatch (1975) analyzed the artifact and grave associations of mound burials at late prehistoric Dallas phase sites in Tennessee. Hatch (1975:134) suggested that status was ascribed in Dallas society because "high status artifacts" were found with both sexes of all ages. He then compared the stature of the individuals interred in the mounds with those found in village cemeteries to test his hypothesis that "among adults the average stature should be greater for high status individuals as compared to low status individuals." (Hatch 1975:136). Low-status individuals were defined as those not buried in a mound. The rationale behind Hatch's argument was that individuals with ascribed status were taller because they were not subjected to nutritional stresses during childhood. An alternative explanation was that such individuals, if taller, may have been genetically taller individuals who were chosen as leaders (Hatch 1975:136). Hatch found a significant difference in stature between males interred in mounds and those in village cemeteries. The differences between the females from both areas were not significant. Further investigation by Hatch (1975:136) showed that stature measurements within the sex groups from the mound were homogeneous, while that for the village were heterogeneous.

Hatch and Geidel (1983) continued Hatch's initial research by using trace element analysis to test whether certain individuals had differential access to different foods, which resulted in the differential height measurements noted in Dallas society. Among subadults, significant differences between mound and village burials were found for three mineral elements--strontium, manganese, and vanadium. These elements would have been concentrated in the plant foods consumed by the Dallas population. The mound burials had lower levels of all three elements. This suggested that the villagers possessed a diet centered on maize. In contrast, the individuals represented by the mound burials probably had a more diffuse diet, or at least access to a wider variety, and possibly greater amounts, of plant and animal foods.

A comparison of the adult male skeletal remains from the two Dallas cemetery areas also reflected differential diets, as did the subadult remains. Unlike these two groups, however, the adult females showed no clear evidence of differential diets. It was proposed that women in Dallas society shared a similar diet regardless of their social position, and that their status was both achieved (probably through marriage) and ascribed (Hatch and Geidel 1983:59).

This 1983 study was taken by the authors (Hatch and Geidel 1983:59) to substantiate the results of Hatch's 1975 analysis of stature where significant differences were noted between the males, but not among the females, from the two Dallas cemetery areas. The combination of these two analytical techniques--stature estimation and trace element analysis--provided a definite step forward in the study of status and, by inference, social organization.

Hatch's work followed Lewis Larson's (1971) study of the skeletal remains from another "Mississippian" ceremonial center, Mound C at the Etowah site near Cartersville, Georgia. Social stratification within the resident population at this site was suggested by the burials in the mound being accompanied by goods made of exotic and rare materials that were not found in the associated village burials (Larson 1971:62-65). From the analysis of the excavated data, Larson (1971:67) stated that a descent group (which implies inherited status) was represented in the mound burials, and that within this group there was also internal ranking.

In 1981, Blakely and Beck used trace element analysis of skeletal remains from Mound C and the Etowah village to investigate the pattern of social stratification suggested by Larson. The authors stated that if status was inherited, one might expect members of a higher-status group to receive preferential treatment, which would have included a higher nutritional standard. It was noted that archaeological and ethnographic evidence from chiefdoms in North America, Africa, and the Philippines all indicated that high-ranking individuals often consumed greater quantities of meat within a more diffuse diet than those of subordinate ranks. For their study, Blakely and Beck (1981:420) set out to test whether skeletons representing the subordinate (village) class at Etowah contained different concentrations of selected trace elements, which in turn indicated a diet different from the higher-status mound population.

Levels of zinc, copper, strontium, and magnesium in the skeletal remains from the village area and Mound C were compared. The results indicated that there were no significant differences between the two samples. Blakely and Beck (1981:420) concluded that although Etowah did constitute a socially stratified society, status was probably achieved rather than ascribed. The implication was that social organization at Etowah incorporated components of both chiefdom and egalitarian societies, perhaps making the social structure more adaptive (Blakely and Beck 1981:420). Although this did not support Larson's initial hypothesis that a chiefdom level of social organization existed at Etowah, it did define more specifically the level (or levels) of social organization that characterized the population as a whole. Unfortunately, the conclusions that Blakely and Beck reached may be erroneous because the comparison population sample from the village area at Etowah may have included burials from a time period later than the Mound C population (Roy S. Dickens, Jr., personal communication, 1983).

A similar dual pattern of organization, where a combination of ascribed and achieved status prevailed, has also been proposed for the population at the King site in northwest Georgia (Funkhouser 1978:69). The King site is a protohistoric period Indian village located on the Coosa River in Floyd County, just west of Etowah. Although no mound is present at this site, the settlement plan consists of a central plaza surrounded by an outer habitation area, a defensive ditch, and a palisade that extends around the perimeter of the site (Funkhouser 1978:20).

The burial location was divided into two major areas, "public" and "private". Public burials were characterized by the presence solely of older adult males and children, and the total absence of adult males under 30 years of age and of adult females. Burials in the private sector were representative of the total population (Funkhouser 1978:69). Funkhouser (1978:69) suggested that the public burials represented a special class of individuals, perhaps village leaders and their children. Furthermore, he suggested that the over-30 age of these public adult males perhaps indicated achieved status, while the presence of children may have been due to ascribed status (Funkhouser 1978:69).

The works by Funkhouser (1978) and Blakely and Beck (1981) are important contributions to the study of mortuary data because they provide possible documentation for several levels of social organization existing simultaneously in a society. All too often archaeologists have identified social organization with one level of an evolutionary typology such as tribe or chiefdom, depending on the presence or absence of particular archaeological traits such as mounds to make the identification. The underlying assumption that supports this tendency is that attributes defining societal types are so strongly associated with each other and so highly redundant that the presence of one attribute, such as a temple mound, implies the presence of all the other traits characteristic of particular social types (Tainter 1978:115). A "checklist" approach to the evaluation of social organization in Neolithic Wessex, England, by

Renfrew (1973) indicated that characteristics associated with a chiefdom as defined by Service (1962) and Sahlins (1968) had to be inferred or otherwise documented. The archaeological evidence itself simply did not exist for the majority of the characteristics. Renfrew (1973:557) concluded that the chiefdom type of social organization "will have to make way for, or be refined to yield subtler and less inclusive concepts."

Tainter (1978:117) suggests that if the objective of the archaeologist is to study social variation and change, then there should be a concentrated effort to develop truly quantitative scales for measuring social characteriestics. Tainter (1975a, 1975b, 1977) applied such quantitative methods to the problem of Middle Woodland to Late Woodland cultural change in west-central Illinois. Using an information theory model, Tainter (1977:85) found that the change in the levels of social organization present during the Middle Woodland to late Woodland periods in Illinois largely reflected transformations in the nature of the resident social systems.

Another quantitative method known as formal analysis is used by James A. Brown (1971) in his study of burials from Spiro, a specialized Mississippian period site in eastern Oklahoma. Brown (1971:95) set up a key diagram where three dimensions could be examined for the domain of mortuary data. These three dimensions included the characteristics associated with burial behavior (the handling of the deceased), grave behavior (burial context), and the population profile (age and sex). Using this key Brown (1971:97-98) identified 13 burial types within the Spiro mortuary complex. It was possible to rank the burial types from those least used (high rank) to those most used (low rank) (Brown 1971:99-100). Brown (1971:102) concludes that the pyramid arrangement of burial types and its inferred association with rank and order of status by membership size, and the disproportinate access to valuable goods, fulfills some of the requirements of an adaptive level of organization that can be labelled "chiefdom".

Brown's model is important, as it presents a deductive framework that exploits the potential mortuary data sets found in each particular archaeological situation, and it is a systematic approach that includes factors of the physical, social, and cultural environment. There are, however, problems with using formal analysis that Brown (1971:93-94) underscores in his article. A major problem is that the initial key used to examine the mortuary data will be very complicated, and one has to be selective in the language used for description and analysis. Another problem, not discussed by Brown, but relevant to all archaeological studies, is the question of sample size. If the skeletal collection is too small, then the key may not be efficiently used. It would be too restricted and could not be used with other burial collections. Having a representative sample is very important in establishing the initial model.

The seven studies reviewed here focus on the inference of social organization and status using mortuary data. Two works, by Funkhouser (1978) and Blakely and Beck (1981), document the results of studies conducted to test hypotheses concerning evolutionary typologies of social organization. These latter two studies indicate that a number of social patterns attributed to tribes and chiefdoms may have co-existed temporally and spatially in certain cultural systems. However, it is equally possible that the two sites reflect different levels of chiefdoms with differing amounts of complexity.

The two works by Tainter (1977) and Brown (1971) mark the initial attempts to replace the limited qualitative methods or checklist approach traditionally used to study status and mortuary data archaeologically. Both of these works advocate the use of quantitative methods to investigate social structure. Tainter's information theory and Brown's formal analysis both provide methodologies that could prove useful to the analysis of mortuary behavior if used within a deductive framework.

This previous research has shown that patterns associated with the disposal of the dead in a living society can be documented. O'Shea (1984:21) abstracts the following regularities (patterns) that are basic to these and other mortuary studies.

1. Mortuary differentiation is patterned and its elements are integrated with other aspects of the sociocultural system.

2. The mortuary differentiation accorded an individual, although not necessarily isomorphic, is consistent with his social position in the living society.

3. The complexity of the system of mortuary differentiation will increase with the complexity of the society at large.

These regularities are fundamental to the study of funerary practices of the past.

The second and third propositions listed by O'Shea are questioned by Hodder (1982) who takes issue with the assumption that an individual's social position in life is reflected by his/her mortuary treatment. Instead, it is suggested that burial patterns are meaningful transformations of social differentiation that do not necessarily directly reflect social hierarchy. Hodder (1982:150) states that most archaeological work on social hierarchies has been concerned with social systems and not social structures. The social system is considered to be patterns of "relationships and roles, the communication and use of power, relations of dependence and authority, the movement of resources and trade." (Hodder 1982:150). Social systems have traditionally been described by archaeologists in terms of complexity and adaptation and homeostasis. Subsystems such as trade, hierarchy, and subsistence interact functionally to form the social system. In contrast, the social structure is comprised of the rules and concepts which give the social system meaning. These rules and concepts, including ideologies and symbolic principles, are organized and continually changing in relation to each other, hence the social structure is reorganized as part of the changing relationships between groups and different powers (Hodder 1980:150). In order to understand social systems, archaeologists must understand the social structures behind them (Hodder 1982:150).

Hodder (1982:152) states that burial ritual may be used as part of an ideology that reflects aspects of a living society, although the ideology of a society may entail "distorting, obscuring, hiding, or inventing particular forms of social relationships." Therefore, mortuary patterning must be understood as being specific to each burial and ritual context. In order to understand the burial and ritual context within a society, models and generalizations concerning burial ritual must be examined, and ethnographic studies of burial ritual and belief must be studied (Hodder 1982:152). This means that the symbolic and ideological basis behind mortuary practices must be identified. Hodder (1982:152) also suggests that because the archaeological social structure or ideology is unknown the assumption cannot be made that a lack of pattern in mortuary practices reflects an egalitarian society because the context of the mortuary ritual may be obscured.

Hodder's arguments and the problems that he sees with identifying social differentiation or status using archaeological burial data alone will have to be borne in mind as the following study is presented. It is thought that the use of formal analysis in this investigation of culture change will enable patterns to be discerned which will at least distinguish similarities and differences in mortuary treatment among the four study samples.

Archaeological Formation Processes

Schiffer (1976:27) defines formation processes as those cultural materials which cease to function in the living culture and become part of the archaeological record. It is important to recognize these processes in order to organize the funerary remains present in the archaeological record. Two major formation processes can be identified (cf. Schiffer 1976), primary depostional processes and post-depositional processes. Primary depositional processes include objects that were interred from which cultural behavior can theoretically be identified. Post-depositional processes are those changes that objects have undergone after their interment (O'Shea 1984:24).

Primary depositional processes are of three types--intentional, coincidental, and accidental. Intentional depositions in a mortuary complex are those cultural acts that are associated with formal burial. These include the type of burial pit, placement of the body in the pit, and objects purposely interred with the individual. Coincidental mortuary depositions are those objects that are not a primary focus of burial behavior, but are more or less a byproduct. An example of coincidental deposition would be the burial of an individual wearing his/her everyday clothing. The clothing may decompose, but buttons or beads may be preserved in the archaeological record. These buttons and beads were not interred for symbolic reasons, but as a part of the everyday clothing worn by the person. Accidental deposition includes midden debris deposited in the grave pit when it is being backfilled, or a musket ball or projectile point embedded in the individual. No symbolic meaning or patterning can be associated with accidental inclusions. However, information on the cause of death and about the general lifestyles of the living society can be forwarded (O'Shea 1984:24).

One obvious problem with the identification of primary depositions is determining when coincidental deposition is just that and not intentional. One aspect of aboriginal clothing identified archaeologically for the societies resident in the Piedmont of the Carolinas and Virginia are shell and bone beads sewn on clothing (J. Wilson 1983:378-385; Hammett 1987:167-183). Such artifacts, and European glass beads are found in contact-period burials, apparently having been originally sewn onto garments (Navey 1982; H. Wilson 1984). Although the presence of these items may be coincidental according to O'Shea's definition, they may have had symbolic meaning within the living society. This meaning could be determined if one sex or a particular age group within the burial population possessed certain combinations and patterns of beads. In this study, therefore, clothing remnants--shell, bone and glass beads--will be retained as an analytical unit in order to investigate such possible age/sex associations.

Post-depositional processes, which generally serve to distort relationships, also affect the archaeological record. An effort has to be made to identify the range of such processes that are exhibited by the archaeological samples that comprise each study population. Post-depositional processes can be the result of natural or cultural activities. Natural processes include decomposition of organic material such as flesh, clothing, matting, wood, and skins (O'Shea 1984:25). Thus, if matting is found preserved in one burial, we cannot assume that it was not present in other burials because differential preservation can occur between burial areas at a site. Copper salts, found in artifacts such as brass bells, also preserve organic material by retarding decomposition due to microbial activity. The remains of such fortuitously preserved items can be observed in the archaeological record. In general, then, organic materials should not be included in studies unless their preservation is not correlated with the presence of artifacts composed of copper or some other preserving agent. Otherwise, the differential occurrence of organic material in a burial population might not reflect differences in its occurrence in the living society, but the vagaries of preservation and decomposition.

Cultural disturbances include activities of the living society or a later society (O'Shea 1984:26). The activities of relic hunters in recent times is a prime example of a cultural disturbance that is very destructive and that causes the removal of particular grave associations from the archaeological record. An important consideration in mortuary analyses, therefore, is whether a burial has been disturbed by relic hunters (O'Shea 1984:26). This is just one of the natural and cultural factors that can affect archaeological contexts. The proper understanding and control of the depositional processes that form the archaeological context and the post-depositional processes that change that context are essential in any study of mortuary variability.

Problems in the Detection and Recognition of Mortuary Activities

In addition to considering the masking of mortuary activities by depositional and post-depositional processes, the representativeness of the burial sample and funerary treatments also has to be assessed (O'Shea 1984:27). The Shannon site burials are all from test squares originally excavated to delineate the palisade that originally surrounded the site. Very little of the excavation at the site has been done within the village proper that was enclosed by that palisade (see Figure 2). The population profile at the late prehistoric period Shannon site indicates that all ages and both sexes are present (see Chapter III). Therefore, in spite of the spatial bias introduced by the excavation strategy at the site, the sample is biologically representative. A biologically representative sample is considered here to mean that all age groups and both sexes are present in almost equal proportions. However, not all social categories may be represented by these burials.

The late protohistoric/early contact period Upper Saratown-Locality 2 skeletal series is also a biologically representative sample with all age groups and both sexes being present. Burials are located within the palisade at this site, and extensive excavations have been conducted in both the palisade and the main habitation areas of the site (see Figure 5). Again, not all sociel categories may be represented in the sample.

Both sites have been subjected to the destructive activities of relic hunters, Upper Saratown-Locality 2 more than the Shannon site. In the analyses that follow, this factor has been recognized and appropriate steps have been taken where necessary to insure that this factor does not introduce any bias into this study. Also, neither site has been completely excavated, so it is not possible at this time to determine if the complete range of mortuary treatment present in each society is represented archaeologically. This problem is also applicable to the Wall site sample. Only a portion of the inner palisade area has been excavated at this late prehistoric/early protohistoric period site. Conversely, the contact-period Fredricks site has been excavated almost completely, with the majority of burials being located just outside the palisade. It is possible that additional burials may be found outside the village proper by future excavations at the Fredricks site. Neither the Wall site nor the Fredricks site has a biologically representative burial sample. Therefore, the Wall and Fredricks site samples are primarily used in this study for comparison with the findings derived from the analysis of the representative burial samples from the Shannon site and Upper Saratown-Locality 2.

Given the sample limitations and biases, and the depositional and post-depositional processes that characterize the four skeletal series, it must be emphasized that the findings of this study can only be viewed as being preliminary at best. Future research on the mortuary behavior of the Indian groups of the Piedmont may benefit from this preliminary study. It is assumed here that this future research will support some aspects of this study, and probably alter others.

Research Framework

Archaeologists have traditionally ascribed two levels of sociocultural integration to the prehistoric and contact period aboriginal societies in the Southeast--tribes and chiefdoms (cf. Swanton 1946; Hudson 1976). However, seldom are explanations offered of how such levels came into being. Service (1962:113-115) notes that the reason for a tribe's existence is conflict, interpreted in this study more broadly as competition, basically for scarce resources. Tribes are defined as boundable systems of relationships whose devices for connecting members are sodalities (cross-cutting associations devoted to kinship affiliations), age grades, secret societies, and ritual congregations (Service

1962:111). The major institutions of social control are carried out by roles and egalitarian statuses that have no governmental function (Service 1962:111). Tribes are adaptive because they provide the alliance and solidarity needed to cope with a certain level of competition (Service 1962:12).

In contrast, chiefdoms are decidedly nonegalitarian, with a "chief" having the ability to plan, organize, and deploy public labor (Service 1962:150). Chiefdoms transcend tribes in two respects (Service 1962:143). They represent a denser and usually larger and more populous society made possible by greater productivity. And they are more complex and more organized. Also, redistribution by a central agent or agency is considered to be a characteristic trait of chiefdoms (Service 1962:143). This form of redistribution differs from that found in a tribe, where reciprocity is most common.

For the late prehistoric Indian societies of the central and northern Carolina Piedmont, traditionally associated with the Siouan Hill Tribes (cf. Lewis 1951), it is suggested that an egalitarian system that perhaps can be equated with a tribal level of organization is the primary form of sociocultural integration. Status in such egalitarian societies would have been achieved by an individual, and clan membership would be a primary cohesive social institution. Essentially, there would be a relatively low level of competition, and little need for a more complex social system.

With the arrival of European explorers, traders, and settlers, the cultural environment began to change drastically, with the change being associated with the protohistoric and contact periods.

European-introduced diseases were very disruptive forces during these periods (cf. Dobyns 1983). Competition related to hunting for the European skin and fur trade would have increased (cf. Waselkov 1977; Gramly 1977). Competition in the form of warfare also escalated, as the prevalence of fortified villages (Gibson 1974:133) and the conflict between the northern Iroquois and the Piedmont Indians of the Carolinas and Virginia (cf. Lawson 1967; J. Wilson 1983) readily attests.

To meet these stresses and to insure the survival of the group in this changing environment, a form of social organization more complex than the egalitarian society that characterized the prehistoric period may have been necessary. Also, with the combining of depopulated villages into aggregates during the protohistoric and contact periods, a more complex level of sociocultural integration may have been advantageous. With a more complex social organization, the mortuary remains from contact-period sites in the Piedmont should show an increased incidence of sociotechnic artifacts and perhaps reflect inherited status.

The mountains of the Southern Applachians were home to populations that possessed a level of organization that approached that of a chiefdom (cf. Dickens 1976). Service (1962:150-151) states that aspects of higher-levels of social organization, such as a chiefdom, are likely to occur among cultural systems such as tribes that are interacting with higher-level societies. This may have been the case along the Wateree/Catawba River drainages of the southern Carolina Piedmont where the local Siouan Indians, later known as the Catawba, apparently came into contact with a true chiefdom, represented by the Pee Dee Focus, which was expanding northward from the Coastal Plain during the late prehistoric period (H. Wilson 1983:38; J. Wilson 1983:572-573). It is not suggested that the Siouan Indians of the Piedmont suddenly took on a chiefdom level of social organization in the protohistoric period. It is possible, however, that artifacts traditionally associated with status in cultural systems of these two ecotones, the Coast and the Mountains, may have been co-opted as indicators of status among the Piedmont groups.

Also, it is suggested that some changes in the natural environment of a cultural system would be indicated by change in the technomic artifacts present, while a change in the social system (and cultural environment) would be mirrored by changes in sociotechnic items (Binford 1971:251). Technomic artifacts are those artifacts which have their primary functional context in coping directly with the physical environment, and include such items as projectile points, hammerstones, bone awls, bone needles, ceramic bowls, brass kettles, guns, lead shot, knives, scissors, iron hoes, brass buttons, and metal spoons (Binford 1971:251; H. Wilson 1983a:34-36). Sociotechnic artifacts are those artifacts that have their primary functional context in the socio-cultural system of a society, such as beads, gorgets, bells, and perhaps brass rings (Binford 1971:251-252; H. Wilson 1983a:35-36). Thus it could be argued that a change from few or no sociotechnic items in the mortuary complex to an increased number of such items would indicate a change from a lower level of sociocultural integration to one more possibly complex. As we move from the protohistoric period into the contact period, we would expect some of the traditional aboriginal technomic and sociotechnic artifacts to be replaced by European inspired counterparts, as well as new items. This would be the result of increased interaction with the Europeans through the skin and fur trade for such artifacts. It is also predicted that fewer European technomic artifacts with new uses (cf. Brain 1979) will have been adopted by the Indians of this period, as there is little change in their relationships with the natural environment. The European technomic artifacts used by the contact period Indians will continue to be utilized in a traditional manner, and may very well not have completely replaced the aboriginal models. Thus, the clustering of burial types from an early contact period Indian site should exhibit a higher number of European sociotechnic artifacts than European technomic and aboriginal sociotechnic artifacts. In a later contact period site, more European than aboriginal technomic items may be present.

Using statistical models, the presence of both achieved status (characteristic of a relatively egalitarian society) and ascribed or inherited status (characteristic of a stratified, and by implication, a more complex society) in the archaeological record can be investigated. For egalitarian societies, because status is achieved, status symbols among such societies would not be inherited. All ages and both sexes will be found in the burial sample from archaeological sites with such a pattern. This implies that cemeteries segregated by age and sex will be uncommon. If different locations of burials (such as public versus private) do occur, both sexes and all age groups will be represented in all locations.

Saxe (1971) suggests that in egalitarian societies achieved status will be indicated by age and sex differentials. Males will probably have more or higher status than females of the same age group. Older females will have more or higher status than younger females. Also, for each sex, there will be differential status in adult age groups. Older adults will generally have more or higher status than younger adults. Lineages and similar clan groupings may be indicated by clustering of individuals, either associated with a common structure or public area, or with similar sociotechnic artifacts, such as gorgets, being found with these burials.

In a stratified society, such as a chiefdom, where status is inherited or ascribed (Service 1962), special treatment of individuals by age and/or sex would be expected. For example, high status subadults would be afforded the same treatment as high status adults. Placement of individuals in public or private sectors should reflect discrete patterning. For example, one age group or one sex may be represented in one or the other sector in the archaeological record. It is possible that evidence of exclusive use of special mortuary paraphernalia by a segregated group within the stratified society would be found, as at Etowah (cf. Blakely and Beck 1981; Larson 1971), in Dallas sites (cf. Hatch 1976; Hatch and Geidel 1983), and Moundville (Peebles 1971; Peebles and Kus 1977). Sociotechnic artifacts, generally associated with achieved adult status in an egalitarian society, would be found with subadults and even infants in a stratified society, indicating the inheritance of the status symbolized by the artifacts.

Saxe (1971) suggests that another aspect of social organization which can be investigated is post-marital residence. The methods involved in such a study makes use of demographic data. The argument is that if more cultural and/or morphological variation is found in burials of one sex, then it is possible that these individuals came into the area from other village groups who represented different breeding populations. This might be indicated by unusual burial pit types or body orientations within the pits. A morphological trait that might indicate immigration among the study populations is cranial deformation, a culturally determined trait characteristic of the Waxhaw Indians of the southern Piedmont of North Carolina (cf. Graham 1973; Lawson 1967), and the Cherokee of the Mountains (cf. Dickens 1976).

Social Organization and Kinship in the Historical Record

The only extensive analysis of the social organization of any of the non-Catawba Indian groups of the North Carolina and Virginia Piedmont has been done by Ernst Lewis (1951). Lewis was interested primarily in the Sara Indians who lived along the Dan River in North Carolina and Virginia during the contact period. However, given the paucity of information about the Piedmont Indian groups in general, Lewis's discussion abstracts information about specific Indian groups, which seldom include the Sara, from the historical record and interprets the Siouan lifestyle at a more general level of analysis. Thus, Lewis's work provides an overview of the ethnohistorical information related to social organization available on the Indian groups of the Piedmont that have generally been thought to have been Siouan (cf. J. Wilson 1983). One problem with the study, besides its age, is the fact that some of the information that Lewis uses, primarily from the writings of John Lawson, may be applicable only to the Indian groups of the coast and coastal plain, such as the Tuscarora and Algonquians, or the socially more complex Catawba Indians of the southern Piedmont.

Basically, Lewis (1951:153) notes some separations along age lines, especially among males, within the groups that Lawson describes during his travels through the Carolinas in the winter and spring of 1701. There were different titles for "Old Man" and "Young Man", and young men would take a new name when they became warriors. Old men were the most powerful individuals in society, presumably due to their organized knowledge of religion. Lawson (1967:43) writes that "Whenever an Aged Man is speaking, none ever interrupts him" and "Old Age being held in as great veneration amongst these Heathens".

Lewis (1951:154) also suggests that there was a definite order or rank within the Siouan tribes. In his accounts of the Waxhaw Indians, Lawson (1967:43) notes that "When an English-Man comes amongst them, perhaps everyone is acquainted with him, yet first, the King bids him Welcome, after him the War-Captain, so on gradually from High to Low."

From these accounts, it appears that status in large degree was achieved in Siouan society, at least for males. Also, there is evidence that status differences existed on a tribal level. We would expect these patterns of social organization to be reflected in the mortuary profiles at sites that can be identified as Siouan in the Piedmont. Generally, older individuals should have more grave associations and reflect a status different than younger individuals, as Saxe (1971) proposes. It is suggested that these patterns will be found at the prehistoric period Shannon site and at the late protohistoric/early contact period Upper Saratown-Locality 2. However, because of the increased dependence on European trade and the increased competition/warfare of the contact period, younger males should reflect a special status due to their skills in hunting and warfare. It is proposed then that a difference in young male status will be evidenced in the late protohistoric and contact-period burial populations. More grave associations, especially of sociotechnic artifacts, will be found among late protohistoric and contact-period younger males when compared with earlier populations.

In considering residence and descent, Lawson provides numerous accounts that indicate matrilineal descent, or possibly biateral descent was (Richard Yarnell, personal communication, 1988), common among the Siouan Indians of the Piedmont. In discussing a Keyauwee Indian King, Lawson (1967:57) writes that "He got this Government by Marriage with the Queen; the Female Issue carrying the Heritage, for fear of Imposters". Succession of a status position was also matrilineal as "The Succession falls not to the King's Son, but to his Sister's Son, which is a sure way to prevent Impostors in the Succession" (Lawson 1967:205).

Generally speaking, descent among the Southeastern Indians was matrilineal, with individuals tracing their relationships to each other through the female line (Hudson 1976:185; Swanton 1946:804-805), although there were differences in this and other generalizations. It has been suggested that the matrilineal descent and matrilocal residence which characterized the Siouan Indians of the prehistoric, protohistoric, and early contact periods changed to patrilineal descent and patrilocal/neolocal residence during the middle and later contact periods (Hudson 1976:187-188; Lewis 1951:162-167). If this occurred, then it is expected that there will be a gradual change in male status through time with more males exhibiting more elaborate mortuary treatment the later in the contact period to which a population dates, relative to earlier populations. Changes in female status would be reflected in a decrease in elaborate mortuary treatment through time.

Another aspect of the social organization of the Siouan Indians of the Carolinas and Virginia that can be considered is the sexual division of labor. Males are thought to have been responsible for hunting, fishing, agriculture, construction, and conducting warfare and trade (Lewis 1951:139, 173). Females supposedly collected wild foods, prepared and preserved foods, gathered wood, and manufactured pottery, clothing, mats and baskets (Lewis 1951:139), and prepared skins (Hudson 1976:266). Hudson (1976:259) states that women were not only responsible for gathering foods but also for cultivation. Because of this sexual division of labor it follows that those technomic artifacts, the items used to cope directly with the natural environment (Binford 1971), used in the tasks outlined above will be found with burials of the sex responsible for those tasks.

Hypotheses and Research Expectations

From the consideration of the ethnohistorical data and within the research guidelines that have just been discussed, a number of hypotheses can be constructed that will guide this analysis of mortuary behavior and social organization. These several hypotheses will be tested using a variety of statistical techniques, including principal component analysis and cluster analysis. First, the hypotheses and the expectations they engender will be delineated.

Hypothesis 1: At the prehistoric Shannon site, a tribal level of social organization existed in which status was achieved.

Expectations: Older individuals will have more elaborate burial treatment.

Hypothesis 2: With European contact, a more different level of social organization developed among the Indian groups of the Piedmont to handle the increased competition present and the agglomeration of different villages.

Expectations:
a) There will be more younger individuals with a special status as evidenced by burial treatment at contact period sites relative to earlier sites.
b) A certain proportion of the subadult segment of the contact period populations will show evidence of a special status that differs from the rest of the subadults in both contact and prehistoric period populations.

Hypothesis 3: With the increased competition due to the European fur and skin trade and warfare in the late protohistoric and contact periods, young males, who will have a high value for these activities, will have a diferent status than in earlier populations.

Expectations: There will be more young males, aged 16 to 30 years, with a special status at Upper Saratown-Locality 2 and the Fredricks site.

Hypothesis 4: There will be evidence of a change from matrifocal to patrifocal orientation in society during the contact period.

Expectations:
a) In the prehistoric period populations, certain females should possess a variety of sociotechnic items that set them apart from the rest of the society and that serve as indicators of status associated with a

matrifocal orientation. Through time, these sociotechnic items or their counterparts should become associated with males as the shift to a patrifocal orientation occurs in the contact period.

b) Males should evidence an unique status when compared to females in patrifocal societies, and females will evidence ascribed status in matrifocal societies, where males will continue to evidence achieved status.

c) In matrifocal societies there should be more biological variation in males than in females within a community. In patrifocal societies there should be more biological variation in females than in males within a community.

Hypothesis 5: Given the sexual division of labor that characterized the Piedmont Indian groups, there should be a dichotomy in the various technomic artifacts found associated with each sex.

Expectations:

a) Because males are the hunters, traders, builders, and warriors, artifacts such as guns, lead shots, nails, projectile points, axes, hammerstones, etc. should be associated with male burials.

b) Because females are associated with food gathering, food preparation, horticulture, pottery making and clothing making, artifacts such as grinding stones, containers, pots, beadmaking and sewing kits, etc., should be associated with female burials.

c) Artifacts associated with farming, such as hoes, would be found with whichever sex is responsible for this task, presumably males for clearing land and females for cultivating and tending the soil.

Methods of Analysis

The analysis of mortuary treatment among the Indian groups of the North Carolina and Virginia Piedmont is modeled after O'Shea's (1984) study of three Plains Indian groups: the Arikara, Pawnee, and Omaha. Three aspects of mortuary variability as evidenced by the four study samples will be addressed; social differentiation, change through time, and possible ethnic distinction. The hypotheses just listed will provide the framework for the investigation of these three subjects. The isolation of any patterns within the data sets will be accomplished using statistical techniques. According to O'Shea (1984:65), the statistical analysis of mortuary data involves two primary operations: the discovery of relationships within the burial data, and the estimation of the significance of these relationships. The statistical procedures employed to accomplish these operations are measure of association, principal component analysis, and cluster analysis (cf. O'Shea 1984:65).

The initial step in this analysis is to determine the constraints that affect the distribution of artifacts according to age and sex groups in a population in order to understand the basic organization of the population's mortuary variation. An artifact and population segment association is considered constrained if the distribution of the artifact is perfectly consistent or occurred most frequently with one age group or one sex. For this study, the constant association of artifacts with two or more individuals in an age or sex category will be used to identify a constrained distribution.

The identification of association constraints is important for evaluating the organization that characterized the material culture of a past culture. A second technique, principal component factor analysis, is used to evaluate the covariation of sets of artifacts observed in each mortuary complex. The choice of the minimum level of occurrence for artifact types before they can be included in the principal component factor analysis is arbitrary (O'Shea 1984:66). In this study all the artifacts are included in the analysis.

For this study, the artifact types were analyzed using principal component analysis as implemented in the Procedure FACTOR of the Statistical Analysis System (SAS) (SAS Institute 1985:39-40, 336-376). Components with an eigenvalue greater than 1.0 were extracted and rotated with varimax criteria in order to simplify the columns of the factor matrix. Each variable will load strongly in either a negative or positive direction on a given factor or will load close to zero. This positive or negative loading allows the interpretation of these factors for the presence or absence of certain variables, i.e., artifacts in this case (O'Shea 1984:66). This analytical framework closely follows O'Shea's (1984:66) outline of his study of the three Plains Indian groups.

One of three generalized patterns of variable loading can be observed in the rotated factors that aid in explaining the factors (O'Shea 1984:66-67). The first is known as a grouped pattern which occurs when a group of variables load strongly (usually greater than ± 0.5) either positively or negatively against low loadings (closer to 0.0) of the remaining variables. The second pattern is bipolar, with both strong positive and negative loading characterizing the factor. This pattern reflects inverse or mutually exclusive relationships. The third pattern is termed specific, and occurs when only one variable loads either strongly positively or negatively. The specific factor pattern usually occurs in weakly structured data sets where types have low correlations (O'Shea 1984:66-67).

The primary purpose of principal component analysis is to uncover the interaction of sets of artifacts. In order to identify similarity and structure between sets of graves in a population, two different cluster procedures are used, agglomerative clustering and monothetic division (O'Shea 1984:68).

Agglomerative clustering techniques combine burials that are most similar with one another into clusters. Ward's minimum variance cluster analysis, as implemented by SAS (SAS Institute 1985:45-69, 255-315), is used in this study to progressively fuse those two clusters that result in the minimum increase in the error sum of squares (O'Shea 1984:68). The data that are clustered by Ward's method are the factor scores produced by the principal component analysis for each burial in a sample. This limits the variables included in the data set to those which were used in the principal component analysis (O'Shea 1984:68). To determine which number of clusters produced by Ward's method is the best solution, three statistical criteria are provided by SAS (SAS Institute 1985:66-67)--the cubic clustering criterion (CCC) (Sarle 1983), the pseudo F statistic (Calinski and Harabasz 1974), and a pseudo t^2 statistic, which is a transformed version of the $J_e(2)/J_e(1)$ statistic of Duda and Hart (1973). To use these statistics to decide on the best clustering solution one has to "...look for a consensus among the three statistics, that is, local peaks of the CCC and pseudo F statistics combined with a small value of the pseudo t^2 statistic and a larger pseudo t^2 for the next cluster fusion." (SAS Institute 1985:67).

The second cluster technique employed here is monothetic division, which divides the burials into clusters based on the presence or absence of a given artifact. The monothetic division technique used here is information analysis as implemented by Clustan Version 1-C (Wishart 1978). This technique employs an information measure to determine the differences between clusters (O'Shea 1984:68). O'Shea (1984:68) notes that there are objections to the use of monothetic divisive cluster techniques on formal grounds, referring to Jardine and Sibson (1971:115), but he goes on to state that Peebles (1972) and Tainter (1975a, 1975b) have successfully used the technique in the archaeological analysis of mortuary variability. The use of monothetic division is to identify major subdivisions within each population by focusing on the artifacts responsible for the divisions and on the characteristics of the created clusters (O'Shea 1984:68). To select the best cluster solution among the set of all possible solutions produced by the monothetic division analysis, Clustan's Procedure RULES, which tests statistically for a significant number of clusters (Wishart 1982:14-18), is used. Appendix C details how the Procedure Rules is implemented.

The data used to create the monothetic clusters include all attributes (artifact types) from each individual burial (cf. O'Shea 1984:68). All graves from the study samples are included in the analysis even if no artifacts are present in a burial.

Both clustering techniques are utilized because they both have certain advantages, and it is reasoned that if a similar or complimentary structure results from the use of different techniques, than the results can be interpreted with more confidence than otherwise. The agglomerative clustering analysis with its use of a data set developed from principal component analysis uses variables which occur most frequently, and weighing the variables differently in terms of importance. The monothetic division cluster technique allows all the attribute data (artifact types) to be used in constructing clusters, although it implicity assumes that variables are of equal importance and weight, which may not always be the case. Comparison of the results obtained from these two clustering techniques will result in the identification of similarities or differences between the two analyses which will serve to support or refute each other (O'Shea 1984:68-69).

It is not possible to determine which cluster procedure is "best" or the actual significance of the results of cluster analysis. Techniques of cluster analysis are useful only in providing information on the organization of the burial data sets. The interpretation of that organization must remain thematic and attempt only to discover why certain divisions in a data set occur (O'Shea 1984:69).

The following sections describe the burial remains recovered from the archaeological components at the four study sites, and interpret the patterns of artifact association as they relate to social differentiation. For each site, the burial treatment and grave associations are analyzed. Detailed information on artifact occurrence and burial characteristics are presented in Appendix A. One data set that has shown itself useful in the investigation of social organization, stature differences in population segments (cf.

Hatch 1975; Hatch and Geidel 1983), could not be used in this study because there were too few individuals for whom stature could be estimated for any of the samples to permit reliable comparisons to be made.

Mortuary Differentiation and Social Distinction at the Shannon Site

A total of 96 burials (31 males, 29 females, 2 unidentified adults and 34 subadults) from the Shannon site could be analyzed. The overall preservation of the skeletal series is quite good, and 89 of the 96 burials could be assigned to specific age groups, and sex could be determined for 60 of the 62 adults. Individual burials at the Shannon site are most often found in a flexed position (78.49% of the inhumations), with the extended position comprising 10.75% of the burials, extended with legs flexed 9.6% and secondary inhumation 1.08% (Table 31). The only differential treatment observed appears to be that subadults make up 80% of those burials in extended and extended with legs flexed positions.

No specific sex appears to be buried in one position or another. Twenty-nine males and 27 females are buried in a flexed position, and one of each sex is in an extended position. The sole secondary burial at the site is a male aged 41 to 45 years at death.

Two different undisturbed pit types are present at the Shannon site (Table 32). Simple pits account for 88 of the burials (29 males, 27 females, one unidentified adult, and 31 subadults). Only one shaft and side chamber burial pit, for a male aged 26 to 30 years at death, is present. No sex differences in the occurrence of

TABLE 31.

Association of Burial Posture with Age, Sex and Adult/Subadult Categories at the Shannon Site.

CATEGORY	FLEXED	EXTENDED	UNUSUAL	EXTENDED W/ LEGS FLEXED	TOTAL
Age in Years:					
0-2	6	5	-	8	19
3-5	2	2	-	-	4
6-10	3	-	-	-	3
11-15	5	-	-	1	6
16-20	3	1	-	-	4
21-25	4	-	-	-	4
26-30	6	-	-	-	6
31-35	5	-	-	-	5
36-40	9	-	-	-	9
41-45	3	-	1	-	4
45+	24	1	-	-	25
Subadult	-	1	-	-	1
Adult	3	-	-	-	3
TOTAL	73	10	1	9	93
Sex:					
Male	29	1	1	-	31
Female	27	1	-	-	28
Indeterminate	17	8	-	9	34
TOTAL	73	10	1	9	93
Subadult/Adult:					
Subadult	16	8	-	9	33
Adult	57	2	1	-	60
TOTAL	73	10	1	9	93

TABLE 32.

Association of Burial Pit Type with Age, Sex and Adult/Subadult Categories at the Shannon Site.

CATEGORY	SIMPLE PIT	SHAFT AND SIDE CHAMBER	DISTURBED	TOTAL
Age in Years:				
0-2	18	-	1	19
3-5	3	-	-	3
6-10	3	-	-	3
11-15	6	-	-	6
16-20	4	-	-	4
21-25	4	-	-	4
26-30	5	1	-	6
31-35	4	-	1	5
36-40	9	-	-	9
41-45	4	-	-	4
45+	25	-	-	25
Subadult	1	-	-	1
Adult	2	-	1	3
TOTAL	88	1	3	92
Sex:				
Male	29	1	1	31
Female	27	-	1	28
Indeterminate	32	-	1	33
TOTAL	88	1	3	92
Subadult/Adult:				
Subadult	31	-	1	32
Adult	57	1	2	60
TOTAL	88	1	3	92

pit types, other than this one male, are present at the Shannon site.

The orientation of the head in over 85% of the burials at the site is generally easterly--northeast, 25.26% of the population; east, 35.79%; and southeast, 24.21% (Table 33). Of the remaining burials, 10 (10.53%) individuals have their heads oriented to the south, two (2.11%) to the southwest, one (1.05%) to the west, and one (1.05%) to the northwest. No significant differences by sex are present in the orientation of the head in the Shannon site burials. However, the two individuals with heads to the west and northwest are both subadults. The two burials with heads to the southwest are both adults.

From this consideration of the formal treatment accorded the burials at the Shannon site, little difference can be discerned between the different age and sex categories in the population. The only possible distinction is that subadults are more likely to have been buried in an extended position than adults.

Artifact Occurrence

A total of 48 aboriginal artifact types can be defined for the prehistoric period burials at the Shannon site. These summary tables are listed in Appendix A. Of these 48 artifact types, eight (16.6%) show a constrained distribution by age group and/or sex category when the two or more observation criteria discussed earlier are employed. Three artifact types are constrained by age, two by sex, and three by both age and sex (Table 34). The artifact type that is found only with subadults aged 11 to 15 years at death (n=2) are deer phalange projectile points, while columella shell

TABLE 33.

Association of Grave Orientation with Age, Sex and Adult/Subadult Categories at the Shannon Site.

CATEGORY	NE	E	SE	S	SW	W	NW	TOTAL
<u>Age in Years:</u>								
0-2	4	4	9	1	-	1	1	20
3-5	2	1	1	-	-	-	-	4
6-10	-	2	-	1	-	-	-	3
11-15	1	1	3	1	-	-	-	6
16-20	-	3	1	-	-	-	-	4
21-25	1	-	2	1	-	-	-	4
26-30	2	2	1	1	-	-	-	6
31-35	1	3	-	2	-	-	-	6
36-40	3	4	-	1	1	-	-	9
41-45	3	-	-	-	1	-	-	4
45+	7	10	6	2	-	-	-	25
Subadult	-	1	-	-	-	-	-	1
Adult	-	3	-	-	-	-	-	3
TOTAL	24	34	23	10	2	1	1	95
<u>Sex:</u>								
Male	11	10	6	3	1	-	-	31
Female	6	14	4	4	1	-	-	29
Indeterminate	7	10	13	3	-	1	1	35
TOTAL	24	34	23	10	2	1	1	95
<u>Subadult/Adult:</u>								
Subadult	7	9	13	3	-	1	1	34
Adult	17	25	10	7	2	-	-	61
TOTAL	24	34	23	10	2	1	1	95

TABLE 34.

Constrained Artifact Associations in the Shannon Site Sample.

Female	Male
Columella Cylindrical Beads	Unaltered Mussel Shell
Shell Beaded Garments	Turkey Tibiotarsal Awl
	Bear Canine Beads

Subadult	Adult
Deer Phalange Projectile Point	Unaltered Mussel Shell
Columella Shell Pendants	Turtle Carapace Cup
	Turkey Tibiotarsal Awl
	Ground Stone Celt

pendants are present with three subadults aged 0 to 2 years at death. Thus, both technomic (the deer phalange projectile points) and sociotechnic (columella shell pendants) are associated with subadults.

For adult individuals, four artifact types are constrained--unaltered mussel shell, turtle carapace cups, turkey tibiotarsal awls, and ground stone celts. The turtle carapace cups and turkey tibiotarsal awls are both technomic artifacts. The ground stone celts are possibly sociotechnic artifacts, although they could be technomic as well, and the function of the unaltered mussel shell is unknown.

For females, two ornamental artifact types are constrained, columella shell cylindrical beads and shell-beaded garments, which are also shared with subadults. The problem alluded to earlier in attempting to impart meaning to the artifact types is a factor in this identification. The columella cylindrical shell beads are found with two subadults (one aged 0-2 years and one aged 11-15 years) and four adult females (one 16-20 years old, one 36-40 years old, one 41-45 years old and one 46+ years old). A total of eight individuals possess shell bead garments, six subadults (four aged 0-2 years, one aged 3-5 years, and one aged 6-10 years) and two adult females (one 26 to 30 years of age and one 46+ years of age). These two artifact types do not appear to be distributed in a manner consistent with status achieved by age. Rather, the two sociotechnic artifact types together might be indicative of individual ascribed status that distinguishes status among females that may reflect lineage associations within a matrilineal society. For now, however, a more definite statement can not be made about the columella shell cylindrical beads and shell-beaded garments than that the shell beads are sociotechnic ornamental items of some kind.

The three artifact types constrained to males are also constrained by age. In all cases, the males (n=4) with these artifacts are more than 45 years old. The three artifacts include unaltered mussel shell (function unknown), turkey tibiotarsal awls (technomic artifact), and bear canine beads (sociotechnic ornamental with ideotechnic overtones). The bear canine beads (and other isolated bear remains at the Shannon site) may be part of a bear ceremonialism in the society, a ceremonialism that many researchers (Guilday et al. 1962; Hallowell 1926; Parmalee 1959; Parmalee et al. 1972; Runquist 1979; Skinner 1919) have speculated existed among the Indian societies of the eastern United States.

Principal Component Analysis

The data used in the principal component analysis of the Shannon site's mortuary complex include all the undisturbed graves at the site. This sample is composed of 96 burials and includes 41 distinct artifact types as variables. The principal component analysis identified 16 factors, which are summarized in Table 35 and listed in Appendix B, with eigenvalues greater than 1 and a total variance of 34.31 for the original dataset. Three of these 16 factors account for about 50% (17 of 34.31) of this total variance. All three of these factors exhibit grouped patterns with strong positive loadings for several artifact types.

Factors 1 and 2 show a strong male orientation. In fact, in all but three of the cases, the artifacts isolated in these two

TABLE 35.

Summary of the Factor Analysis Pattern for the Shannon Site Sample.

FACTOR #	LOADING PATTERN	VARIANCE EXPLAINED	DIAGNOSTIC POSITIVE LOADINGS
1	grouped	7.7 (22.4%)	unaltered mussel shell M+ <
			turkey tibiotarsal awl M+ <
			beaver incisor chisel M+ * <
			deer longbone chisel M+ * <
			deer bone flaker M+ * <
			chipped stone projectile point
			chipped stone drill M+ * <
			ground stone celt + <
			stone abrader M+ * <
			raw/hammered native copper M+ * <
2	grouped	6.8 (19.8%)	unaltered mussel shell M+ <
			turtle carapace cup +
			turkey tibiotarsal awl M+ <
			eagle talon beads M+ * <
			deer longbone beads M+ * <
			elk tooth beads M+ * <
			chipped stone scraper M+ * <
			stone pendant M+ * <
			rock crystals MSA
3	grouped	2.5 (7.3%)	olive shell beads - *
			mountain lion claw beads
			deer phalange projectile point -
			chipped stone projectile point
4	grouped	1.7 (5.0%)	marginella shell beads
			columella shell pendants -
			turkey coracoid beads FSA
5	grouped	1.7 (5.0%)	columella cylindrical beads FSA
			turkey longbone tube beads
			stone/rock -*
6	grouped	1.6 (4.7%)	wolf canine beads -*
			rock crystals MSA
7	grouped	1.5 (4.4%)	bear canine beads MSA
			bear mandible M+*<
8	grouped	1.5 (4.4%)	columella small disc beads
			chipped stone blade M+*
9	grouped	1.4 (4.1%)	turtle carapace cup +
			turkey digit beads M+*<

TABLE 35. (continued)

FACTOR #	LOADING PATTERN	VARIANCE EXPLAINED	DIAGNOSTIC POSITIVE LOADINGS
10	grouped	1.3 (3.8%)	turkey tibiotarsal awl M+< clay pipe M+*
11	grouped	1.2 (3.5%)	columella tube beads bone hairpin F+*
12	bipolar	1.0 (2.9%)	hammerstone (positive loading) M+*< deer bone beads (negative loading) -*
13	specific	1.0 (2.9%)	rolled native copper bead -*
14	specific	1.0 (2.9%)	clay pot -*
15	specific	1.0 (2.9%)	chipped stone knife M+*<
16	specific	1.0 (2.9%)	deer bone fishhook M+*

Constraints:

+ adult only	M male only	MSA males & subadults	< males 45+ years
- subadult only	F female only	FSA females & subadults	* (n=1)

factors are associated only with males older than 45 years of age. Factor 1 includes only technomic artifacts, some of which (awls, chisels, flakers, projectile points, and drills) are indicative of tool assemblages used in hunting and tool manufacture. Factor 2 includes both sociotechnic ornamental artifacts which are found only with males over 45 years of age (elk tooth beads and stone pendant), and technomic artifacts associated with working leather (awls and stone end scraper). Only three artifacts in Factor 2 cannot be associated with one of these two categories. One of these unassigned artifacts, unaltered mussel shell, is unique to males over the age of 45, but two others, turtle carapace cup and rock crystals, are shared by the oldest males with other segments of the population, including a small number of younger males, females and subadults.

Factor 3 combines sociotechnic ornamental items associated with a select number of adults (male and female) and subadults (mountain lion claw beads) and only a subadult (olive shell beads), and technomic hunting artifacts unique to subadults (deer phalange projectile point) and technomic hunting artifacts found with both adults and subadults (chipped stone projectile points). The third factor represents a more general grouping that includes a number of males and subadults, but only one female.

Factor 4 has a grouped pattern and consists of ornamental artifacts, of which only one is constrained by age. Columella shell pendants are found only with subadults. The other two artifact types are marginella shell beads and turkey coracoid beads. The marginella shell beads are found in male (n=2) and female (n=6) adult burials as well as subadult burials (n=8). Turkey coracoid beads are found only in female (n=1) and subadult (n=1) burials.

Factor 5, which also has a grouped pattern, is composed of two ornamental sociotechnic artifacts (columella cylindrical beads and turkey longbone beads) and a possible technomic artifact (a stone/rock). The columella cylindrical beads are found only with females (n=4) and subadults (n=2). The turkey longbone beads are found with males (n=1), females (n=2) and subadults (n=2). The possible technomic artifact, a stone/rock, is present in one subadult burial.

Factor 6 has a grouped pattern composed of wolf canine beads (a sociotechnic ornamental artifact) and rock crystals (a possible sociotechnic artifact). The wolf canine beads are found with one subadult. The rock crystals are found with one adult male aged 46+ years and one subadult.

Factors 7 and 9 are grouped and have at least one artifact that is associated with a male over 45 years old. Factor 7 consists of a sociotechnic ornamental artifact, bear canine beads, found with males aged 46+ years (n=2) and with subadults (n=2), and a sociotechnic artfact, a bear mandible, found with a male aged 46+ years (n=1). Factor 9 has a technomic artifact, a turkey carapace cup, constrained to adults (n=3, two males and one female), and a sociotechnic ornamental artifact, turkey digit beads, found with one male aged 46+ years.

The artifacts in grouped Factor 8 are sociotechnic columella small disc shell beads and a technomic chipped stone blade. The former are found with females (n=3), males (n=1) and subadults (n=1), and the latter is found with an adult male.

Factor 10 possesses grouped artifacts, turkey tibiotarsal awl and clay pipe, that are associated with males more than 45 years old. The turkey tibiotarsal awl has a constrained distribution with such males (n=4), while the sole occurrence of a clay pipe is with a male 46+ years.

Factor 11 has a grouped pattern. The artifacts in this factor, columella shell tube beads and a bone hairpin, are both sociotechnic. Columella shell tube beads are found with males (n=3), females (n=5), and subadults (n=6). The bone hairpin is associated with one female aged 16 to 20 years at death.

Factor 12 has the only bipolar loading pattern for the Shannon site sample. This factor consists of a negative loading for deer bone beads, which are a sociotechnic ornamental artifact found with one subadult, and a positive loading for a hammerstone, a technomic artifact associated with a single adult male aged greater than 45 years at death.

Factors 13, 14, 15 and 16 are all characterized by specific loading patterns. The sociotechnic ornamental artifact, a rolled native copper bead, in Factor 13 is found with a single subadult burial, as is the technomic artifact, a clay pot, in Factor 14. Males are associated with the technomic artifacts that comprise Factors 15 and 16. The chipped stone knife of Factor 15 is associated with a male aged greater than 45 years. And Factor 16 consists of a deer bone fishhook found with a male 41 to 45 years old.

Overall, the results of the factor analysis appear to emphasize the male role within the Shannon site population. Males are distinctly separated from females by the distribution of technomic artifacts used in hunting, tool and bead manufacturing, and possible leather working. The fact that the artifacts found in Factors 1 and 2 all occur with males over 45 years of age supports the observation that status may have been achieved among males in the Shannon site society. No females stand distinct from any segment of the population when the results of the factor analysis of the artifact associations are considered. However, Factor 5 indicates that columella shell cylindrical beads, which are found only with adult females (n=4) and subadults (n=2) might set apart certain females and subadults from the rest of the population. This pattern has previously been discussed in the earlier section on the Artifact Occurrence at the Shannon site. Also, the inclusion of turkey longbone tubular beads, which are found with one male, two female and two subadult burials, in this factor obscures the meaning of this factor grouping.

Agglomerative Clustering

Applying Ward's minimum variance cluster analysis to the factor scores produced by the principal component analysis for each burial at the Shannon site, a 16 cluster solution was determined to be the best ordering of the data according to the results of the pseudo T^2 statistic (see Appendix C). These clusters are summarized by Table 36. The overall clustering pattern suggests a strong orientation toward achieved male status with some associated subadult clustering. Clusters 15 and 16 both represent males over the age of

TABLE 36.

Summary Description of the 16 Groupings Defined by the Agglomerative Cluster Analysis for the Shannon Site Sample.

Cluster 1:	Number of Individuals	2
	Number of Males	0
	Number of Females	1
	Number of Adults	1
	Number of Subadults	1
Cluster Members:	49, 98.	
Cluster 2:	Number of Individuals	76
	Number of Males	22
	Number of Females	28
	Number of Adults	51
	Number of Subadults	25
Cluster Members:	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, 35, 36, 38, 39, 40, 44, 46, 47, 48, 50, 51, 53, 54, 55, 57, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 78, 79, 80, 81, 83, 84, 85, 86, 87, 88, 89, 90, 91, 93, 94, 95, 97.	
Cluster 3:	Number of Individuals	5
	Number of Males	3
	Number of Females	0
	Number of Adults	3
	Number of Subadults	2
Cluster Members:	25, 37, 56, 58, 99.	
Cluster 4:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	6.	
Cluster 5:	Number of Individuals	1
	Number of Males	0
	Number of Females	1
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	75.	
Cluster 6:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	77.	

TABLE 36. (continued)

Cluster 7:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	61.	
Cluster 8:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	43.	
Cluster 9:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	92.	
Cluster 10:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	34.	
Cluster 11:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	41.	
Cluster 12:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	18	
Cluster 13:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
Cluster Members:	52.	

TABLE 36. (continued)

Cluster 14:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	82.	
Cluster 15:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	4.	
Cluster 16:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
Cluster Members:	45.	

45 that have numerous sociotechnic and technomic artifact associations. A third male aged more than 45 with both technomic and sociotechnic artifacts comprises Cluster 12. Clusters 9 and 14 are also males over 45 years of age, but they have only technomic artifacts. Cluster 7 is a male aged 41 to 45 years that likewise has only technomic artifacts. Cluster 3 is composed of three males (one aged 31-35 years and two aged 45+ years) and two subadults aged 0 to 2 years. This cluster has primarily sociotechnic ornamental artifacts with a heavy loading toward artifacts manufactured from bear (*Ursus americanus*) remains.

Females dominate two clusters, numbers 1 and 5. Cluster 1 has one adult female and one subadult aged 11 to 15 years of age, and both possessed only a single technomic item, a hammerstone. Cluster 5 is a young female aged 16 to 20 who possesses only a bone hairpin.

Subadults aged 11 to 15 years of age comprise Clusters 8 and 10. The burial in Cluster 8 has only a technomic artifact associated with it, a clay pot. Cluster 10 has both technomic and sociotechnic ornamental artifact associations. Clusters 11 and 13 are both individuals aged 6 to 10 years at death that have sociotechnic ornamental grave associations. Subadults aged 0 to 2 years are found in Clusters 4 and 6, and both these clusters possess only sociotechnic ornamental objects.

Cluster 2 represents the mass of the population, and is composed of both sexes and all age groups. The artifact associations of this group range from no artifacts present in the burial to a small number of technomic and sociotechnic items being found.

To summarize the results of the agglomerative clustering technique, adult males over the age of 45 stand out from the population and are interpreted to represent a segment of the population with special status at the Shannon site. The wide range of both technomic and sociotechnic artifacts associated with the clusters that are formed by these old males appear to indicate that this status was achieved. Clusters of a small number of subadults aged 0 to 10 years of age have primarily sociotechnic ornamental artifacts. Clusters of a small number of slightly older subadults (11 to 15 years of age) are divided between those with only technomic artifacts and those with both technomic and sociotechnic items. The agglomerative analysis clusters that possess females do not have strong sociotechnic artifact associations, which tentatively suggests that females had little achieved or ascribed status in the society.

<u>Trace Element Assays and the Agglomerative Cluster Results</u>

Table 37 presents the trace element assays for the adults in each of the 16 clusters produced by the agglomerative clustering techniques. The lowest strontium level is exhibited by Cluster 16 (a male aged 46+), followed closely by Cluster 2 (the mass of the sample). The lowest zinc level, however, is found in Cluster 12, with the highest levels of zinc appearing in Clusters 9 and 14 (both are males aged 46+). The large number of individuals in the sample that comprise Cluster 2 have a mean zinc level of 196 ppm. Except for Cluster 12 (a male aged 46+), all the clusters have higher zinc levels than Cluster 2. Also, all the clusters except

TABLE 37.

Average Adult Trace Element Assays by Cluster for the Agglomerative Cluster Analysis of the Shannon Site Sample.

AGGLOMERATIVE CLUSTER #	n	STRONTIUM	MAGNESIUM	ZINC	COPPER
1	1	-	-	-	-
2	43	350	1184	196	8
3	2	468	1586	241	-
4	0	-	-	-	-
5	1	-	-	-	-
6	0	-	-	-	-
7	1	384	1220	247	0
8	0	-	-	-	-
9	1	374	1218	326	47
10	0	-	-	-	-
11	0	-	-	-	-
12	1	407	1383	104	0
13	0	-	-	-	-
14	1	486	1159	345	12
15	1	421	1139	244	6
16	1	345	976	211	0
Sample Mean	51	360	1200	204	8.3

for 2 and 12 (an adult male aged 46+) are above the sample mean for zinc.

From the survey of the mean strontium trace element levels by cluster, it does not appear that older males had preferential access to meat, with lower levels of strontium being equated with more meat in a diet. The zinc levels, however, are higher in a number of the clusters with males aged 46+ years than the mean for the sample as a whole and the mass of the burial sample in Cluster 2. This indicates that some at present unidentified protein source is being tapped by a select number of the males aged 46+, indicating that these individuals may have had a diet that differed from the rest of the Shannon site burial sample.

Monothetic Division Cluster Analysis

A total of 96 burials and 42 artifact types were included in the monothetic division cluster analysis of the Shannon site skeletal series. A total of 11 clusters was selected as being the best division of the sample given the artifacts present based on the results of Clustan's Procedure Rules (see Appendix C). Table 38 and Figure 9 provide a summary of these 11 clusters.

Cluster I, the first cluster formed, is composed of those individuals with no artifacts. The remaining individuals with artifacts were subdivided into those individuals with turkey tibiotarsal awls and those without this artifact type. The individuals with tibiotarsal awls were further subdivided into those with columella beads (Cluster II) and those with no columella beads. This latter group of individuals was divided again into individuals

TABLE 38.

Summary Description of the 11 Groupings Defined by the Monothetic Cluster Analysis for the Shannon Site Sample.

Cluster I:		Number of Individuals 46
		Number of Males 17
		Number of Females 16
		Number of Adults 34
		Number of Subadults 12
		Number of Unidentified 1
	Cluster Members:	2, 3, 7, 9, 13, 14, 19, 21, 23, 24, 27, 28, 30, 31, 33, 35, 36, 38, 39, 40, 44, 47, 50, 53, 54, 55, 57, 62, 64, 66, 67, 69, 70, 71, 76, 78, 79, 80, 81, 83, 84, 85, 87, 89, 90, 91.
	Attributes Common to all Members:	No artifact associations.
Cluster II:		Number of Individuals 1
		Number of Males 1
		Number of Females 0
		Number of Adults 1
		Number of Subadults 0
		Number of Unidentified 0
	Cluster Members:	45.
	Attributes Common to all Members:	columella shell tube beads, unaltered mussel shell, turkey tibiotarsal awl, beaver incisor chisel, deer longbone chisel, deer bone flaker, chipped stone projectile point, chipped stone drill, ground stone celt, stone abrader, raw/hammered native coppr.
Cluster III:		Number of Individuals 6
		Number of Males 1
		Number of Females 3
		Number of Adults 4
		Number of Subadults 2
		Number of Unidentified 0
	Cluster Members:	1, 11, 15, 51, 59, 68.
	Attributes Common to all Members:	marginella shell beads, columella shell tube beads.
Cluster IV:		Number of Individuals 7
		Number of Males 1
		Number of Females 2
		Number of Adults 3
		Number of Subadults 4
		Number of Unidentified 0
	Cluster Members:	8, 26, 37, 48, 73, 75, 97.
	Attributes Common to all Members:	columella shell tube beads.

TABLE 38. (continued)

Cluster V:	Number of Individuals	1
	Number of Males	1
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	4	
Attributes Common to all Members:	unaltered mussel shell, turtle carapace cup, turkey longbone beads, turkey tibiotarsal awl, eagle talon beads, deer longbone awl, elk tooth beads, chipped stone end scraper, stone pendant, rock crystal.	
Cluster VI:	Number of Individuals	4
	Number of Males	1
	Number of Females	1
	Number of Adults	2
	Number of Subadults	2
	Number of Unidentified	0
Cluster Members:	34, 60, 65, 72.	
Attributes Common to all Members:	mountain lion claw beads.	
Cluster VII:	Number of Individuals	3
	Number of Males	0
	Number of Females	1
	Number of Adults	1
	Number of Subadults	2
	Number of Unidentified	0
Cluster Members:	6, 63, 95.	
Attributes Common to all Members:	columella cylindrical beads.	
Cluster VIII:	Number of Individuals	2
	Number of Males	2
	Number of Females	0
	Number of Adults	2
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	18, 82.	
Attributes Common to all Members:	turkey tibiotarsal awl.	

TABLE 38. (continued)

Cluster IX:	Number of Individuals	3
	Number of Males	2
	Number of Females	0
	Number of Adults	2
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	25, 56, 99.	
Attributes Common to all Members:	bear canine beads.	
Cluster X:	Number of Individuals	10
	Number of Males	1
	Number of Females	3
	Number of Adults	4
	Number of Subadults	6
	Number of Unidentified	0
Cluster Members:	10, 12, 16, 17, 20, 52, 74, 86, 93, 94.	
Attributes Common to all Members:	marginella shell beads.	
Cluster XI:	Number of Individuals	13
	Number of Males	4
	Number of Females	4
	Number of Subadults	5
	Number of Unidentified	0
Cluster Members:	5, 15, 22, 29, 41, 43, 46, 49, 58, 61, 88, 92, 98.	
Attributes Common to all Members:	None (left over individuals with artifacts).	

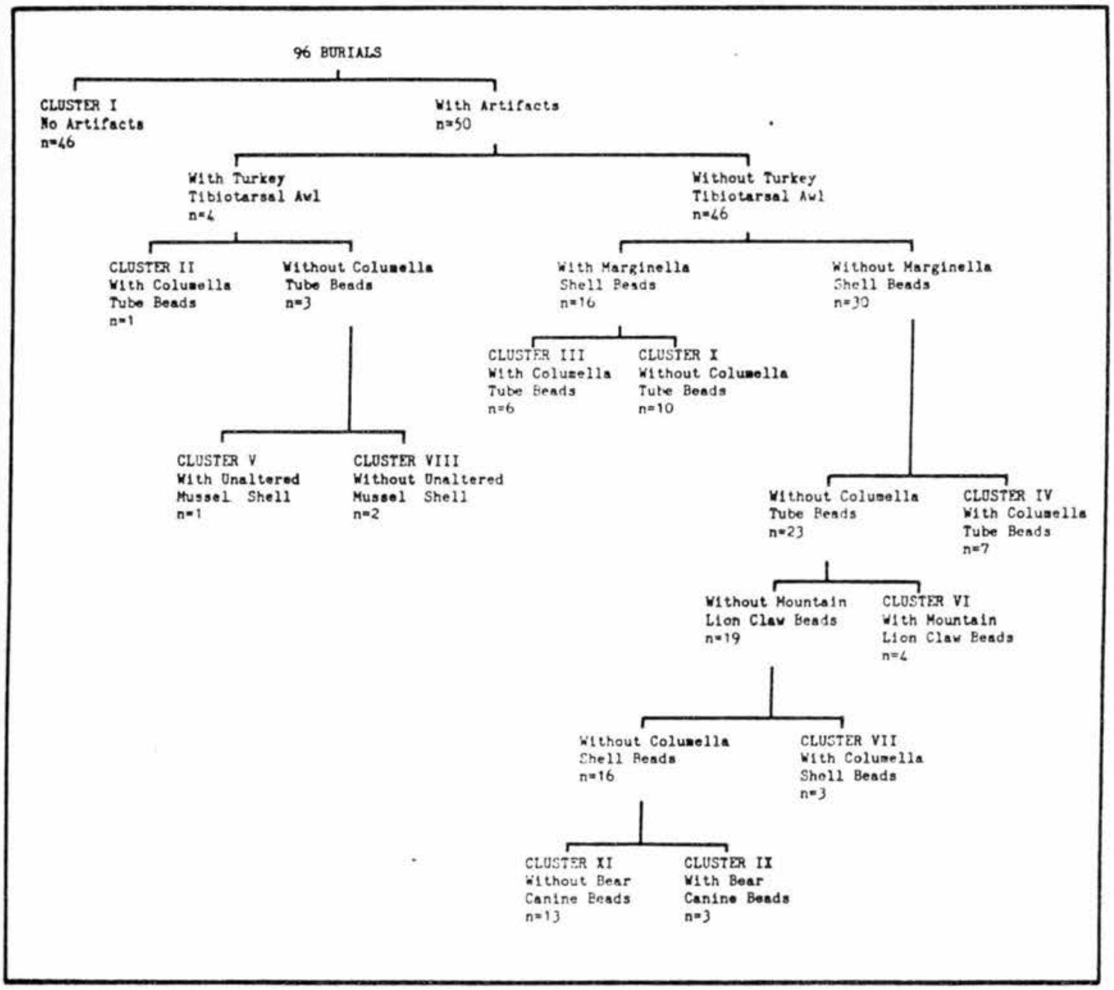

Figure 9. Monothethic division clusters produced for the artifacts associated with the Shannon site burials.

with unaltered mussel shell (Cluster V), and those without unaltered mussel shell (Cluster VIII).

The segment of the sample that did not have turkey tibiotarsal awls eventually were divided into seven more clusters, with the initial separation occurring for those with and those without marginella shell beads. The individuals with marginella shell beads divided into a group with columella tube beads (Cluster III), and a group without this artifact (Cluster X). The group without marginella beads was also divided on the basis of columella tube beads into a group with this artifact (Cluster IV) and those without. This without segment was split into a group with mountain lion claw beads (Cluster VI) and without mountain lion claw beads. The presence of columella cylindrical beads split off Cluster VII from the group without mountain lion claw beads. The final division in the sample was of this group without mountain lion claw beads into a group with bear canine beads (Cluster IX) and a group without bear canine beads (Cluster XI).

Examining these 11 clusters and the artifacts that are responsible for the clustering, there is a definite division in the Shannon site sample according to age and sex characteristics. Clusters II, V, and VII all contain turkey tibiotarsal awls and are all males aged 46+. Cluster IX is composed of two males over the age of 45, and a subadult aged 0 to 2 years. These three individuals in Cluster IX all have bear canine beads. Males over the age of 45 are associated with turkey tibiotarsal awls and bear canine beads. The awl is assumed to be a technomic artifact used to sew garments, to attach beads to garments, and perhaps to work the beads themselves. Bear canine beads are considered to be sociotechnic artifacts.

Females of all ages and subadults appear in clusters that are formed on the basis of the presence of sociotechnic ornamental artifacts manufactured of shell (Clusters III, IV, VII and X). It is interesting to note that 11 of the 13 subadults in Clusters III, IV, VII and X are 2 years of age or less. Cluster VI is unusual in that it includes one male and one female, both aged 36 to 40, and two subadults, one aged 0-2 years and the other 11-15 years. The four individuals in this cluster all possess mountain lion claw beads.

The only cluster that possesses no males, only females (n=1) and subadults (n=2), is Cluster VII. This cluster is separated by the presence of columella shell cylindrical beads, an artifact type which has previously been shown to have a constrained relationship with females and subadults. Only one of the four females with this artifact are included in Cluster VII, the other three being separated from the rest of the sample previously by the presence of columella shell tube beads (n=2) and marginella shell beads (n=1) into clusters that possess males and subadults.

The results of the monothetic division cluster analysis indicate that males dominate those clusters that evidence a pattern of artifact association different from the vast majority of the sample. This domination may indicate a special status for certain males relative to other segments of the sample. Clusters II, V, VIII, and IX vividly illustrate this pattern. Technomic artifacts in the form of tibiotarsal awls characterize Clusters II, V, and VII, and Cluster IX has a sociotechnic item, bear canine beads, that sets it apart from the other clusters. Females of all ages and subadults 0 to 2 years of age are associated with sociotechnic shell ornamental artifacts, as Clusters III, IV, VII and X show. However, males also possess sociotechnic shell ornamental artifacts, indicating that while females and young subadults are associated with shell artifacts, shell artifacts are not necessarily solely associated with females and young subadults. The tentative identification of columella cylindrical shell beads and shell-beaded garments as possible indicators of a special status for certain females earlier in this section is not corroborated by the monothetic division cluster analysis.

Shannon Site Social Organization

The combined results of the agglomerative and monothetic division cluster analyses of the Shannon site skeletal series indicates that there are distinct patterns of mortuary status present in the society. The propositions that status is achieved in the society, and that an egalitarian form of social organization similar to what might be called a tribe is present, are supported by males aged more than 45 years being associated with distinct artifacts of both technomic and sociotechnic function (see Tables 34 and 35).

Cluster IX of the monothetic division analysis consists of two males aged 46+ and one subadult aged 0 to 2 years that possessed bear canine beads. Swanton (1946:661) notes that Bear clans are commonly found among the Indian groups of the Southeast. It was discussed previously in this work that a number of researchers

(Guilday et al. 1962; Hallowell 1926; Parmalee 1959; Parmalee at al. 1972; Skinner 1919) have identified the presence of bear ceremonialism among the Southeastern Indians. Runquist (1979:141-146) goes so far as to suggest that bear ceremonalism was common among the prehistoric period Indians, but gradually disappeared with European contact. The presence of subadults within Cluster IX may be indicative of clan relationships in which membership is gained at birth. Likewise, Cluster VI with its mountain lion claw beads might represent another clan, that of the panther, within the society (cf. Swanton 1946:661).

The distinct status evidenced by older males and the lack of any corresponding distinct special status for females leads to the conclusion that the social structure that characterized the Shannon site society is dominated by males. Males in general are associated with technomic artifacts used for hunting, working leather and horticulture, and a number of sociotechnic artifacts as well. Females are associated primarily with a few sociotechnic ornamental artifacts. This generalization related to the sexual division of labor further emphasizes the importance of males over females in the Shannon site society. Columella cylindrical shell beads and shell-beaded garments may indicate status among females at the Shannon site. There is no evidence of achieved status for females, that is there are no group of older females possessing unique artifacts, and there is little evidence for ascribed status that might be tied to importance within a lineage in a matrifocal society.

Mortuary Differentiation and Social Distinction at the Wall Site

Only eight burials comprise the skeletal sample analyzed from the late prehistoric/early protohistoric Wall site. Given the small size of the sample, no statistical analyses could be performed. Instead, the data produced by the analysis of the Wall site sample can be used only for comparison with trends and patterns delineated by the study of the two more representative samples.

Preservation of the Wall site burial series is good for adults (n=3), but is poor for subadults (n=4). A total of nineteen artifact types are associated with this sample (see Appendix A). The three adults are males, meaning that no female adults are present in the sample. All eight burials are primary interments, and, with one exception, a burial with an indeterminate position, all have a flexed position (Table 39). Simple pits and shaft-and-side-chamber pits are the two burial pit types present at this site (Table 40). A total of two individuals, one subadult and one of the adult males, have simple pits, and the other six individuals (four subadults and two adult males) have the shaft and side chamber variety. In general, the orientation of the head within the burials (Table 41) is to the northeast (n=3). There is also one individual each with their heads to the east, southeast, and southwest. The other two burials have an indeterminate head orientation.

Artifact Occurrence

At this time, very few valid comments can be offered concerning the artifact associations that characterize the Wall site mortuary complex. Bearing in mind that the population sample from the Wall

TABLE 39.

Association of Burial Posture with Age and Adult/Subadult Categories at the Wall Site.

CATEGORY	FLEXED	INDETERMINATE	TOTAL
Age in Years:			
0-2	2	2	4
3-5	1	-	1
21-25	1	-	1
46+	2	-	2
TOTAL	6	2	8
Subadult/Adult:			
Subadult	3	2	5
Adult	3	-	3
TOTAL	6	2	8

TABLE 40.

Association of Burial Pit Type with Age and Adult/Subadult Categories at the Wall Site.

CATEGORY	SIMPLE PIT	SHAFT AND SIDE CHAMBER	TOTAL
Age in Years:			
0-2	1	3	4
3-5	-	1	1
21-25	-	1	1
46+	1	1	2
TOTAL	2	6	8
Subadult/Adult:			
Subadult	1	4	5
Adult	1	2	3
TOTAL	2	6	8

TABLE 41.

Association of Grave Orientation with Age and Adult/Subadult Categories at the Wall Site.

CATEGORY	NE	E	SE	SW	INDETERMINATE	TOTAL
Age in Years:						
0-2	1	-	-	1	2	4
3-5	-	-	1	-	-	1
21-25	1	-	-	-	-	1
46+	1	1	-	-	-	2
TOTAL	3	1	1	1	2	8
Subadult/Adult:						
Subadult	1	-	1	1	2	5
Adult	2	1	-	-	-	3
TOTAL	3	1	1	1	2	8

site is not representative, the following observations can be made. Using the constrained criterion of association with two or more burials of the same population segment, columella shell gorgets and rolled copper beads occur only with subadults. The shell gorgets present are similar to those found in southwestern Virginia, including the Shannon site, but differ from those found in the interior southwest of the Roanoke River (Hammett 1987:169; Sizemore 1984:6-11).

Although not a constrained relationship, among the adult males clay pipes (n=1) and serrated mussel shell (n=1) are found only with individuals aged 46+ (n=2), who have no shell beads of any type associated with them. The pattern for the small subadult sample is similar to that for the Shannon site subadults. The occurrence of mussel shell and clay pipes with older adult males at the Wall site also parallels what is found at the Shannon site. What is different is that no sociotechnic ornamental artifacts occur with the males older than 45 years at the Wall site, whereas such artifacts are common in this age group at the Shannon site. Both sociotechnic ornamental and technomic artifacts are present in the one Wall site male burial that is aged 21 to 25 years at death, and in the subadult burials.

Wall Site Social Organization

There are no older males at the Wall site that have the artifact associations indicative of the special achieved status that is characteristic of the few older males at the Shannon site. Instead, the older males at the Wall site are more like the older males at the Shannon site that have technomic associations. In the

Wall site sample, the young male 21 to 25 years old exhibits the most unique status according to the technomic and sociotechnic artifact associations present. What these few characterizations indicate is that the sample is inadequate to provide a basis for conducting the same kind of indepth study that could be done for the Shannon site, and more work is needed at this site and related sites to explore fully the status relationships that characterized the Wall site society.

Mortuary Differentiation and Social Distinction at Upper Saratown-Locality 2

A total of 111 analyzed burials comprise the late protohistoric/early contact period sample at Upper Saratown-Locality 2. All age groups are represented in the sample, and 46 of the 60 adults could be accurately sexed (25 males and 21 females). The normative burial treatment accorded the majority of the individuals in the sample (n=93) is a flexed primary position (Table 42). One male exhibits an unusual position (lying on the back with the legs crossed in a squatting position), and two males have an extended position with their legs flexed (both are in a double interment with each other). One adult individual of indeterminate sex is in an extended position. Posture could not be determined for 14 of the burials. In summary, the only variation from the normative flexed body position is found in adult burials, primarily of males, as all the subadults exhibit a flexed posture.

Pits present at Upper Saratown-Locality 2 (Table 43) can be divided into five categories--simple pit, shaft and side chamber, shaft and central chamber, reused storage pit, and disturbed

TABLE 42.

Association of Burial Posture with Age, Sex and Adult/Subadult Categories at Upper Saratown-Locality 2.

CATEGORY	FLEXED	EXTENDED	UNUSUAL	EXTENDED W/ LEGS FLEXED	INDETERMINATE	TOTAL
<u>Age</u> <u>in</u> <u>Years</u>:						
0-2	6	-	-	-	1	7
3-5	17	-	-	-	1	18
6-10	13	-	-	-	1	14
11-15	2	-	-	-	1	3
16-20	4	-	-	1	-	5
21-25	1	-	-	-	-	1
26-30	15	1	-	-	1	17
31-35	6	-	-	-	-	6
36-40	4	-	-	-	3	7
41-45	4	-	1	1	-	6
45+	8	-	-	-	1	9
Unid. Subadult	1	-	-	-	1	2
Unid. Adult	8	-	-	-	1	9
TOTAL	93	1	1	2	14	111
<u>Sex</u>:						
Male	18	-	1	2	4	25
Female	20	-	-	-	1	21
Indeterminate	55	1	-	-	9	65
TOTAL	93	1	1	2	14	111
<u>Subadult/Adult</u>						
Subadult	39	-	-	-	5	44
Adult	50	1	1	2	6	60
TOTAL	89	1	1	2	11	104

TABLE 43.

Association of Burial Pit Type with Age, Sex and Adult/Subadult Categories at Upper Saratown-Locality 2.

CATEGORY	SIMPLE PIT	SHAFT AND SIDE CHAMBER	CENTRAL CHAMBER	DISTURBED	STORAGE PIT	TOTAL
Age in Years:						
0-2	5	-	2	-	-	7
3-5	6	3	8	1	-	18
6-10	7	2	5	-	-	14
11-15	1	-	1	1	-	3
16-20	-	2	1	-	1	4
21-25	-	-	1	-	-	1
26-30	3	-	14	-	-	17
31-35	-	1	5	-	-	6
36-40	3	-	4	-	-	7
41-45	-	2	4	-	-	6
45+	2	2	5	-	-	9
Unid. Subadult	1	-	-	1	-	2
Unid. Adult	1	-	3	3	-	7
Indeterminat	1	-	3	3	-	7
TOTAL	30	12	60	7	1	110
Sex:						
Male	4	1	19	-	-	24
Female	4	6	10	-	1	21
Indeterminate	22	5	31	7	-	65
TOTAL	30	12	60	7	1	110
Subadult/Adult						
Subadult	20	5	16	3	-	44
Adult	9	7	41	1	1	59
TOTAL	29	12	57	4	1	103

(potted). Of the four undisturbed pit types, 49% (n=20) of the subadults are buried in simple pits, 39% (n=16) in shaft and central chamber pits, and 12% (n=5) in shaft and side chamber pits. No subadults appear to have been buried in reused storage pits. Adults as a whole are most often found in shaft and central chamber pits (71%), followed by simple pit (15%), shaft and side chamber (12%), and finally, a reused storage pit (2%). There does not appear to be any association between pit type and a specific age group at Upper Saratown-Locality 2.

Comparing subadults to adults, there does appear to be some difference between the two in the type of pit in which they are buried, with more subadults being found in simple pits and more adults in shaft and central chamber pits. A factor that may affect this pattern is that plowing has removed approximately the top foot of most of the burial pits at the site. Because subadult pits are shallower (and smaller) than adult burial pits, more of the former may have had the ledges indicative of a shaft and central pit plowed away, which would bias the resulting subadult pit type sample in favor of simple pits. For now there is no way to control for this potential bias.

Considering sex and pit type association, 79% (n=19) of the males are buried in shaft and central chamber pits, 17% (n=4) of the males in simple pits, and 4% (n=1) in shaft and side chamber pits. Females vary with only 47% (n=10) in shaft and central chamber pits, 19% (n=4) in simple pits, 29% (n=6) in shaft and side chamber pits, and 1% in a reused trash pit. Although shaft and central chamber pits are the preferred pit type for males and females, a great many more males than females by count and percentage are associated with this type. The shaft and side chamber pit type accounts for the rest of the major difference by sex, with a greater percentage and number of females than males being interred in this pit type.

Orientation of the burials is generally to the east, with both subadults and adults represented in all the east categories (Table 44). However, twice as many adults (n=14) as subadults are oriented to the southeast. Both one subadult and one adult are oriented to the south, and two adults have their heads oriented to the west. No specific age group and neither sex appears to be associated with a particular head orientation at Upper Saratown-Locality 2.

Considering all these aspects of funerary treatment, the only distinctions within the sample are in the type of pits in which individuals are buried, and, to a lesser extent, the posture in which the burials are interred. Females are always found in a flexed position (one female burial has an indeterminate posture). The great majority of the males are also buried in a flexed position (n=18 with four indeterminate postures). However, only males of the identified adults have a posture other than flexed--one example of an unusual cross-legged position and two examples of extended burials with flexed legs (a variation of the normative tightly flexed posture). This indicates that, for some reason, a small number of males were accorded burial treatment that differed from the rest of the sample.

Considering pit types, adults are found most often in shaft and central chamber pits, subadults in simple pits. By sex, males have more shaft and central chamber pits than do females, and females

TABLE 44.

Association of Grave Orientation with Age, Sex and Adult/Subadult Categories at Upper Saratown-Locality 2.

CATEGORY	NE	E	SE	S	W	INDETERMINATE	TOTAL
Age in Years:							
0-2	1	5	1	-	-	-	7
3-5	2	14	1	-	-	1	18
6-10	1	8	3	1	-	1	14
11-15	1	-	1	-	-	1	3
16-20	-	3	-	-	1	1	5
21-25	-	-	1	-	-	-	1
26-30	1	10	5	1	-	-	17
31-35	1	2	3	-	-	-	6
36-40	2	2	-	-	-	3	7
41-45	1	4	-	-	1	-	6
45+	1	4	3	-	-	1	9
Unid. Subadult	-	1	-	-	-	1	2
Unid. Adult	1	5	2	-	-	1	9
Indeterminat	1	3	-	-	-	3	7
TOTAL	13	61	20	2	2	13	111
Sex:							
Male	4	12	4	1	1	3	25
Female	2	12	4	-	1	2	21
Indeterminate	7	37	12	1	-	8	65
TOTAL	13	61	20	2	2	13	111
Subadult/Adult							
Subadult	5	28	6	1	-	4	44
Adult	7	30	14	1	2	6	60
TOTAL	12	58	20	2	2	10	104

have more shaft and side chamber pits than do males. The distinction between adults and subadults may reflect differences in energy expended in digging the burial pits, and it may reflect the effects of post-depositional disturbance in the form of plowing on the data set. The contribution of each to the observed adult-subadult pattern cannot be determined at this time.

The male-female difference in pit type, however, deserves more comment. The low incidence of shaft and side chamber pits among male burials suggests that certain females were accorded differential burial treatment in the society at Upper Saratown-Locality 2. Also, the one male with a shaft and side chamber burial pit (Burial 108) differs from the rest of the sample in burial posture, it possesses the unusual position noted earlier. This unusual position is a squatting position with the head to the west. The only artifacts associated with this individual are a clay pipe and a single-strand necklace of small glass beads. The shaft and side chamber pit identified with Burial 108 also differs from that associated with the females and subadults, for whom a shallow cavity into one side of the pit comprises the side chamber. The side chamber for Burial 108 consists of a continuation of the central shaft straight down with a step along one wall creating the side chamber. There appears to be some unknown reason(s) other than differential status for the funerary treatment accorded the male in Burial 108. This and other patterns in the formal funerary treatment accorded certain segments of the population will be considered again in the following examination of the artifact associations at the site.

Artifact Occurrence

A total of 55 artifact types, 21 aboriginal types and 34 types of European origin, are present in the Upper Saratown-Locality 2 assemblage. Only seven of these artifacts are constrained on the basis of age or sex (Table 45), when the constant association with two or more individuals of the same age or sex group criterion is invoked.

Subadults have constrained associations with glass bead leggings and unidentified brass objects, both of which exhibit strong European connections. The glass beads are of European origin, while the leggings are of Indian manufacture. Adult constrained artifacts are columella hairpins, clay pipes, unidentified iron objects, chipped stone projectile points, brass rings and red ochre. These artifacts can be identified as aboriginal sociotechnic ornamental, aboriginal technomic, and European sociotechnic ornamental and possibly technomic. In addition to the unidentified iron objects, identified iron artifacts, including single occurrences of a pair of scissors, a hoe, an axe, a knife, and a spike/chisel, are found only with adults. Only one artifact is constrained for females, brass rings, a sociotechnic ornamental artifact of European origin. Males have constrained associations with chipped stone projectile points, an aboriginal technomic artifact.

In summary, subadults and females exhibit constrained associations with European sociotechnic ornamental artifacts. Only aboriginal technomic artifacts are constrained to males. And adults

TABLE 45.

Constrained Artifact Associations in the Upper Saratown-Locality Sample.

Female	Male
Brass rings	Chipped stone projectile point*

Subadult	Adult
Glass bead leggings	Columella hairpin
Misc. brass fragments	Clay pipe
	Unid. iron object
	Cspp
	Brass rings
	Red ochre

* Chipped stone projectile points were associated with 2 males and 1 unidentified adult.

have constrained relationships with both aboriginal and European sociotechnic ornamental, and aboriginal technomic artifacts.

Examining the distribution of iron and brass artifacts within the adult sample by sex (see Appendix A), an unconstrained relationship for these items with females can be documented. There are a total of 12 artifacts made of iron or brass (brass gorgets, large brass tubes, geometric brass pendants, brass wire, small brass bells, rolled brass beads, iron scissors, iron knife, iron hoe, iron axe, iron spike/chisel, and unidentified iron object) that are found with either males or females. Of these, only four--brass wire, small brass bells, rolled brass beads, and unidentified iron object--are found with male burials. Only the brass wire is found solely with a male (n=1), and only one male possesses small brass bells (two females do). Also, six females have rolled brass beads as opposed to two males. All five of the identified iron technomic artifact types are found only with females, and three of the six brass sociotechnic artifacts are found only with females. This general relationship underscores the differential funerary treatment accorded certain females at Upper Saratown-Locality 2 relative to other segments of the population, including males.

Principal Component Analysis

A total of 16 factors with eigenvalues greater than 1 were extracted from the principal component analysis of the Upper Saratown-Locality 2 sample. The first six factors represent more than 56% (17.55 of 31.326149) of the total variance exhibited by the rotated factor pattern (Table 46 and Appendix B). Among these first six factors a number of distinct patterns of positive

TABLE 46.

Summary of the Factor Analysis Pattern for the Upper Saratown-Locality 2 Sample.

FACTOR #	LOADING PATTERN	VARIANCE EXPLAINED	DIAGNOSTIC POSITIVE LOADINGS
1	grouped	3.8 (12.1%)	columella shell hairpins + chipped stone projectile point M+ chipped stone drill + stone/rock + * clay pot unidentified iron object +
2	grouped	3.7 (11.8%)	iron knife F+ * iron hoe F+ * iron spike/chisel F+ * brass rings F+
3	grouped	3.5 (11.7%)	columella shell disc beads F+ * iron scissors F+ * metal spoon FSA
4	grouped	2.3 (7.3%)	turtle carapace cup - * clay pot large brass cones - *
5	grouped	2.2 (6.9%)	ground stone discs - * clay dipper - *
6	grouped	2.1 (6.7%)	ground stone celt + * hammerstone + *
7	grouped	1.7 (5.4%)	chipped stone flakes M+*< red ochre +
8	grouped	1.6 (5.1%)	geometric brass pendants FSA large brass bells -*
9	grouped	1.6 (5.1%)	deer bone beads -* large brass beads FSA
10	grouped	1.5 (4.8%)	fired clay lump -* brass gorget FSA small brass bells
11	grouped	1.4 (4.5%)	small glass beads lead shot
12	grouped	1.3 (4.1%)	clay pipe + brass wire M+*

TABLE 46. (continued)

FACTOR #	LOADING PATTERN	VARIANCE EXPLAINED	DIAGNOSTIC POSITIVE LOADINGS
13	specific	1.2 (3.8%)	iron axe F+*
14	specific	1.2 (3.8%)	rolled brass beads
15	specific	1.0 (3.2%)	miscellaneous brass fragments -
16	specific	1.0 (3.2%)	brass animal effigy -*

Constraints:

+ adult only	M male only	MSA males & subadults	* (n=1)
- subadult only	F female only	FSA females & subadults	< males 45+ years

technomic loading coupled with few ornamental loadings can be identified, with these patterns perhaps defining groups of tool kits. Factor 1 possesses grouped positive loadings for columella hairpins, chipped stone projectile points, chipped stone drills, stone/rocks, clay pots, and unidentified iron objects. The technomic artifacts represent general hunting, and tool and ornament manufacturing kits. One of these artifacts, chipped stone projectile points, is constrained to males. With the exception of the clay pot category, which in two instances is found with subadults and in two instances with unidentified adults, all these artifacts are associated with adults.

Factors 2 and 3 represent grouped patterns that load positively for sociotechnic and technomic items of European origin associated with females. The artifacts in Factor 2 consist of the iron knife, iron hoe, iron spike/chisel and brass rings. This factor exhibits a domestic/agricultural orientation, and also possesses sociotechnic artifacts in the form of the brass rings. Factor 3 loads positively for columella small disc beads, iron scissors, and metal spoons. The first two artifacts are found only with females, and metal spoons are found only with females and subadults. These reflect a domestic assemblage that also includes an aboriginal sociotechnic artifact type.

Factors 4 and 5 represent grouped patterns that are strongly oriented toward the subadults in the sample. Factor 4 loads positively for turtle carapace cups, clay pots, and large brass cones. This collection of artifacts consists of European sociotechnic ornamental types and aboriginal technomic items that are associated in general with food consumption. Factor 5 loads positively for ground stone discs and clay dippers. Both of these artifacts are aboriginal in origin, and represent sociotechnic and technomic artifacts respectively. The clay dipper is associated with food consumption, as are the aboriginal technomic artifacts in Factor 4.

Factor 6 represents a grouped positive loading on adult aboriginal artifacts--hammerstones and ground stone celts. The former is a technomic artifact associated with tool making, and the latter is a sociotechnic item.

Factors 7 and 12 are both grouped patterns that exhibit a male orientation. Factor 7 consists of chipped stone flakes, a technomic artifact, found with one male aged 45+, and red ochre, a sociotechnic artifact, constrained to adults (six males and one female). Factor 12 also has two artifacts, clay pipes and brass wire. Clay pipes, a sociotechnic artifact, are constrained to adults, being found with six males, one female and two unsexed adults. The brass wire, which may be a bracelet, a sociotechnic artifact, is associated with a male aged 26 to 30 years at death.

Factors 8 and 9 are also grouped, and include ornamental sociotechnic items. The Factor 8 artifacts are geometric brass pendants that are found with females (n=2) and subadults (n=5), and large brass bells that are found with only one subadult. Factor 9 loads positively on large brass tubes, which are associated with females (n=2) and subadults (n=8), and deer bone beads, which are found with one subadult.

Factor 10 has another grouped pattern with positive loadings. The artifacts in this factor consist of a fired lump of clay, a technomic item found with a subadult; brass gorgets, a sociotechnic item found with females (n=2) and subadults (n=7); and small brass bells, a sociotechnic ornamental item found with males (n=1), females (n=2) and subadults (n=8).

Factor 11 is the last factor that has a grouped pattern. Small glass beads, a sociotechnic ornamental artifact found with males (n=14), females (n=11), unsexed adults (n=14), and subadults (n=30), and lead shot, a technomic possibly sociotechnic artifact found with one male aged 31 to 35 years at death, one female aged 16 to 20 years at death, and four subadults.

Factors 13, 14, 15 and 16 all have specific positive loading patterns. Factor 13 consists of an iron axe, a technomic possibly sociotechnic artifact, found with an adult female aged 26 to 30 years at death. The item in Factor 15 is miscellaneous brass fragments, a technomic, probably sociotechnic, artifact found with subadults (n=2). Likewise, Factor 16 consists of a sociotechnic artifact, a brass animal effigy associated with a single subadult burial.

Factor 14 loads positively for rolled brass beads, a sociotechnic ornamental item. This artifact is found predominately with females (n=6), and to a lesser extent with subadults (n=3) and males (n=2).

To summarize the results of the principal component factor analysis, there appears to be discernible patterns in the distribution of artifacts in the mortuary complex at Upper Saratown-

Locality 2. Grave associations tend to emphasize age and sex, with females and subadults apparently being highlighted by the technomic artifact associations and the variation in the occurrence of ornamental sociotechnic artifacts.

Agglomerative Cluster Analysis

All 111 burials in the Upper Saratown-Locality 2 sample could be included in the agglomerative cluster analysis of the factor scores produced for each burial in the sample. A total of 11 clusters were produced by this clustering technique (Table 47 and Appendix C). Cluster 1 consists of 85 individuals, the greater portion of the sample, who possess no artifact associations, or who possess sociotechnic ornamental artifacts of European (primarily glass beads) and aboriginal origins and a fewer technomic items of both European and aboriginal manufacture. This cluster is composed of 18 males, 16 females, 6 unsexed adults, and 34 subadults of all age groups.

The remaining ten clusters segregate the sample into male, female and subadult groupings. Clusters 2 and 7 appear to represent male groupings (given the artifact associations), although only individuals in Cluster 2 could be accurately sexed.

The Cluster 2 sample consists of 13 individuals, seven males (two aged between 18 and 25 years and four over 40 years of age), one female aged 16 to 20 years, one unsexed adult, and four subadults (one aged 0 to 1 year, two aged 3 to 5 years, and one aged 11-15). Inclusion in this group is primarily dependent on the presence of red ochre (aboriginal sociotechnic) or lead shot (European technomic). The two males with associated chipped stone

TABLE 47.

Summary Description of the 11 Groupings Defined by the Agglomerative Cluster Analsysis for the Upper Saratown-Locality 2 Sample.

Cluster 1:	Number of Individuals	85
	Number of Males	18
	Number of Females	16
	Number of Adults	45
	Number of Subadults	34
	Number of Unidentified	6
Cluster Members:	2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 32, 33, 34, 35, 38, 39, 40, 41, 46, 47, 49, 50, 51, 52, 53, 54, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 69, 70, 72, 73, 74, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85, 86, 87, 88, 90, 92, 93, 94, 97, 98, 99, 100, 101, 102, 105, 106, 107, 108, 109, 111.	
Cluster 2:	Number of Individuals	13
	Number of Males	7
	Number of Females	1
	Number of Adults	9
	Number of Subadults	4
	Number of Unidentified	0
Cluster Members:	28, 42, 45a, 45b, 48, 55, 68, 71, 89, 95, 96, 104, 110.	
Cluster 3:	Number of Individuals	3
	Number of Males	0
	Number of Females	1
	Number of Adults	2
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	8, 31, 36.	
Cluster 4:	Number of Individuals	3
	Number of Males	0
	Number of Females	1
	Number of Adults	2
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	43, 57, 91.	
Cluster 5:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	103.	

TABLE 47. (continued)

Cluster 6:	Number of Individuals	1
	Number of Males	0
	Number of Females	1
	Number of Adults	1
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	1.	
Cluster 7:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	44.	
Cluster 8:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	15.	
Cluster 9:	Number of Individuals	1
	Number of Males	0
	Number of Females	1
	Number of Adults	1
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	17.	
Cluster 10:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	0
	Number of Subadults	1
	Number of Unidentified	0
Cluster Members:	80.	
Cluster 11:	Number of Individuals	1
	Number of Males	0
	Number of Females	0
	Number of Adults	1
	Number of Subadults	0
	Number of Unidentified	0
Cluster Members:	37.	

projectile points are also in this cluster, and other artifact associations include chipped stone flakes (n=1), clay pipes (n=2 males), brass gorgets (n=2 subadults with lead shot), brass bells (n=1 subadult), and rolled brass beads (n=2, 1 unsexed adult with red ochre, and 1 female with red ochre and lead shot). The artifacts other than red ochre and lead shot comprise both aboriginal technomic items associated with hunting and tool manufacturing and sociotechnic artifacts made of European derived materials (brass beads, brass bells and brass gorgets).

Cluster 7 (n=1) consists of one adult that could not be accurately sexed or aged. The artifact in this cluster found only with males is a chipped stone projectile point (n=2), the artifact found predominantly with males is a clay pipe (n=6), and an artifact split between identified males (n=1) and females (n=1) is an unidentified iron object. The columella hairpin present with this individual is found only in one other burial at the site, that of a female, and the rolled brass beads in the Cluster 7 burial are found predominately with females, although two other male burials at Upper Saratown-Locality 2 also have this artifact type. In general, the artifacts present in the Cluster 7 burial include an aboriginal technomic item associated with hunting and tool manufacture, an aboriginal sociotechnic ornamental item, and an European technomic/sociotechnic item (the unidentified iron object).

A total of five of the remaining five clusters--3, 4, 6, 9, and 11--all appear to be correlated with females, females and subadults, or suggest a correlation with females. The primary artifacts that set off the individuals in these clusters include sociotechnic items manufactured of brass obtained from Europeans (rolled beads, tubes/cones, gorgets, geometric shaped pendants), sociotechnic items obtained from the Europeans (brass bells), technomic artifacts of iron obtained from Europeans (scissors and axe), a miscellaneous metal technomic item of European origin (a spoon), aboriginal sociotechnic artifacts (deer bone beads, columella shell cylindrical and disc beads, and a columella shell gorget). The technomic items of European origin are present in four of the five clusters. Only Cluster 11, which is composed of an unsexed adult with artifact associations (rolled brass beads) that suggest a female orientation, does not have any technomic artifact of European origin.

Cluster 6 is composed of one adult female aged 18 to 22 years at death, that also shows evidence of cranial deformation. This individual had been interred in a shaft and side chamber pit. This burial possesses both aboriginal (shell beads) and European-derived (brass gorget, brass pendants, and brass bells) sociotechnic artifacts. Also, two of the technomic artifacts of European origin that reflect a domestic orientation, scissors and a spoon, are present. And this burial has an unidentified iron object associated with it.

Cluster 9 is unique in that only objects of European origin are present. This cluster consists of one adult female, an old female more than 45 years of age, who also has cranial deformation, and is buried in a shaft and side chamber pit. Technomic artifacts in this cluster include an iron knife, an iron hoe, and an iron spike/chisel, all of which are tools with possible associations with horticulture. Sociotechnic items include a brass gorget, geometric brass pendants, and brass rings.

The individual females associated with Clusters 6 and 9, despite their differences in age, stand out from the rest of the sample in the sociotechnic and technomic artifacts they possess, their funerary treatment, and their physical appearance.

Clusters 3 and 4 both contain a mix of females and subadults. Cluster 3 has a female aged 26 to 30 years of age, an unidentified adult, and a subadult aged 6 to 10 years. This cluster possesses one of the two aboriginal sociotechnic ornamental artifacts, deer bone beads, that occur only once in the mortuary complex at Upper Saratown-Locality 2. Sociotechnic artifacts in this cluster that are manufactured of European-derived materials include large brass tubes and rolled brass beads. One European technomic artifact present is an iron axe.

Cluster 4 possesses a female 30 to 35 years of age, and two subadults, one 1 to 2 years in age and the other 6 to 10 years of age. Cluster 4 (composed of one adult female, one unidentified adult and one subadult) has the other one of the two aboriginal sociotechnic artifacts that occur at the site only once, an incised (with a rattlesnake design) columella shell gorget. Sociotechnic artifacts made of brass obtained in trade with the Europeans include brass tubes and rolled brass beads (like Cluster 3), and brass gorgets, brass pendants, and brass bells.

The final three groups denoted in the sample by Clusters 5, 8 and 10 are all composed of individual subadults. The burial in Cluster 5 is aged 5 to 10 years, and has associations only with

European sociotechnic items--glass beads and a brass animal effigy. Cluster 8 has a subadult also aged 5-10 years at death. The only European sociotechnic artifacts present in this cluster are large brass cones. Two aboriginal technomic artifacts, a turtle carapace cup and a clay pot, are also present. The burial that comprises Cluster 10 is a subadult aged 3 to 5 years at death. European sociotechnic artifacts with this individual include brass tubes/cones and large glass beads. An aboriginal sociotechnic artifact, ground stone discs, and an aboriginal technomic item, a clay dipper, are also associated with this subadult.

In summary the results of the agglomerative cluster analysis show that there are distinct male and female artifact associations that may indicate differential status in the Upper Saratown-Locality 2 society. Males with a special status are separated from the other segments of the society by aboriginal and European technomic artifacts associated with hunting and warfare (chipped stone projectile points and lead shot), and an aboriginal sociotechnic item, red ochre. These distinguished males evidence fewer sociotechnic artifacts in general, but especially ornamental types, than do the other segments of the sample.

Females with a special status appear to possess a wide range of aboriginal and European-derived sociotechnic artifacts, including a variety of ornamental types, and a number of technomic items, primarily of European origin, that can be associated with horticulture and domestic activities. Artifact types of European origin or manufactured of materials obtained from Europeans predominate among the females.

This pattern of females possessing both sociotechnic and technomic artifacts also exists in the earlier related site of Upper Saratown-Locality 1. Burial 3 at this protohistoric period Sara village is an adult female 20 to 30 years of age (J. Wilson 1983:383). Sociotechnic artifacts that accompany this individual include an incised (with a rattlesnake design) shell gorget, two shell hairpins, columella shell cylindrical beads, and marginella shell beads that had originally been sewn on a cloak or sleeved garment. Technomic artifacts with this burial are one unworked mussel shell, one turkey tibiotarsal awl, two deer longbone needles/awls, two quartz flakes. What appear to be the remains of bags of animal bone beads--turkey phalanx beads and rabbit innominate beads--along with a number of turkey longbone bead "blanks" and small stones, can be identified with the technomic artifacts listed as a bead-making kit. Burial 3 had also been placed in a shaft and side chamber burial.

The relation of the two Upper Saratown locales is quite explicit when the material assemblages of the two sites are compared, and a direct lineal relationship between the two has been suggested (J. Wilson 1983:377-454). The Burial 3 artifact associations clearly show a profound difference from that documented for the male-dominated Shannon site sample, where no females of any age possessed turkey tibiotarsal awls, deer longbone awls, or unaltered mussel shell. Only Shannon site males possessed these artifacts. Unfortunately, the sample from Upper Saratown-Locality 1 is the smallest considered in this study (n=6), consisting of only the one adult female and five subadults. Obviously, no patterns that can be used in comparison with the other samples can be extracted from this late protohistoric period site. However, the information furnished by Burial 3 does conform to the pattern of female association with both sociotechnic and technomic artifacts in the slightly later sample at Upper Saratown-Locality 2, and provides some time depth to this pattern.

Subadults found in clusters other than the main sample grouping of Cluster 1 at Upper Saratown-Locality 2 tend to possess primarily sociotechnic artifacts of European origin, with a small number of aboriginal technomic and aboriginal sociotechnic items also being present.

Trace Element Assays and the Upper Saratown-Locality 2 Agglomerative Cluster Analysis

Table 48 provides a summary of the average trace element assays that are associated with each of the 11 clusters defined by the agglomerative cluster analysis of the Upper Saratown-Locality 2 sample. Only two clusters, 1 and 3, have lower strontium than the sample mean of 788 ppm. The two clusters with the highest strontium levels are 4 and 6, with Cluster 4 having one female, one unsexed adult and one subadult. Cluster 6 comprises the young female aged 18 to 22 years at death that exhibits the outstanding funerary treatment. These strontium figures indicate that there is some variation among the female-associated clusters in regard to plant food consumption.

The highest zinc levels are present in Clusters 4 and 9, which are both composed of older females. The individual in Cluster 9 is the older counterpart of the Cluster 4 female that also exhibits a distinctive funerary treatment in the society. For Clusters 4 and

TABLE 48.

Average Trace Element Assays by Agglomerative Cluster
for the Upper Saratown-Locality 2 Adults.

AGGLOMERATIVE CLUSTER #	n	STRONTIUM	MAGNESIUM	ZINC	COPPER	LEAD
1	39	785	1129	397	32	79
2	7	823	1089	337	-	68
3	1	586	1194	275	-	77
4	1	1019	964	416	-	38
5	0	-	-	-	-	-
6	1	935	1033	247	-	102
7	0	-	-	-	-	-
8	0	-	-	-	-	-
9	1	808	1092	428	-	79
10	0	-	-	-	-	-
11	0	-	-	-	-	-
Sample Mean	42	788	1099	376	1.0	77

9, the two groups with the highest zinc levels, however, the strontium levels are also high. This indicates that the protein being used as a food resource by these two older females comes from a source other than animals, most likely nuts. This resembles the pattern noted among the older males at the Shannon site.

In summary, it appears that females identified as having a special status at Upper Saratown-Locality 2 exhibit the same variability in their diet and access to protein as do the rest of the sample, as indicated by the trace element assays.

Monothetic Division Cluster Analysis

All 111 burials and 42 artifact types could be used in the monothetic division cluster analysis of the Upper Saratown-Locality 2 sample. A total of five clusters were delineated (Table 49 and Figure 10). The results of Clustan's Procedure Rules used to chose the optimum cluster solution are given in Appendix C.

The initial division within the society is between those individuals with small glass trade beads (n=71) and those that have none (n=40). Those with small glass beads are divided into a group with brass gorgets (Cluster I, n=9) and one without brass gorgets (n=62). The burials without brass gorgets are subdivided into those with large glass beads (Cluster V, n=39) and those without large glass beads (Cluster III, n=23).

The 40 burials that do not possess glass trade beads are subdivided into two groups, one with no artifacts (Cluster II, n=16), and a group with some artifact occurrence (Cluster IV, n=24). The artifacts that are found with the burials in Cluster IV are listed in Appendix A.

TABLE 49.

Summary Description of the Five Groupings Defined by the Monothetic Cluster Analsysis for the Upper Saratown Locality 2 Population.

Cluster I:	Number of Individuals	9
	Number of Males	0
	Number of Females	2
	Number of Adults	2
	Number of Subadults	7
	Number of Unidentified	0
Cluster Members:	1, 5, 8, 17, 43, 54, 55, 57, 71.	
Attributes Common to all Members:	small glass beads, brass gorgets.	
Cluster II:	Number of Individuals	16
	Number of Males	3
	Number of Females	4
	Number of Adults	9
	Number of Subadults	6
	Number of Unidentified	1
Cluster Members:	4, 7, 11, 12, 14, 18, 25, 32, 67, 79, 86, 88, 90, 101, 105, 111.	
Attributes Common to all Members:	No artifacts.	
Cluster III:	Number of Individuals	23
	Number of Males	2
	Number of Females	7
	Number of Adults	13
	Number of Subadults	9
	Number of Unidentified	1
Cluster Members:	13, 34, 35, 36, 38, 39, 40, 46, 47, 48, 50, 51, 56, 64, 65, 66, 69, 72, 74, 76, 95, 107, 109.	
Attributes Common to all Members:	small glass beads, large glass beads	
Cluster IV:	Number of Individuals	24
	Number of Males	8
	Number of Females	5
	Number of Adults	17
	Number of Subadults	7
	Number of Unidentified	0
Cluster Members:	9, 15, 16, 20, 22, 24, 26, 27, 29, 30, 33, 37, 44, 45a, 45b, 49, 77, 78, 87, 91, 96, 102, 104, 110.	
Attributes Common to all Members:	Absence of small glass beads.	

TABLE 49. (continued)

Cluster V:	Number of Individuals	39
	Number of Males	12
	Number of Females	3
	Number of Adults	19
	Number of Subadults	15
	Number of Unidentified	5
Cluster Members:	2, 3, 6, 10, 19, 21, 23, 28, 31, 41, 42, 52, 53, 58, 59, 61, 62, 63, 68, 70, 73, 75, 80, 81, 82, 83, 84, 85, 89, 92, 93, 94, 97, 98, 99, 100, 103, 106, 108.	
Attributes Common to all Members:	small glass beads.	

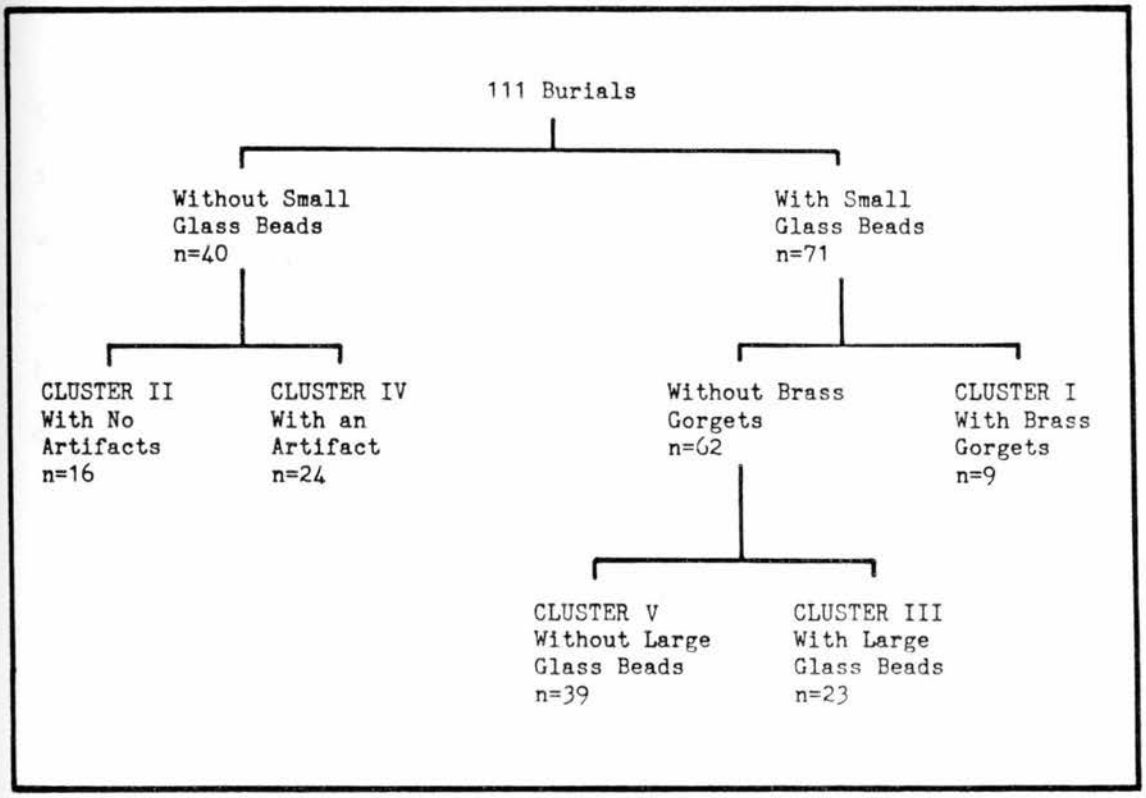

Figure 10. Monothetic division clusters produced for the artifacts associated with the Upper Saratown-Locality 2 burials.

The separation within the sample as defined by the use of monothetic division cluster analysis appears to be due to the presence/absence of small glass trade beads (a European sociotechnic ornamental artifact) and brass gorgets (a sociotechnic item made of material obtained by trade with Europeans).

Clusters I, III, and V all possess small glass trade beads. In Cluster I, all the individuals also possess brass gorgets. These individuals include two females (one 16-20 years old, and one aged 46+), and seven subadults (two aged 0 to 2 years at death, three aged 3 to 5 years, and two aged 6 to 10 years). Although no hierarchy can be observed according to age, a female-associated grave assemblage indicative of a special status that contains sociotechnic artifacts is defined by Cluster I. If Burial 91, a female aged 31-35 years who possesses a columella shell gorget incised with a rattlesnake design and a rolled brass bead necklace, is taken from Cluster IV and added to Cluster I to create a generic gorget group, then three females aged 16-20 years, 31-35 years and 46+ years are present. With this configuration, only the ten-year age segment from 21 to 30 within the sample is without at least one representative that possesses a gorget.

Cluster III comprises 23 individuals that possess both large and small glass beads. This group includes seven females of all age groups, two males (one aged 26 to 30 years and the other aged 36 to 40 years), and nine subadults (one 0 to 2 years of age, five 3 to 5 years of age, two 6 to 10 years of age, and one 11 to 15 years of age). Also, there are four unsexed adults, two of which are 26 to 30 years of age. Again, there appears to be a strong female/subadult orientation in this cluster which is denoted by the presence of European sociotechnic ornamental artifacts.

Cluster V contains 39 individuals that all possess small glass beads. In this group are 12 males (five aged 26-30 years, one aged 31-35 years, three aged 36-40 years, one aged 41-45 years, and two aged 46+), three females (one aged 31 to 35 years, one aged 36 to 40 years, and one aged 46+), four unsexed adults (one of which is aged 26 to 30 years at death), and 15 subadults (one 0-2 years of age, eight 3-5 years of age, three 6-10 years of age, one 11-15 years of age, and one subadult that could not be accurately aged). Another five individuals in the cluster could not be identified as to age or sex. Thus, while no age-specific associations can be identified in Cluster V, there are more males than females in the group.

Of the two remaining divisions of individuals with no small glass trade beads, Cluster II is composed of individuals with no artifact associations and Cluster IV comprises the 24 burials that possess some type of artifact but no small trade beads. Cluster II has 16 burials, including four females (one aged 26-30, one aged 36-40, one aged 41-45, and one aged 46+), three males (one 31 to 35 years old, one 36 to 40 years old, and one 41 to 45 years old), two unidentified adults, six subadults (one aged 0-2 years and 5 aged 6-10 years), and one unidentifiable individual. Adults of different ages and both sexes are present, but no subadults aged 3 to 5 years at death.

The 24 burials in Cluster IV consist of five females (two aged 16-20 years old, one aged 26-30 years old, one aged 31-35 years old, and one aged 46+ years old), eight males (one aged 16 to 20, two aged 26 to 30, one aged 31 to 35, two aged 41 to 45, and two aged 46+), and four unidentified adults (one aged 21-25, one aged 26-30, and two of indeterminable age). Also, seven subadult groups (two aged 0 to 2 years, two aged 3 to 5 years, two aged 6 to 10 years, and one aged 11 to 15 years) are present in this cluster.

In summary, the monothetic division analysis continues to emphasize those patterns first delineated in the principal component analysis and the agglomerative cluster analysis. Females and subadults appear to be associated with European sociotechnic artifacts, as illustrated by Clusters I and III. Males do appear in one of the clusters which evidence European sociotechnic artifacts (Cluster III), but there appear to be fewer European sociotechnic artifacts associated with males in general.

<u>Upper Saratown-Locality 2 Social Organization</u>

In contrast to the Shannon site sample, some females at Upper Saratown-Locality 2 exhibit artifact associations that are interpreted here to indicate a special status when compared to the rest of the sample. The analyses that have been reported in this section suggest that certain females of all ages and subadults aged 3 to 5 years at death have a status that differs from the rest of the society. Also, a number of females and subadults are separated from the rest of the sample by the presence of gorgets made of both shell and brass. The one shell gorget associated with a burial at Upper Saratown-Locality 2, a female aged 30 to 35 years old, has an incised rattlesnake motif. This artifact could be a clan marker, possibly indicating that clan membership is decided within the female line. This would be consistent with the generally accepted identification of this Siouan population being a matrilineal based society. Swanton (1946:661) notes that snake clans are present among both Siouan and Algonquian groups of the Southeast. An alternative explanation is that this shell gorget, and the brass gorgets, are lineage status indicators that mark special status females and subadults in a matrilineal society. This implies that those subadults with gorgets are female.

Related to this question of shell and brass gorgets as status indicators is the distribution of shell gorgets among the late prehistoric sites of the mountains of western North Carolina and eastern Tennessee (cf. H. Wilson 1983; J. Wilson 1987). In these populations shell gorgets are almost invariably associated with a select number of females and subadults (Kneberg 1959:39; Lewis and Kneberg 1946:147; Smith and Smith 1987). It is possible that this artifact, which apparently indicated a differential status of the female and subadult burials in which they occur, diffused from the mountains into the Piedmont of North Carolina during the protohistoric period following Spanish contact in the sixteenth century. In the protohistoric period Siouan populations, to which the Sara Indians belong, these indicators of female status were possibly incorporated as an indicator of a special status that certain females and subadults already possessed. During the latter portions of the protohistoric period and into the contact period, this badge of female status came to be manufactured of brass. This proposition cannot be investigated further in this study, but it can be addressed by future research involving the various Indian groups of the central, western, and southwestern North Carolina Piedmont and the Mountains of North Carolina and Tennessee.

Another possible grave association that could be a status marker, which also may have diffused from the Mountains during the early part of the protohistoric period, is the shaft and side chamber burial pit. This burial pit type has been identified at the late prehistoric period late Pisgah phase sites, which date to A.D. 1250-1450 (Dickens 1976:206), in the mountains of western North Carolina. As noted in this chapter this burial pit type is found at all of the sites in this study. The time depth of the shaft and side chamber burial pit in the Carolina and Virginia Piedmont needs to be more fully explored before its distribution can be tied to interaction between Indian societies of the protohistoric period.

As expected, given the hypotheses that guide the research conducted for this section, more younger individuals and subadults have sociotechnic artifacts that differentiate them from the rest of the late protohistoric/contact period sample at Upper Saratown-Locality 2. This differs from the pattern exhibited by the earlier late prehistoric Shannon site. However, young males at Upper Saratown-Locality 2 do not appear to have artifact associations that would indicate they possessed a status similar to females. Males appear to continue to be associated with technomic hunting/warfare artifact types, while females appear to be associated with technomic artifacts useful in horticulture. This pattern is distinct from that noted at the Shannon site. Also, iron and brass artifacts are generally associated with segments of the Upper Saratown-Locality 2 sample that do not include males. Both females and subadults possess the great majority of the identified and unidentified brass and iron artifacts. Only two males possess rolled brass beads (six females do), only one male burial contains an unidentified iron object (as does one female burial), only one male burial possesses small brass bells (two females do), and only one male interment has a brass object, wire, that no female burial has.

The patterns exhibited for the Upper Saratown-Locality 2 appear to be indicative of a society in which females evidence both achieved and ascribed status, and males possess achieved status. This is consistent with what probably characterizes a matrifocal society. The patterns also are consistent with the importance of women rulers in southern Siouan groups as indicated by the identification of queens, but no kings, among the Indian groups of the lower Catawba and Yadkin River drainages encountered by the Spanish explorer Juan Pardo in his two journeys into the Carolina Piedmont between 1566 and 1567 (Folmesbee and Lewis 1965:114, 119). It is not until later in the historic period after 1670 that individuals identified as kings come to be mentioned in relation to queens among the Piedmont groups, as John Lawson (1967:57) found in 1701 while he resided for a short time with the Keyauwee Indians. Spanish (Folmesbee and Lewis 1965:114, 119) and English explorers (Lawson 1967:30, 35, 44, 45, 49 51, 229, 241) both note the presence of important male figures other than kings, including war leaders, shamens and important men. These patterns differ markedly from those found in the earlier Shannon site and Wall site samples, and they differ from what is found in the later contact period Fredricks site.

Mortuary Differentiation and Social Distinction at the Fredricks Site

The analysis of the burial sample from the middle contact period Fredricks site is limited to a consideration of the formal treatment accorded the burials and of the pattern of the artifact distribution within the sample. There are too few individuals in the sample to permit statistical analyses to be done, and the interpretations involving data from the site are limited to comparison with trends denoted in the analysis of more representative samples.

A total of 15 burials are found in the mortuary complex at the contact period Fredricks site. Preservation states of the burials range from poor to good. Of the seven adults in the sample, six could be aged and sexed with some degree of accuracy, one female and five males. This distribution of adults by sex underscores the biased nature of the sample. The other eight members of the sample are subadults.

All of the adult burials at the Fredricks site are, with the exception of one adult male aged 26 to 30 years of age that is a secondary burial, primary burials buried in a flexed posture (Table 50). All of the subadult burials are also primary flexed interments, except for two poorly preserved subadults aged 0-2 years whose burial posture is indeterminate.

Pit types are primarily simple pits (n=14), with only one subadult 0-2 years of age being buried in a shaft and side chamber pit (Table 51). Head orientation is generally to the southeast

TABLE 50.

Association of Burial Posture with Age, Sex and Adult/Subadult Categories at the Fredricks Site.

CATEGORY	FLEXED	UNUSUAL	INDETERMINATE	TOTAL
Age in Years:				
0-2	1	-	2	3
3-5	3	-	-	3
6-10	1	-	-	1
11-15	1	-	-	1
16-20	1	-	-	1
21-25	2	-	-	2
26-30	-	1	-	1
36-40	2	-	-	2
45+	1	-	-	1
TOTAL	12	1	2	15
Sex:				
Male	4	1	-	5
Female	1	-	-	1
Indeterminate	7	-	2	9
TOTAL	12	1	2	15
Subadult/Adult				
Subadult	6	-	2	8
Adult	6	1	-	7
TOTAL	12	1	2	15

TABLE 51.

Association of Burial Pittype with Age, Sex and Adult/Subadult Categories at the Fredricks Site.

CATEGORY	SIMPLE PIT	SHAFT AND SIDE CHAMBER	TOTAL
Age in Years:			
0-2	2	1	3
3-5	3	-	3
6-10	1	-	1
11-15	1	-	1
16-20	1	-	1
21-25	2	-	2
26-30	1	-	1
36-40	2	-	2
45+	1	-	1
TOTAL	14	1	15
Sex:			
Male	5	-	5
Female	1	-	1
Indeterminate	8	1	9
TOTAL	14	1	15
Subadult/Adult			
Subadult	7	1	8
Adult	7	-	7
TOTAL	14	1	15

(n=9), with three individuals oriented to the southwest and three with indeterminate head orientation (Table 52).

This brief consideration of the formal treatment accorded individuals in the mortuary complex at the Fredricks site shows that there is little to differentiate the burials in the sample.

Artifact Occurrence

A total of 54 artifact types are present in the Fredricks site mortuary assemblage, a surprisingly large number considering the small size of the burial sample. Artifacts of native manufacture comprise 28% (n=15) of this total, and items of European origin the other 72% (n=39). This represents a slight increase in the number of European artifact types when the Fredricks site is compared to Upper Saratown-Locality 2. A very large increase is indicated when the small number of Fredricks site burials (n=15) that produced this total is compared to the large number of burials in the Upper Saratown-Locality 2 sample (n=111).

Of the 54 Fredricks site artifact types, 18 are constrained according to age or sex (Table 53), although the biased nature of the sample cannot be ignored. Artifacts that occur only with subadults are primarily sociotechnic ornamental shell items of aboriginal manufacture. A few European items are also constrained with subadults, including metal spoons (a technomic artifact), and small glass beads and brass bells (two sociotechnic artifacts).

A sociotechnic ornamental shell item that does not have a constrained relationship with subadults is shell gorgets, although the only occurrence of this artifact type is with Burial 1, a subadult aged 3 to 5 years at death. The two shell gorgets with

TABLE 52.

Association of Grave Orientation with Age, Sex and Adult/Subadult Categories at the Fredricks Site.

CATEGORY	SE	SW	INDETERMINATE	TOTAL
Age in Years:				
0-2	-	1	2	3
3-5	3	-	-	3
6-10	1	-	-	1
11-15	1	-	-	1
16-20	1	-	-	1
21-25	1	1	-	2
26-30	-	-	1	1
36-40	2	-	-	2
45+	-	1	-	1
TOTAL	9	3	3	15
Sex:				
Male	2	2	1	5
Female	1	-	-	1
Indeterminate	6	1	2	9
TOTAL	9	3	3	15
Subadult/Adult				
Subadult	5	1	2	8
Adult	4	2	1	7
TOTAL	9	3	3	15

TABLE 53.

Constrained Artifact Associations in the Fredricks Site Sample.

Female	Male
-	Metal pipe#
	Glass bottle
	Iron axe
	Kaolin pipe
	Iron scissors*
	Metal porringer*
Subadult	**Adult**
Columella cylindrical beads	Iron axe
Small disc beads	Glass bottle
Runtee beads	Metal pipe
Columella garment	Kaolin pipe
Columella necklace	Wire bracelet
Shell beaded bracelet	Glass bead leggings/anklet
Shell beaded garment	
Small glass beads	
Brass bells	
Brass bell legging/anklet	
Metal spoon#	

constrained by age group- Male 21-25; Subadult 3-5

* one subadult also in this category

this burial are of note, however, because they are decorated with lines and designs formed by punctations (Hammett 1987:170). Shell gorgets decorated in a similar manner have been found at the Irene site on the coast of Georgia, the Patawomeke site on the Potomac River in the Chesapeake Bay region, and at an ossuary in Richmond County, Virginia, on the north side of the Rappahannock River in northeastern Virginia that dates to approximately 1650 (Sizemore 1984:8-9). These latter two sites underscore again the interaction with the Middle Atlantic region evidenced by the Occaneechi and the Fredricks site material remains.

Adults have only European artifacts constrained with them. The technomic items include iron axes and glass bottles. The metal pipes and kaolin pipes present are considered to be technomic/sociotechnic items. Two adult European sociotechnic ornamental artifacts include wire bracelets and glass beaded leggings/anklets.

Males are associated with a number of technomic artifacts of European origin. These include glass bottles, iron scissors, iron axe, and metal porringer. The iron scissors and metal porringer artifact types are shared with subadults, where one occurrence of each is noted. Also, males possess technomic/sociotechnic Euroean artifacts, metal pipes and kaolin pipes. Two of the constrained European artifacts, metal smoking pipe and iron scissors, are found only with young males aged 21-25 years old.

Although these artifact associations do not indicate a hunting/warfare orientation as expected, they do suggest a relationship with trade. This is especially true of the metal pipes. These kinds of pipes were preferred by Euro-American travelers in the eighteenth century because they would not break (Noel Hume 1982:308). The presence of the iron axe suggests associations with a multitude of activities, including construction, warfare/hunting, and horticulture. Artifacts definitely tied to horticulture--iron hoes--are found in male and subadult burials, and the one female burial. This one female does not have any artifacts unique to her burial, possessing only the iron hoe, an iron knife and lead shot. All of these items are also found with both males and subadults. No sociotechnic artifacts, ornamental or others, are associated with the one identified female burial. Conversely, males have sociotechnic artifacts, including ornamental types, that are of aboriginal manufacture. The fact that males at the Fredricks site possess identified iron technomic artifacts, and sociotechnic brass gorgets, stands in stark contrast to the pattern at Upper Saratown-Locality 2, where such artifacts are found only with females.

Examination of the artifacts that do not have constrained associations at the Fredricks site indicates that males 21 to 25 years of age and subadults 3 to 5 years of age possess most of these items. The suggestion is that these young males and subadults aged 3 to 5 years of age occupy a niche in the Fredricks site sample that could indicate a special status compared to other segments of the sample, given that there are older males and other subadult age groups present in the sample. A similar interpretation of the Fredricks site burials is given by Ward (1987:109), who suggests that the traditional big men in society at this time were young males.

Social Organization at the Fredricks Site

Although it is obvious that the Fredricks site burial sample is extremely biased, the following general comments can be offered. The mortuary complex shows a strong male orientation that is similar in many ways to what is found at the late prehistoric Shannon site. The major difference appears to be that young males at the Fredricks site, not older males as at the Shannon site, exhibit the artifact associations indicative of a special status in the society. The overall pattern of artifact occurrence within the Fredricks site sample, especially among the males, implies the presence of a male-dominated society. This pattern is consistent with a patrifocal form of social organization. A larger population sample from the site, especially one with more females, would permit more than this tenuous characterization.

As originally hypothesized, the younger males at this contact period site, as indicated by the elaborate funerary treatment, appear to exhibit a special status within the sample that differs from that at the two earlier sites (the Shannon site and Upper Saratown-Locality 2) with more representative samples. This probably reflects the value of males to the society in hunting, trade, and warfare, activities which have a high premium among later contact period groups. At the Fredricks site, males possess artifacts associated with hunting/warfare (firearms and axes), and trading (metal smoking pipes). Horticulture-related artifacts (iron hoes) are found among all segments of the population--males, females and subadults--indicating that this activity may have been a shared responsibility. The lack of sociotechnic ornamental artifacts with the female burial at the Fredricks site suggests that the status of this sex may have decreased greatly by this date in the middle contact period. Certainly a better sample is needed before this can be validated.

Summary and Conclusions Concerning this Study of Mortuary Variability

This study of the mortuary practices of the Indian societies represented by the five Piedmont sites was conducted in order to test five hypotheses concerning the structure and change within the social organization of these groups from the prehistoric period to the contact period.

The initial hypothesis postulated stated that populations of the prehistoric period should evidence a tribal level of sociocultural organization, with status being primarily achieved. This hypothesis is supported by the data from the Shannon site, where older males have a unique burial treatment indicative of a special status different from other segments of the burial sample. Also, males are associated with both technomic and sociotechnic artifacts, some of which may indicate clan membership. In summary, the burial behavior at the Shannon site emphasizes males over females, and there is only scarce evidence to suggest a differential status among the female segment of the sample.

The second hypothesis considered in this study states that with European contact a more complex form of social organization would be necessitated by the increased competition and the consolidation of villages that marked the period. Status in a society with a more complex social organization would not only be achieved, but evidence of ascribed status might be found. In such a society, younger individuals should exhibit a special status through their possession of elaborate funerary treatment that their prehistoric period counterparts lack. This proposition is supported by the burial data from the two contact period sites of Upper Saratown-Locality 2 and the Fredricks site. Young adults of both sexes at Upper Saratown-Locality 2 have graves equally as elaborate as, or more so than, the older individuals in the society, which contrasts with the pattern at the prehistoric period sites. Among females at Upper Saratown-Locality 2, differences in female status may be indicated by gorgets. At the Fredricks site, the young adults have the most elaborate burials in the sample which concurs with the expected findings according to the original hypothesis.

Another expectation of this second hypothesis is that subadults at contact-period sites would evidence more elaborate burials than at the earlier prehistoric sites. This pattern does appear to be substantiated when the Upper Saratown-Locality 2 and Fredricks site samples are compared with that at the Shannon site. Of note is the age of the subadults with the more elaborate funerary treatments at the prehistoric and contact period sites. Subadults aged 0 to 2 years at death appear to have the more elaborate graves at the Shannon site. In contrast, subadults aged 3 to 5 years at Upper Saratown-Locality 2 and the Fredricks site exhibit the more elaborate grave associations. This may be tied to the increased "worth," or parental investment to insure their survival, that the subadults aged 3 to 5 years in the late protohistoric and contact periods embody. This pattern was originally predicted in the earlier consideration in Chapter IV of r- and K- selection, weaning and age of subadults at death. Also, the distribution of gorgets among subadults at Upper Saratown-Locality 2 might be indicative of ascribed status.

The third hypothesis is that younger males will evidence a special status during the contact period due to the value placed on their contribution to society as hunters, traders and warriors. This proposition is generally supported by the contact period samples. At the late protohistoric/early contact period Upper Saratown-Locality 2, young males appear to have a status similar to that of older males. In general, few males at Upper Saratown-Locality 2 evidence a special status relative to the rest of the burial sample when their entire funerary treatment and artifact associations are examined. Males in general show an association with technomic artifacts, but few sociotechnic items separate them from the other population segments. That certain males, primarily the younger ones, appear to differ from other males in funerary treatment at Upper Saratown-Locality 2 is consistent with the concept of achieved status in a society. This shift is expected given the original third hypothesis for this section.

At the middle contact period Fredricks site, young males between the age of 20 and 30 years have the most elaborate burial treatment, which indicates that they have a unique status within this society. From this it does not appear that young males become the most important individuals in contact-period society until later in the period (after the early 1680s, the earliest date that might be associated with the Fredricks site).

The fourth hypothesis states that there will be evidence of a change from a matrifocal to a patrifocal society during the contact period. This proposition is tentatively supported in part by this study. At the prehistoric Shannon site, old males are accorded the most elaborate funerary treatment, and possess most of the sociotechnic artifacts that separate segments of the sample. Any segment of the sample that is set off from the rest of the society has males associated with it, and sometimes has subadults (and no females) associated with the males. Females exhibit few sociotechnic items, and none that separate that sex from males or other segments of the sample, except in isolated cases. This pattern suggests that a male-dominated or patrifocal society characterized the prehistoric Shannon site.

In stark contrast, at Upper Saratown-Locality 2 females of all ages and selected subadults exhibit the most elaborate and unique burial treatments. This includes the association with females of a variety of sociotechnic artifacts of aboriginal manufacture and items made of materials obtained from Europeans. The pattern exhibited by the females in general, and of a small number of males that exhibit better funerary treatment than other males, in association with the artifact associations for subadults is consistent with a female-dominated matrifocal society.

At the middle contact period Fredricks site, young males exhibit the most elaborate and unique burials. The sample is small, but the presence of sociotechnic artifacts with males in general at this site, both young and old, and the absence of such artifacts in the single female burial, suggests a pattern of funerary treatment that might characterize a male dominated patrifocal society. The overall pattern for males exhibited by the late prehistoric/protohistoric period Wall site sample is similar to that for the Fredricks site, although no older males have sociotechnic objects at the former site. There are no females in the Wall site sample, which prohibits further comparison with the trends indicated for the other samples.

The tentative patterns that have been identified in this study of the hypothesized change from a matrifocal society characterizing the prehistoric period to a patrifocal society in the contact period raises a number of questions concerning the social organization of the groups included in this study. It can be asked immediately if all of these groups are really Siouan. The prehistoric period Shannon site, the middle contact period Fredricks site, and, very tentatively, the late prehistoric/early protohistoric period Wall site all give evidence of male-dominated societies. The relatively close biological similarities between the Shannon site and Fredricks site samples discussed in Chapter III, combined with the results of this analysis of mortuary practices, definitely separates the groups resident at these two sites from the Sara occupation at Upper Saratown. It is possible that the two samples--and the Wall site sample--may be Iroquoian-speaking groups similar to the Meherrin, Nottoway and Tuscarora of the Inner Coastal Plain. The split into northern and southern groups that has traditionally been identified with the "Siouan" groups of the Carolina and Virginia Piedmont based primarily on linguistics (Griffin 1945; Lewis 1951; Swanton 1936), and the subsequent migration of the northern groups to New York where they became part of the League of the Iroquois (J. Wilson 1983:144-173) is consistent with this suggestion that the Occaneechi are not Siouan. The limited Siouan linguistic similarities noted among the Tutelo language spoken by a few individuals in New York may be the result of Siouan words incorporated into Occaneechi during the late seventeenth century when Occaneechi was widely used among Indians to conduct trade (Merrell 1987:20, 27). Also, the strong association between the Susquehannock Indians, an Iroquoian group of the Middle Atlantic region, and the Occannecchi (cf. Ward 1987:89-90) would be explained. The ceramics associated with the supposed Occaneechi occupation of the Fredricks site show a close relationship to the ceramics found at the late prehistoric/early protohistoric Wall site, and they are very different from ceramics that can be associated with the Sara Indian occupations along the Dan River of North Carolina (Davis 1987:213-214).

The ceramics found at the Shannon site, although primarily limestone-tempered, show strong similarities with other predominantly net-impressed ceramic wares that have traditionally been associated with both northern and southern Siouan groups (cf. J. Wilson 1983:238-505). Clarkesville ceramics, which are very similar to the pottery found at the Shannon site (Benthall 1969:147), have always been something of an enigma in the archaeology of the Roanoke drainage, and have usually been equated with the Dan river ceramics of the North Carolina Piedmont (J. Wilson 1983:278-279). It may be that Clarkesville ceramics are associated with the northern Siouan Saponi and Tutelo Indian groups of the Roanoke drainage during the late prehistoric period (cf. Coe

1952b; J. Wilson, personal communication, 1988). The separation noted between Clarkesville and Dan River ceramics would mirror the split between the southern and northern Siouan groups. Certainly, the entire question of ethnic identity and material culture associations needs to be investigated further.

The population resident at Upper Saratown-Locality 2, as the name implies, can be associated with the Sara Indians of the larger southern Siouan group who eventually moved south and incorporated with the Catawba in the late 1730s (J. Wilson 1983:168), and may represent the only true Siouan Indians in this study. The hypothesis concerning the change from a matrifocal society to a patrifocal society that contributed to these conclusions is only partially supported at this time. Before the larger question of differing ethnic affiliations suggested here, and the associated question of change from a matrifocal society to a patrifocal society, can be addressed in greater detail to more archaeological and biological data have to be obtained on the prehistoric and contact period populations that may be connected with both the northern and southern groupings that researchers have delineated. Any future research that is conducted will certainly have to give strong consideration to the ethnic affiliations proposed for the Indian groups of the Piedmont in this study.

The fifth and final hypothesis investigated in this study states that the sexual division of labor characteristic of each society should be reflected in the funerary treatment accorded members of that society. In general, males appear to be consistently associated through time with artifacts used in hunting and warfare. In this study, artifacts indicative of horticulture appear to be associated primarily with males in the prehistoric period (cf. the Shannon site), with females during the early part of the late protohistoric/early contact period (cf. Upper Saratown-Locality 2), and with both males and females during the middle contact period (cf. the Fredricks site). This changing pattern is not totally unexpected, if, prior to contact, males were traditionally responsible for a large portion of the horticulture practiced. During the late protohistoric and contact periods, there would have been an increased need for males to act as hunters to acquire furs and skins to trade to the Europeans, and to engage in warfare. The decreased time spent by males on horticulture would have corresponded with an increased female involvement in horticulture during the early contact-period societies, as noted in this study. The involvement of all segments of the population in horticulture during the later contact period, as represented by the Fredricks site, would have been the result of the decreased size of the overall population present to provide subsistence for the population as a whole. This decrease may have necessitated that males assist more in the procurement of food resources from the horticultural base of the society.

This investigation of social organization and change among the Piedmont Indians has provided answers for some questions. However, as is usual in studies of archaeological data, a number of questions that require attention in future research conducted on the Piedmont Indians have also been raised. The most intriguing question concerns probable Iroquoian ethnic identification (meaning similar to the Meherrin, Nottoway, and Tuscarora Indians) of a number of groups that have traditionally been assumed to have been Siouan, i.e., those groups associated by past researchers with the northern Division of Siouan groups. Although some of the expected trends in the change of social organization from the prehistoric period into the contact period were substantiated, the basic question on the effects of European contact on the social organization of the Indian groups of the Virginia and Carolina Piedmont cannot be addressed properly until more research is conducted on representative populations that can be identified with the prehistoric and contact period societies that inhabited the region.

CHAPTER VIII

CONCLUSIONS

This study has investigated the effects of European contact on the aboriginal populations of the Carolina and Virginia Piedmont through five levels of inquiry--biological distance, demographic profiles, trace element assays, pathologies, and mortuary practices. The four central questions addressed in the analysis and interpretation of these five datasets are 1) the ethnic associations of the five populations; 2) the overall change in health from the prehistoric period into the middle contact period; 3) the change in diet associated with European contact; and 4) the changes that occurred in social organization.

The five skeletal series used in this study form a temporal sequence that spans the era from the late prehistoric period, circa A.D. 1300, to the middle contact period, circa A.D. 1712. The two sites with the most biologically representative burial samples, the late prehistoric period Shannon site (n=96) and the late protohistoric/early contact period Upper Saratown-Locality 2 site (n=111), form the core of this study. Information from three other sites--the late prehistoric/early protohistoric period Wall site, the protohistoric period Upper Saratown-Locality 1 site, and the middle contact period Fredricks site--, with burial samples too small to be used in and of themselves to build patterns, is considered in conjunction with the trends and patterns abstracted from the comparison of the data sets from the Shannon site and Upper Saratown-Locality 2.

The results of the biological distance studies (Chapter III) and the analysis of funerary treatment (Chapter VII) provide important insights into the ethnic identity and social organization of the Indian groups of the Carolina and Virginia Piedmont. Previous researchers have generally considered the majority of these aboriginal inhabitants to comprise part of the larger group of Siouan Indians that share a similar material culture. Within these parameters, there should also have been a close physical similarity evidenced by the skeletal remains associated with these individual Siouan groups--including the burial samples used in this study. The statistical techniques used to determine the mean measure of divergence between four of the five study samples indicate that the late prehistoric period Shannon site and the middle contact period Fredricks site samples are the closest biologically, standing distinct from the Upper Saratown-Locality 2 burial sample. The prehistoric period Wall site burial sample is the least similar to the other three samples, which certainly reflects the small size of the sample from this site.

It is suggested that the similarities between the Shannon and Fredricks site study samples are due to the northern orientation, i.e., close ties with the Indian groups of the Chesapeake Bay and the Middle Atlantic region, of the two societies these sites represent--presumably the prehistoric counterparts of the Tutelo Indians at the Shannon site, and the Occaneechi Indians of A.D. 1700 at the Fredricks site. This northern orientation is consistent with the interpretations of previous researchers (Griffin 1945:321; Lewis 1951:10-11; Swanton 1936:379), but the meaning of this orientation might differ radically from that favored by these same researchers.

The analysis of the mortuary practices of the study samples (Chapter VII) provides evidence that reflects on the meaning of this northern orientation. It has generally been assumed that the Siouan groups of the Carolinas and Virginia possessed a matrilineal society (Hudson 1976:185; Lewis 1951:153-167; Swanton 1946:654-655), and certainly one in which certain females identified as queens possessed some status different from other segments of the society. The funerary treatment accorded individuals at both the Shannon site and the Fredricks site favors males in the society without any clear evidence of preferential treatment for any group of females which would be consistent with a differential (and high) status for certain females in the society. At the Shannon site, certain older males and subadults aged 0 to 2 years of age possess the most elaborate funerary treatment, with the burials of these older males being suggestive of achieved status. In the Fredricks site burial sample, younger males and subadults aged 3 to 5 years evidence the most elaborate funerary treatment, relative to other males (and one female) and subadults in the society. The treatment accorded the younger adult males is consistent with achieved status which reflects the increasing importance that young males as a group have as hunters in the skin and fur trade, as traders, and as warriors during the later portions of the contact period. This male orientation in the funerary treatment accorded individuals at the

Fredricks site is consistent with a patrifocal or male dominated society. This is expected in the case of the Fredricks site , given the change from a matrilineal society to a patrilineal society postulated by researchers (Hudson 1976:187-188; Lewis 1951:162-167) for most Indian groups of the southeastern United States over the course of the contact period. The pattern of male dominance evidenced by the prehistoric period Shannon site burials is not consistent with what was expected.

In contrast to the male orientation exhibited by the Fredricks site and Shannon site burial samples, the mortuary patterns identified at Upper Saratown-Locality 2, and corroborated to some degree by the small burial sample from the slightly earlier site of Upper Saratown-Locality 1, reflect an orientation toward a group of females that include all age groups, subadults aged 3 to 5 years old, and a small number of subadults age 0 to 10 years old. The unique female burials and the close association of technomic artifacts of European manufacture and sociotechnic items in general with females, combine with evidence of achieved status by males (again as hunters and warriors) to provide a pattern of funerary treatment that is considered here to reflect a female dominated society that is consistent with a matrifocal society.

The results of the trace element assays (Chapter V) also provide information useful to the study of status among the study samples. At the Shannon and Wall sites, all age groups and the great majority of both sexes appear to have similar diets (see Tables 17-20) evidencing no noticeable differences in access to animal and plant food resources. However, males older than 36 years of age and the female segment of the population aged between 36 and 40 years have higher zinc levels than do the rest of the burial sample (Tables 25-26). The female segment of the population aged 41+ years shows a large drop in the zinc assay from the level for the 36-40 age group.

At Upper Saratown-Locality 2, individuals older than 40 have higher levels of zinc (Table 22), with females in general having higher zinc assays than males (Table 24). Also, older males more than 46 years of age have higher zinc levels than do younger males (Table 27), while females more than 41 years old have higher zinc levels than younger females in general and all males (Table 28). The results of an F Test statistical comparison of males and females at Upper Saratown-Locality 2 (Table 29) shows that there is a significant difference in the two at the 0.10 confidence level.

These differences in the trace element assays for certain segments of the two representative study samples are considered to support the patterns of social organization documented in the analysis of funerary treatment. At the Shannon site, older males appear to have differential access to protein-rich food sources. Because strontium levels are similar for the population segments, these protein-rich food sources did not replace vegetable foods, and appear to be food other than meat, such as protein rich nuts. Such a pattern would be expected in an egalitarian society with elements of a tribal level of social organization where achieved status is associated with older males.

At Upper Saratown-Locality 2, females evidence a higher protein diet according to the trace element analysis. The similarity of strontium levels among all population segments suggests that this protein source is not directly attributable to animal food sources. Also, older females (40+) and older males (45+) have higher zinc levels than the rest of the population. This pattern of older females and males in the society having preferential access to a protein-rich food source is consistent with achieved status that would have characterized the female-dominated society at this late protohistoric/early contact period site.

The trace element assays for the Fredricks site skeletal series reflect the presence of a high level of protein from animal foods in the diet of all individuals. Interpretation of the variation within the trace element levels that does occur is hampered by the fact that the mixed Fredrcks site burial sample appears to be composed of a large number of individuals from villages located in different environments. The differences in the strontium levels especially are affected by this factor. Therefore, the general pattern exhibited by the unrepresentative sample from the contact period Fredricks site cannot be considered further at this time.

Another aspect of this study has been to investigate the hypothesized catastrophic effects of European epidemic diseases (cf. Dobyns 1983) on the aboriginal populations of the Carolina and Virginia Piedmont during the protohistoric and contact periods. Along with a general population decline, the stress of epidemic disease (and warfare) resulted in the formation of single villages from the combination of the population remnants from a number of other often unrelated villages. Such a pattern of population decline and recombination would result in increased biological diversity characterizing groups resident at contact period sites. The results of the diversity studies conducted in this study (Chapter III) indicate that the late protohistoric/early contact period Upper Saratown-Locality 2 burial sample has the lowest biological within-population diversity of the four sites. The late prehistoric/early protohistoric period Wall site skeletal series (a very biased sample) exhibits the next lowest diversity level followed by the late prehistoric Shannon site burial sample. The highest within-population biological diversity is found at the middle contact period Fredricks site.

Comparing this biological diversity with diversity for surface finish and decoration in ceramics (Chapter III), the Upper Saratown-Locality 2 assemblage indicates that the Indians resident at this site were experiencing changes in the fabric of their society that did not include incorporation of other related and unrelated distinct groups. This suggests that the Sara at Upper Saratown during the late protohistoric/early contact period were a viable society that was as yet not adversely affected by the stresses associated with European contact, especially that associated with smallpox epidemics. Given that there is a 141 year gap from the time of the first major smallpox epidemic in 1520-1524 until the second in 1665-1667 (Dobyns 1983:15), the stability and lack of admixture evidenced by the Sara Indians living at Upper Saratown-Locality 2 is consistent with the pre-contact, pre-1665 era of low-level indirect interaction with Europeans, which is even earlier than the dates suggested elsewhere in this study for Upper Saratown-Locality 2. The high biological diversity found at the middle contact period Fredricks site, associated with the Occaneechi Indians of 1700, provides ample evidence of the adverse effects of stress contributing to population decline and admixture during the post 1665 contact period. The contrast in the patterns of biological distance between the Fredricks site and Upper Saratown-Locality 2 supports the identification of the latter with the lower-stressed (relative to the middle contact period) pre-1665 protohistoric/early contact period that characterized Indian-European interaction in the Carolina and Virginia Piedmont.

This general finding can be expanded when the changes within and between the study samples in health and diet with European contact (Chapters IV, V and VII) are considered. In general, there is a decrease in the overall health within the populations as the decreased life expectancy (Chapter IV) at Upper Saratown-Locality 2 and the Fredricks site illustrate. More detailed analysis of the individual pathologies (Chapter VI) present indicates that the middle contact period Fredricks site burial sample is the least healthy. This finding is consistent with the high-stress middle-contact-period that dates between 1675 and 1710 for the Indian groups of the Piedmont.

Comparison of the late prehistoric period Shannon site burial sample with the late protohistoric/early contact period Upper Saratown-Locality 2 skeletal series shows a decline through time in the percentage of all pathologies except for enamel hypoplasia and dental caries. Only 43.1% of the pathologies at the Shannon site are diet related in contrast to 50.3% at the contact period site. This increase is primarily due to the increased incidence of dental caries, which can be tied to the introduction of the peach and watermelon (cf. Wilson 1977), and rum into the diet. The increased amount of sugar that these food resources would have contributed to the diet could have accounted for the increase in dental caries. A change in diet between the two sites which is suggested by the effects of peach, watermelon and rum on dental caries, is supported by the pattern of lower levels of magnesium documented by the trace element analysis (Chapter V) at Upper Saratown-Locality 2 compared to the Shannon site. This difference suggests a lessened reliance on maize in the late protohistoric/early contact period diet at Upper Saratown-Locality 2.

In general, the Upper Saratown-Locality 2 burial sample appears to have experienced rather good health, especially when compared with the late prehistoric period Shannon site and the middle contact period Fredricks site. This reflects the fact that the Upper Saratown population lived before the time of the intense stresses associated with the middle contact period, and after the occurrence of the stress related to epidemics of smallpox that characterized the early protohistoric period. The decline in the life expectancy at Upper Saratown-Locality 2 is an aberration given the analysis of pathologies conducted in this work (Chapter VI), and it may reflect the presence of influenza or measles, two European diseases not identified in the historic record nor identifiable in an analysis of skeletal material.

The trace element analysis (Chapter V) also contributed information on the health of the study samples. The definite increase in zinc levels at Upper Saratown-Locality 2 and at the

Fredricks site suggests that there is an increase in the amount of animal protein in the diet of the later samples, which is not unexpected given the increase in hunting of fur and skin bearing animals induced by trade with Europeans in furs and skins. The increased hunting would presumably have resulted in more meat being available in the diets of these two populations. This increase in protein available to the Upper Saratown-Locality 2 inhabitants is consistent with the overall healthy burial sample present at the site, which is not unexpected given the relatively low stress load (compared to the middle contact period) this late protohistoric/early contact period group experienced. In contrast, increased protein from animal sources in the middle contact period Fredricks site sample was not enough to compensate for the dual stresses of European disease and extensive warfare. The overall poor health of this middle contact period skeletal series vividly reflects this fact.

In closing, this study has been able to address a number of questions about the effects of European contact on the aboriginal cultures of the Carolina and Virginia Piedmont. However, a number of new questions about these groups have also been raised. Of special interest, and one that <u>requires</u> further research, is the question of the ethnic affiliation of these supposedly Piedmont Siouan groups. It is suggested here that the groups of Indians previously identified with the northern Siouans, including the Tutelo and Occaneechi, have definite affinities with the Iroquoian societies of the Inner Coastal Plain and the Middle Atlantic region. The social organization and biological similarities that characterize the presumed Tutelo occupation at the Shannon site and the Occaneechi village at the Fredricks site differentiate these two populations from the Sara Indians resident at Upper Saratown-Locality 2.

The interaction of the Tutelo and Occaneechi with the Iroquoian Indian groups to the north, and the Sara with the Siouan groups to the south, is documented in no uncertain terms in the ethnohistoric record of these groups during the later contact period. Ward (1987:89-90) recounts the close connections between the Occaneechi and the Susquehanna Indians, an Iroquoian-speaking group who lived on the Susquehanna River in New York, Pennsylvania and Maryland until approximately 1675 (Swanton 1952:56). Between 1675 and 1676 the main body of the Susquehanna Indians were defeated and absorbed by the Iroquois Indians of New York (Swanton 1952:57). Small groups of Susquehanna Indians sought refuge with the Occaneechi (Swanton 1946:164) and apparently with the Meherrin Indians (Swanton 1952:62). The Occaneechi, Susquehanna and a number of other Indian groups, including the Mannakin of the Virginia Piedmont, resident on an island in the Roanoke River were shortly thereafter attacked and defeated by Nathaniel Bacon in 1676 (Billings 1975:267-269). By the early 1680s the Occaneechi and presumably the Indians incorporated with them moved into the Piedmont of North Carolina (J. Wilson 1983:113-114, 183-184). Later, the Occaneechi moved to Fort Christanna and between 1711 and 1712 incorporated with the Saponi, Stukanox, and Tutelo Indians as tributaries to the colony of Virginia (J. Wilson 1983:131). In approximately 1740, the Saponi and other Fort Christanna Indians moved north into Pennsylvania initially, and then New York, where they became part of the Iroquois Confederacy, which was comprised of core Indian groups that spoke Iroquoian dialects (J. Wilson 1983:169). In contrast to these movements, the Sara Indians and other Indian groups of the southern Siouan division moved south and southeast from the North Carolina Piedmont, and eventually incorporated with the Catawba Indians in the late 1730s (J. Wilson 1983:191-197).

In addition to the Susquehanna Indians, three Iroquoian-speaking groups of the Inner Coastal Plain of North Carolina and Virginia--the Tuscarora, Meherrin, and Nottoway (Boyce 1978:282-283; Swanton 1946:10-11)--also live in close proximity to the Occaneechi Indians. Unfortunately, beyond the classification of the language associated with these three groups, little is known of the material culture or social organization of the Tuscarora, Meherrin, and Nottoway. Leadership was at a community level, with status being determined by access to goods and services (Boyce 1978:283). Men typically were the leaders and were called "Kings" amongst these Iroquoian-speaking groups of Virginia and North Carolina (Boyce 1978:283). Of special interest is the fact that Tuscarora women in North Carolina were traditionally given less elaborate mortuary treatment than men (Boyce 1978:285-286). Also, the Tuscarora of New York buried their dead in special areas according to clan affiliation (Landy 1978:523). A similar pattern of spatially segregated burials by social unit is suggested by Ward (1987:109) to have existed among the Occaneechi based on the archaeology of a cemetery area at the Fredricks site.

From this study, a number of characteristics are delineated that distinguish three of the study samples--Shannon site, the Wall site, and the Fredricks site--from the Sara populations of the Dan River. These include the male orientation evidenced by the funerary treatment at all three non-Sara sites; the low biological distance associated with the Shannon site and Fredricks site populations; the close affiliation of the Wall and Fredricks site ceramics; the similarity of gorget types between the Wall site and Shannon site material cultures; and the interaction documented in the ethnohistoric record of the three non-Sara populations with the Indian groups northeast of the study area. The following propositions can be advanced to account for these characteristics.

First, the Indian groups that have traditionally been identified with the northern Siouan division, including the Tutelo and Occaneechi, are in reality non-Siouan, most probably Iroquoian-speaking, groups. Secondly, it can be proposed that the northern Siouan division does exist, comprised of the Sapona and Tutelo Indians, with the Occaneechi Indians being non-Siouan. Other Indian groups traditionally placed in the northern division such as the Manakin would have to be placed in an unknown group pending further archaeological research. A third proposition is that the northern Siouan division is composed of the groups traditionally identified with it and that the hypotheses defined by Lewis (1951:11) are valid: that

> 1. A territorially coterminous group of tribes in Virginia and the Carolinas, speaking dialects of the Siouan linguistic stock, possessed a language and culture which differed significantly from that of other indigenous groups which bordered on it.

> 2. Within this group there were linguistic differences of such cultural significance that the culture common to tribes of the "northern" unit differed from the culture common to tribes of the "southern" group.

Unfortunately, none of these three proposals accounts for all of the common characteristics denoted above and the differences that this study has identified for the three non-Sara sites.

The first proposal covers all of the characteristics except for the difference in the ceramics found at the Shannon site and those found at the Wall and Fredricks sites (Chapter VII), and the distinction of the Wall site burial sample from the other two burial samples when biological distance is considered. The second proposal does not account for the low biological distance between the Shannon site (Tutelo) sample and the Fredricks site sample, nor is the close interaction documented by the ethnohistoric record satisfactorily explained. The third proposal suffers from the same shortcomings identified for the first proposal. At this time, not one of these three propositions can be chosen as the correct model of the culture history of these Indian groups, although the second proposal appears to be the best approximation currently available.

In order to investigate the implications of these propositions concerning ethnic and cultural composition, further archaeological, biological, and historical research that incorporates a number of sites dating to the temporal continuum defined by the late prehistoric, protohistoric and contact periods in both the areas associated with both the "northern Siouan" groups and the "southern Siouan" groups in the Carolinas and Virginia must be conducted.

Until investigations that incorporate both biological and archaeological data are conducted, the reconstruction, interpretation, and explanation of the past lifestyles and cultures of the Indian groups resident in the Piedmont will not be possible.

APPENDIX A.

BURIAL AGE, SEX AND ARTIFACT ASSOCIATIONS

TABLE 1A.

Codes Used to Identify the Artifacts Associated with Each Burial in the Study Samples.

CODE	ARTIFACT
V1	olive shell beads
V2	marginella shell beads
V3	columella segment beads
V4	columella cylindrical beads
V5	columella tube beads
V6	columella small disc beads
V7	runtee beads
V8	wampum beads
V9	columella shell pendant
V10	columella shell gorget
V11	columella shell hairpin
V12	marginella shell necklace
V13	marginella shell bracelet
V14	columella shell beaded garment
V15	marginella shell legging
V16	columella shell necklace
V17	columella shell bracelet
V18	columella shell anklet
V19	columella shell legging
V20	unaltered mussel shell
V21	serrated mussel shell
V22	turtle carapace cup
V23	turkey digit beads
V24	turkey coracoid beads
V25	turkey longbone tubular beads
V26	turkey tibiotarsal awl
V27	eagle talon beads
V28	animal bone hairpin
V29	rabbit scapula beads
V30	beaver incisor chisel
V31	wolf canine beads
V32	mountain lion claw beads
V33	bear canine beads
V34	bear mandible (part of a mask ?)
V35	deer bone beads
V36	deer longbone awl
V37	deer longbone needle
V38	deer longbone chisel
V39	deer bone flaker
V40	deer bone fishhook
V41	deer phalange projectile point
V42	elk tooth beads
V43	chipped stone projectile point
V44	chipped stone drill
V45	chipped stone knife (with antler handle)
V46	chipped stone blade

TABLE 1A. (continued)

CODE	ARTIFACT
V47	chipped stone end scraper
V48	chipped stone flakes
V49	ground stone discs (gaming discs)
V50	ground stone celt
V51	ground stone beads
V52	stone pendant
V53	stone abrader
V54	hammerstone
V55	rock crystals (amythest & quartz)
V56	stone/rock (unaltered)
V57	red ochre
V58	mica pendant
V59	clay pot
V60	clay pipe
V61	clay dipper
V62	fired clay lump
V63	rolled native copper bead
V64	raw/hammered native copper
V65	split cane basket
V66	small glass beads (white, blue, & black)
V67	large glass beads (multi-colored & multi-shaped)
V68	brass gorget (bar and circular shapes)
V69	large brass tubes (hairpipes)
V70	large brass cones (tinklers)
V71	geometric brass pendant (small disc-, u-, crescent- and triangle-shaped)
V72	brass animal effigy
V73	brass wire
V74	small brass bells
V75	large brass bells
V76	rrolled brass beads
V77	miscellaneous brass fragment(s)
V78	iron scissors
V79	iron knife
V80	iron hoe
V81	iron axe
V82	iron spike/chisel
V83	iron nail
V84	unidentified iron object
V85	metal bucklle (brass)
V86	metal button (brass, lead, & pewter)
V87	wire bracelet (brass)
V88	glass bottle (wine/rum)
V89	glass fragment
V90	metal kettle (brass)
V91	metal porringer
V92	metal spoon (brass, latten & silver plated brass)

TABLE 1A. (continued)

CODE	ARTIFACT
V93	metal pipe (pewter)
V94	kaolin pipe
V95	ember tender
V96	jew's harp
V97	gun
V98	gun parts (dog-lock spring)
V99	gunflint
V100	lead shot
V101	glass beaded garment
V102	glass bead necklace
V103	glass bead bracelet
V104	glass bead anklet
V105	glass bead legging
V106	brass bell necklace
V107	brass bell bracelet
V108	brass bell anklet
V109	brass bell legging
V110	garment with glass beads and brass ornaments
V111	brass bead necklace
V112	brass bead bracelet
V113	brass bead anklet
V114	brass bead legging
V115	shell beaded garment
V116	shell bead necklace
V117	shell bead bracelet
V118	shell bead anklet
V119	shell bead legging
V120	bone bead garment
V121	bone bead necklace
V122	bone bead legging
V123	bone bead anklet
V125	brass rings
V126	lead bale seal
V127	vermillion/red lead
V128	snuff tin
V129	case knife

TABLE 2A.

Burial Number, Age, Sex, and Grave Associations for Individuals Interred at the Shannon Site.

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
1	FEMALE	46+	V2, V4, V5, V16, V115, V116.
2	SUBADULT	0-2	NONE
3	MALE	26-30	NONE
4	MALE	46+	V20, V22, V25, V26, V27, V36, V42, V47, V52, V54, V121.
5	SUBADULT	11-15	V9.
6	SUBADULT	0-2	V4, V16, V25, V56, V116, V120, V121.
7	MALE	26-30	NONE
8	FEMALE	41-45	V4, V5, V6, V16, V116.
9	FEMALE	46+	NONE
10	MALE	41-45	V2, V12,V116.
11	FEMALE	16-20	V2, V5, V6, V12, V16, V116.
12	SUBADULT	0-2	V2, V115.
13	MALE	26-30	NONE
14	SUBADULT	3-5	NONE
15	MALE	21-25	V2, V5, V12, V16, V116.
16	FEMALE	31-35	V2, V12, V116.
17	SUBADULT	0-2	V2, V12, V116.
18	MALE	46+	V22, V26, V23.
19	MALE	26-30	NONE
20	FEMALE	16-20	V2, V4, V12, V16.
21	FEMALE	46+	NONE
22	FEMALE	21-25	V22.
23	MALE	46+	NONE
24	MALE	31-35	NONE
25	MALE	46+	V33, V121.
26	SUBADULT	0-2	V5, V25, V116, V121.
27	SUBADULT	6-10	NONE
28	SUBADULT	0-2	NONE
29	FEMALE	21-25	V25, V121.
30	MALE	36-40	NONE
31	FEMALE	31-35	NONE
32	NO INFORMATION—OMITTED		
33	SUBADULT	3-5	NONE
34	SUBADULT	11-15	V1, V32, V41, V43, V116, V121.
35	FEMALE	46+	NONE
36	FEMALE	46+	NONE
37	SUBADULT	0-2	V5, V16, V33, V63, V116, V121.
38	MALE	46+	NONE
39	MALE	41-45	NONE
40	ADULT	36-40	NONE
41	SUBADULT	6-10	V35, V121.
42	NO INFORMATION—OMITTED		
43	SUBADULT	11-15	V59.
44	MALE	31-35	NONE

TABLE 2A. (continued)

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
45	MALE	46+	V5, V16, V20, V26, V30, V38, V39, V43, V44, V50, V53, V64, V116.
46	FEMALE	46+	V50.
47	FEMALE	46+	NONE
48	SUBADULT	0-2	V5, V9, V16, V116.
49	FEMALE	ADULT	V54.
50	MALE	46+	NONE
51	SUBADULT	0-2	V2, V5, V12, V16, V116.
52	SUBADULT	6-10	V2, V31, V55, V115, V116, V121.
53	MALE	46+	NONE
54	SUBADULT	0-2	NONE
55	FEMALE	31-35	NONE
56	MALE	46+	V33, V34, V121.
57	MALE	46+	NONE
58	MALE	31-35	V6, V16, V46, V116.
59	SUBADULT	0-2	V2, V5, V9, V16, V115, V116.
60	FEMALE	36-40	V32,V50, V122, V123.
61	MALE	41-45	V40.
62	FEMALE	36-40	NONE
63	FEMALE	36-40	V4, V16, V116.
64	SUBADULT	3-5	NONE
65	MALE	36-40	V32, V121.
66	MALE	ADULT	NONE
67	FEMALE	46+	NONE
68	FEMALE	26-30	V2, V5, V6, V24, V115, V116, V121.
69	FEMALE	46+	NONE
70	FEMALE	21-25	NONE
71	FEMALE	46+	NONE
72	SUBADULT	0-2	V32, V121.
73	SUBADULT	0-2	V5, V16, V116.
74	SUBADULT	3-5	V2, V115.
75	FEMALE	16-20	V5, V28, V116.
76	FEMALE	16-20	NONE
77	SUBADULT	0-2	V43.
78	SUBADULT	0-2	NONE
79	SUBADULT	0-2	NONE
80	SUBADULT	0-2	NONE
81	FEMALE	26-30	NONE
82	MALE	46+	V26, V60.
83	SUBADULT	?	NONE
84	MALE	46+	NONE
85	MALE	46+	NONE
86	SUBADULT	0-2	V2, V9, V24, V115, V121.
87	MALE	46+	NONE
88	MALE	36-40	V25, V121.
89	FEMALE	46+	NONE
90	SUBADULT	11-15	NONE
91	FEMALE	36-40	NONE
92	MALE	46+	V45.

TABLE 2A. (continued)

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
93	FEMALE	ADULT	V2, V12, V116.
94	SUBADULT	0-2	V2, V12, V116.
95	SUBADULT	11-15	V4, V16, V41, V116.
96	NO INFORMATION—OMITTED		
97	MALE	36-40	V5, V16, V116.
98	SUBADULT	11-15	V54.
99	SUBADULT	0-2	V6, V33, V115, V121.
100	NO INFORMATION—OMITTED		

TABLE 3A.

Burial Number, Age, Sex, and Grave Associations for Individuals Interred at the Wall Site.

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
1	MALE	46+	V59, V60.
2	SUBADULT	0-2	V6, V10, V15, V17, V59, V63.
3	MALE	46+	V21.
4	MALE	21-25	V3, V6, V16, V17, V18, V59.
5	SUBADULT	0-2	NONE
1-83	SUBADULT	3-5	V2, V3, V6, V10, V14, V15, V16, V19, V20, V59, V63.
2-83	SUBADULT	0-2	V3, V16, V56.
3-83	SUBADULT	0-2	V59.

TABLE 4A.

Burial Number, Age, Sex, and Grave Associations for Individuals Interred at Upper Saratown-Locality 1.

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
1	SUBADULT	6-10	NONE
2	SUBADULT	6-10	V5, V10, V16, V116.
3	FEMALE	26-30	V6, V10, V15, V23, V25, V26, V29, V37, V48, V115.
4	SUBADULT	11-15	V4, V6, V16, V17, V56, V116, V117.
5	SUBADULT	6-10	V4, V17, V117.
6	SUBADULT	3-5	V2, V6, V15, V21, V24, V25, V26, V29, V59, V68 (?), V115, V116, V120, V121.

TABLE 5A.

Burial Number, Age, Sex, and Grave Associations for Individuals Interred at Upper Saratown-Locality 2.

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
1	FEMALE	16-20	V4, V6, V66, V68, V71, V74, V78, V84, V92, V110, V116,
2	MALE	26-30	V4, V16, V66, V102, V116.
3	MALE	26-30	V60, V66, V73, V101, V103.
4	MALE	31-35	NONE
5	SUBADULT	3-5	V59, V66, V68, V69, V103, V104, V105.
6	MALE	36-40	V66, V101, V102.
7	ADULT	?	NONE
8	SUBADULT	6-10	V35, V66, V68, V69.
9	SUBADULT	6-10	V67, V102.
10	ADULT	?	V66, V102, V103.
11	SUBADULT	6-10	NONE
12	ADULT	?	NONE
13	ADULT	26-30	V66, V67, V101, V102, V103.
14	FEMALE	36-40	NONE
15	SUBADULT	3-5	V22, V59, V70.
16	FEMALE	16-20	V11.
17	FEMALE	46+	V66, V68, V79, V80, V82, V101, V124.
18	FEMALE	46+	NONE
19	FEMALE	46+	V66, V69, V102.
20	MALE	26-30	V4, V16, V116.
21	SUBADULT	11-15	V66.
22	FEMALE	16-20	V67, V69.
23	SUBADULT	0-2	V66, V101, V102, V103.
24	MALE	26-30	V67, V102.
25	MALE	41-45	NONE
26	SUBADULT	0-2	V2, V12, V116.
27	ADULT	26-30	V69.
28	ADULT	26-30	V57, V66, V76, V102, V111.
29	MALE	31-35	V60.
30	SUBADULT	6-10	V77.
31	INDETERMINATE	?	V66, V69.
32	INDETERMINATE	?	NONE
33	SUBADULT	11-15	V69.
34	INDETERMINATE	?	V66, V67.
35	SUBADULT	3-5	V66, V67, V101, V102.
36	FEMALE	26-30	V66, V67, V76, V81, V102, V111.
37	ADULT	21-25	V50, V54, V76, V111.
38	ADULT	26-30	V66, V67, V101, V102.
39	ADULT	?	V66, V67, V76, V101, V102.
40	SUBADULT	3-5	V66, V67, V101, V102.
41	ADULT	?	V66, V101, V104.
42	MALE	26-30	V57, V66, V101.
43	SUBADULT	6-10	V66, V68, V69, V71, V75, V76, V101, V111.

TABLE 5A. (continued)

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
44	ADULT	?	V11, V43, V44, V56, V59, V60, V76, V84, V111.
45a	MALE	41-45	V43, V57.
45b	MALE	16-20	V43, V57, V60.
46	SUBADULT	3-5	V66, V67, V101, V102.
47	SUBADULT	6-10	V66, V67, V101, V104.
48	SUBADULT	11-15	V66, V67, V100, V101, V102.
49	ADULT	?	V59, V60, V69.
50	MALE	26-30	V66, V67, V101, V102.
51	FEMALE	46+	V66, V67, V74, V101, V102, V106.
52	SUBADULT	6-10	V4, V66, V76, V101.
53	SUBADULT	3-5	V4, V16, V66, V74, V101, V108, V116.
54	SUBADULT	3-5	V66, V68, V74, V92, V101, V104, V108.
55	SUBADULT	3-5	V66, V67, V68, V74, V100, V101, V102, V104, V106.
56	FEMALE	26-30	V66, V67, V76, V101, V102.
57	SUBADULT	0-2	V62, V66, V68, V74, V101, V108.
58	FEMALE	31-35	V66, 101, V102, V103.
59	INDETERMINATE	?	V66, V77.
60	NO INFORMATION--OMITTED		
61	SUBADULT	3-5	V66, V77, V102.
62	MALE	26-30	V66, V101.
63	SUBADULT	3-5	V66, V102.
64	SUBADULT	0-2	V66, V67, V71, V74, V101, V103, V104, V110.
65	FEMALE	26-30	V66, V67, V101, V102, V103.
66	FEMALE	41-45	V66, V67, V101.
67	MALE	36-40	NONE
68	MALE	31-35	V4, V66, V100, V101.
69	SUBADULT	6-10	V4, V66, V67, V74, V102, V110.
70	MALE	26-30	V66.
71	SUBADULT	0-2	V66, V67, V68, V100, V101.
72	ADULT	?	V66, V67.
73	MALE	46+	V4, V16, V60, V66, V76, V101, V111, V116.
74	MALE	36-40	V66, V67.
75	MALE	45+	V4, V66, V101.
76	SUBADULT	3-5	V66, V67, V101.
77	FEMALE	26-30	V67, V76, V101, V102, V103, V112.
78	SUBADULT	3-5	V67, V71.
79	FEMALE	41-45	NONE
80	SUBADULT	3-5	V61, V67, V69, V102.
81	MALE	36-40	V66, V74, V108.
82	FEMALE	36-40	V66, V76.
83	SUBADULT	3-5	V66, V102, V103, V105.
84	SUBADULT	?	V66, V71, V102, V103.
85	SUBADULT	3-5	V66, V76, V101, V106.
86	SUBADULT	6-10	NONE
87	FEMALE	46+	V60.

TABLE 5A. (continued)

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
88	SUBADULT	6-10	NONE
89	SUBADULT	3-5	V66, V100.
90	SUBADULT	6-10	NONE
91	FEMALE	31-35	V10, V76, V111.
92	INDETERMINATE	?	V66, V71.
93	INDETERMINATE	?	V66.
94	INDETERMINATE	?	V66, V76.
95	FEMALE	16-20	V57, V66, V67, V76, V100, V103.
96	MALE	46+	V57.
97	SUBADULT	?	V66.
98	SUBADULT	6-10	V66.
99	SUBADULT	3-5	V4, V16, V66, V102, V116.
100	MALE	36-40	V66, V84, V101.
101	SUBADULT	0-2	NONE
102	SUBADULT	0-2	V67, V74, V102, V109.
103	SUBADULT	6-10	V66, V72, V101, V105.
104	MALE	46+	V48, V57, V60.
105	FEMALE	26-30	NONE
106	ADULT	?	V66, V76.
107	SUBADULT	3-5	VV66, V67, V74, V101, V102, V104, V108.
108	MALE	41-45	V60, V66, V102.
109	FEMALE	31-35	V66, V67, V71, V101, V102, V103.
110	MALE	41-45	V57.
111	SUBADULT	6-10	NONE

TABLE 6A.

Burial Number, Age, Sex, and Grave Associations for Individuals Interred at the Fredricks Site.

BURIAL	SEX	AGE	GRAVE ASSOCIATIONS
1	SUBADULT	3-5	V3, V4, V6, V7, V8, V10, V14, V16, V17, V67, V78, V79, V86, V92, V102, V115, V116, V117.
2	SUBADULT	6-10	V4, V6, V7, V8, V14, V16, V17, V59, V66, V79, V84, V86, V91, V96, V100, V115, V116, V117.
3	MALE	21-25	V78, V79, V81, V83, V84, V88, V89, V93, V95, V98, V99, V100, V127.
4	MALE	26-30	V5, V16, V88, V91, V116.
4a	SUBADULT	0-2	NONE
5	MALE	46+	V8, V79, V81, V94.
6	MALE	21-25	V59, V67, V78, V80, V93, V97, V100, V104.
7	SUBADULT	0-2	V74, V109.
8	SUBADULT	3-5	V59, V65, V79, V85, V90, V92, V127.
9	FEMALE	36-40	V79, V80, V100.
10	SUBADULT	3-5	V22, V50, V59, V66, V74, V80, V100, V101, V109.
11	ADULT	16-20	V59, V67, V86, V87, V96, V100, V104, V105, 127, V128, V129.
12	SUBADULT	0-2	V4, V19, V74, V109, V119, V126.
13	MALE	36-40	V79, V91, V94.
14	SUBADULT	?	V7, V16, V17, V66, V85, V86, V117, V117, V125.

TABLE 7A.

Artifacts Found with Individuals in Cluster IV Derived from the Monothetic Division Cluster Analysis of the Upper Saratown-Locality 2 Sample.

BURIAL	ARTIFACT ASSOCIATION
9	deer bone beads, small glass beads, brass gorget, large brass tubes.
15	turtle carapace cup, clay pot, large brass cones.
16	columella hairpin.
20	columella cylindrical beads.
22	large glass beads, large brass tubes.
24	large glass beads.
26	marginella shell beads.
27	large brass tubes.
29	clay pipe.
30	miscellaneous brass fragments.
33	large brass tubes.
37	ground stone celt, hammerstone, rolled brass beads.
44	columella shell hairpin, chipped stone projectile point, chipped stone drill, stone/rock, clay pot, clay pipe, rolled brass beads, unidentified iron object.
45a	chipped stone projectile point, red ochre.
45b	chipped stone projectile point, red ochre, clay pipe.
49	clay pot, clay pipe, large brass tubes.
77	large glass beads, rolled brass beads.
78	large glass beads, geometric brass pendant.
87	clay pipe.
91	columella shell gorget, rolled brass beads.
96	red ochre.
102	large glass beads, small brass bells.
104	chipped stone flake, red ochre, clay pipe.
110	red ochre.

APPENDIX B

FACTORS PRODUCED BY THE PRINCIPAL COMPONENTS ANALYSIS WITH VARIMAX ROTATION FOR THE SHANNON SITE AND UPPER SARATOWN-LOCALITY 2.

TABLE 1B.

The 16 Factors Produced by the Principal Components Analysis
with Varimax Rotation for the Shannon Site.

ARTIFACT	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
Olive Shell Beads	0.00254	-0.00315	0.93528	0.00345
Marginella Shell Beads	-0.05203	-0.06332	-0.06479	0.62244
Columella Cylindrical Beads	-0.03656	-0.05888	0.07543	0.03096
Columella Tube Beads	0.24074	-0.03174	-0.06663	0.39017
Columella Small Disc Beads	-0.02669	-0.01984	-0.02671	0.21113
Columella Shell Pendants	-0.02341	-0.00414	-0.02677	0.69509
Unaltered Mussel Shell	0.70215	0.70716	-0.01069	-0.00294
Turtle Carapace Cup	-0.01920	0.56482	-0.02393	-0.03974
Turkey Digit Beads	-0.00955	-0.04530	-0.02160	-0.03099
Turkey Coracoid Beads	-0.01832	0.00068	-0.00709	0.75669
Turkey Longbone Tubular Beads	-0.02118	0.47446	-0.06279	-0.07176
Turkey Tibiotarsal Awl	0.56222	0.57100	-0.02281	-0.02281
Eagle Talon Beads	-0.00886	0.99649	-0.00317	-0.00582
Bone Hairpin	-0.04331	-0.00005	-0.01776	-0.17623
Beaver Incisor Chisel	0.99662	-0.00169	-0.01186	0.00168
Wolf Canine Beads	-0.00898	-0.00896	-0.01786	-0.02472
Mountain Lion Claw Beads	0.00247	-0.01131	0.66254	-0.06247
Bear Canine Beads	-0.02338	-0.01623	-0.03134	-0.04507
Bear Mandible	-0.01040	-0.00805	-0.01322	-0.03259
Deer Bone Beads	-0.00852	-0.00372	-0.05430	-0.10942
Deer Longbone Awl	-0.00886	0.99649	-0.00317	-0.00582
Deer Longbone Chisel	0.99662	-0.00169	-0.01186	0.00168
Deer Bone Flaker	0.99662	-0.00169	-0.01186	0.00168
Deer Bone Fishhook	-0.00703	-0.00699	-0.02845	-0.05438
Deer Phalange Projectile Point	-0.01944	-0.02013	0.83773	-0.01731
Elk Tooth Beads	-0.00886	0.99649	-0.00317	-0.00582
Chipped Stone Projectile Point	0.71026	-0.00344	0.65642	0.00365
Chipped Stone Drill	0.99662	-0.00169	-0.01186	0.00168
Chipped Stone Knife	-0.00703	-0.00769	-0.02713	-0.05246
Chipped Stone Blade	-0.00866	-0.00348	-0.01755	-0.14283
Chipped Stone End Scraper	-0.00886	0.99649	-0.00317	-0.00582
Ground Stone Celt	0.62557	-0.01392	0.05966	-0.05631
Stone Pendant	-0.00886	0.99649	-0.00317	-0.00582
Stone Abrader	0.99662	-0.00169	-0.01186	0.00168
Hammerstone	-0.01405	-0.01024	-0.04415	-0.07957
Rock Crystals	-0.01269	0.70199	-0.01495	-0.02171
Stone/Rock	-0.00455	-0.01591	-0.04501	-0.06615
Clay Pot	-0.00702	-0.00771	-0.02703	-0.05227
Clay Pipe	-0.02426	-0.01627	-0.02346	-0.03495
Rolled Native Copper Bead	-0.00702	-0.00774	-0.02691	-0.05205
Raw/Hammered Native Copper	0.99662	-0.00169	-0.01186	0.00168

TABLE 1B. (continued)

ARTIFACT	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
Olive Shell Beads	-0.01802	0.00229	0.00725	-0.00559
Marginella Shell Beads	0.05265	0.40005	-0.07475	0.06289
Columella Cylindrical Beads	0.74974	0.04372	-0.03152	0.10309
Columella Tube Beads	0.11218	-0.01814	0.04759	0.14956
Columella Small Disc Beads	0.06026	-0.00696	0.11348	0.85484
Columella Shell Pendants	-0.07164	-0.11242	-0.03077	-0.18013
Unaltered Mussel Shell	0.00948	0.00868	-0.00082	-0.00029
Turtle Carapace Cup	-0.02360	-0.01520	-0.02315	-0.01880
Turkey Digit Beads	-0.02048	-0.01088	-0.01923	-0.01637
Turkey Coracoid Beads	-0.03819	-0.05077	-0.00857	0.15871
Turkey Longbone Tubular Beads	0.56799	-0.07037	-0.02706	-0.08197
Turkey Tibiotarsal Awl	-0.00805	-0.00364	-0.01358	-0.01117
Eagle Talon Beads	0.00929	0.01076	-0.00329	-0.00009
Bone Hairpin	-0.08274	-0.02808	-0.05589	-0.08068
Beaver Incisor Chisel	0.00404	0.00145	0.00213	-0.00032
Wolf Canine Beads	-0.03000	0.96485	-0.01157	-0.03010
Mountain Lion Claw Beads	-0.11002	-0.04397	-0.04746	-0.03672
Bear Canine Beads	-0.03783	-0.02604	0.86521	0.09979
Bear Mandible	-0.02015	-0.00033	0.84287	-0.07653
Deer Bone Beads	-0.10464	-0.08231	-0.09823	-0.04282
Deer Longbone Awl	0.00929	0.01076	-0.00329	-0.00009
Deer Longbone Chisel	0.00404	0.00145	0.00213	-0.00032
Deer Bone Flaker	0.00404	0.00145	0.00213	-0.00032
Deer Bone Fishhook	-0.04998	-0.03163	-0.04449	-0.01907
Deer Phalange Projectile Point	0.15035	0.01354	-0.00153	0.00545
Elk Tooth Beads	0.00929	0.01076	-0.00329	-0.00009
Chipped Stone Projectile Point	-0.00994	0.00266	0.00667	-0.00420
Chipped Stone Drill	0.00404	0.00145	0.00213	-0.00032
Chipped Stone Knife	-0.04799	-0.03000	-0.04271	-0.01839
Chipped Stone Blade	-0.05512	-0.01933	-0.07860	0.80581
Chipped Stone End Scraper	0.00929	0.01076	-0.00329	-0.00009
Ground Stone Celt	-0.07230	-0.03428	-0.04386	-0.02666
Stone Pendant	0.00929	0.01076	-0.00329	-0.00009
Stone Abrader	0.00404	0.00145	0.00213	-0.00032
Hammerstone	-0.07155	-0.04725	-0.06297	-0.03131
Rock Crystals	-0.01472	0.69352	-0.01056	-0.02147
Stone/Rock	0.82783	-0.03455	-0.01323	-0.06684
Clay Pot	-0.04780	-0.02984	-0.04253	-0.01831
Clay Pipe	-0.02713	-0.01844	-0.02211	-0.01874
Rolled Native Copper Bead	-0.04758	-0.02965	-0.04232	-0.01822
Raw/Hammered Native Copper	0.00404	0.00145	0.00213	-0.00032

TABLE 1B. (continued)

ARTIFACT	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12
Olive Shell Beads	0.00594	0.00872	0.00588	-0.00335
Marginella Shell Beads	-0.02768	-0.01664	0.13268	-0.02716
Columella Cylindrical Beads	0.00690	0.01693	0.11760	-0.01482
Columella Tube Beads	-0.03421	-0.02722	0.66208	-0.04062
Columella Small Disc Beads	-0.00811	-0.00630	0.12561	-0.02134
Columella Shell Pendants	-0.02700	-0.02269	-0.01827	-0.01476
Unaltered Mussel Shell	0.02372	0.02136	0.02219	0.02219
Turtle Carapace Cup	0.72919	-0.01121	-0.02866	-0.01917
Turkey Digit Beads	0.94692	-0.01182	-0.02591	-0.02849
Turkey Coracoid Beads	-0.00160	-0.00070	-0.06968	-0.01602
Turkey Longbone Tubular Beads	-0.03852	-0.04537	-0.03975	-0.01814
Turkey Tibiotarsal Awl	0.00784	0.59363	-0.00057	-0.01524
Eagle Talon Beads	0.02999	0.01054	-0.00200	0.00116
Bone Hairpin	-0.02133	-0.01588	0.82863	-0.03064
Beaver Incisor Chisel	0.00338	0.01951	0.03321	0.00221
Wolf Canine Beads	-0.01723	-0.01484	-0.04759	-0.02097
Mountain Lion Claw Beads	-0.05125	-0.06176	-0.08736	-0.02598
Bear Canine Beads	-0.01975	-0.01577	0.03640	-0.02178
Bear Mandible	-0.00944	-0.00683	-0.06091	-0.01716
Deer Bone Beads	-0.11054	-0.10229	-0.14741	-0.51780
Deer Longbone Awl	0.02999	0.01054	-0.00200	0.00116
Deer Longbone Chisel	0.00338	0.01951	0.03321	0.00221
Deer Bone Flaker	0.00338	0.01951	0.03321	0.00221
Deer Bone Fishhook	-0.04222	-0.03483	-0.05533	-0.10409
Deer Phalange Projectile Point	0.01764	0.02945	0.02978	0.00247
Elk Tooth Beads	0.02999	0.01054	-0.00200	0.00116
Chipped Stone Projectile Point	0.00662	0.02007	0.02779	-0.00081
Chipped Stone Drill	0.00338	0.01951	0.03321	0.00221
Chipped Stone Knife	-0.04021	-0.03309	-0.05321	-0.10425
Chipped Stone Blade	-0.01807	-0.01424	-0.10544	-0.00186
Chipped Stone End Scraper	0.02999	0.01054	-0.00200	0.00116
Ground Stone Celt	-0.04252	-0.05840	-0.06494	-0.01911
Stone Pendant	0.02999	0.01054	-0.00200	0.00116
Stone Abrader	0.00338	0.01951	0.03321	0.00221
Hammerstone	-0.06119	-0.05256	-0.08474	0.83593
Rock Crystals	0.00907	-0.00306	-0.03525	-0.01408
Stone/Rock	-0.01952	-0.02196	-0.11766	-0.02206
Clay Pot	-0.04000	-0.03289	-0.05295	-0.10591
Clay Pipe	-0.01994	0.98727	-0.03219	-0.02948
Rolled Native Copper Bead	-0.03974	-0.03265	-0.05263	-0.10704
Raw/Hammered Native Copper	0.00338	0.01951	0.03321	0.00221

TABLE 1B. (continued)

ARTIFACT	FACTOR 13	FACTOR 14	FACTOR 15	FACTOR 16
Olive Shell Beads	-0.01252	-0.01243	-0.01234	-0.01115
Marginella Shell Beads	-0.02648	-0.02626	-0.02604	-0.02416
Columella Cylindrical Beads	-0.02781	-0.02761	-0.02741	-0.02549
Columella Tube Beads	-0.03661	-0.03632	-0.03602	-0.03386
Columella Small Disc Beads	-0.02161	-0.02144	-0.02126	-0.01986
Columella Shell Pendants	-0.00579	-0.00572	-0.00564	-0.00500
Unaltered Mussel Shell	0.00240	-0.00235	-0.00236	-0.00272
Turtle Carapace Cup	-0.01524	-0.01512	-0.01500	-0.01432
Turkey Digit Beads	-0.02292	-0.02273	-0.02253	-0.02099
Turkey Coracoid Beads	-0.01400	-0.01387	-0.01374	-0.01259
Turkey Longbone Tubular Beads	-0.00019	-0.00014	-0.00009	-0.00003
Turkey Tibiotarsal Awl	-0.01491	-0.01481	-0.01471	-0.01426
Eagle Talon Beads	0.00028	0.00026	0.00024	-0.00036
Bone Hairpin	-0.02026	-0.02010	-0.01993	-0.01908
Beaver Incisor Chisel	-0.00358	-0.00357	-0.00356	-0.00346
Wolf Canine Beads	-0.01500	-0.01486	-0.01472	-0.01355
Mountain Lion Claw Beads	0.01880	0.01182	0.01184	0.01188
Bear Canine Beads	-0.01766	-0.01751	-0.01735	-0.01606
Bear Mandible	-0.01374	-0.01362	-0.01349	-0.01239
Deer Bone Beads	-0.36018	-0.36056	-0.36028	-0.36354
Deer Longbone Awl	0.00028	0.00026	0.00024	-0.00036
Deer Longbone Chisel	-0.00358	-0.00357	-0.00356	-0.00346
Deer Bone Flaker	-0.00358	-0.00357	-0.00356	-0.00346
Deer Bone Fishhook	-0.09944	-0.09868	-0.09813	0.90697
Deer Phalange Projectile Point	-0.01891	-0.01880	-0.01869	-0.01723
Elk Tooth Beads	0.00028	0.00026	0.00024	-0.00036
Chipped Stone Projectile Point	-0.01145	-0.01138	-0.01131	-0.01038
Chipped Stone Drill	-0.00358	-0.00357	-0.00356	-0.00346
Chipped Stone Knife	-0.09762	-0.09736	0.90807	-0.09732
Chipped Stone Blade	0.00511	-0.00509	0.00507	0.00478
Chipped Stone End Scraper	0.00028	0.00026	0.00024	-0.00036
Ground Stone Celt	0.01498	0.01495	0.01492	0.01437
Stone Pendant	0.00028	0.00026	0.00024	-0.00036
Stone Abrader	-0.00358	-0.00357	-0.00356	-0.00346
Hammerstone	-0.14938	-0.15076	-0.15241	-0.15425
Rock Crystals	-0.01046	-0.01038	-0.01029	-0.00989
Stone/Rock	-0.00743	-0.00732	-0.00720	-0.00622
Clay Pot	-0.09741	0.90807	-0.09699	-0.09676
Clay Pipe	-0.02225	-0.02207	-0.02189	-0.02061
Rolled Native Copper Bead	0.90823	-0.09679	-0.09657	-0.09582
Raw/Hammered Native Copper	-0.00358	-0.00357	-0.00356	-0.00346

TABLE 2B.

The 16 Factors Produced by the Principal
Components Analysis with Varimax Rotation for Upper Saratown-Locality 2.

ARTIFACT	Factor 1	Factor 2	Factor 3	Factor 4
Marginella Shell Beads	-0.01373	-0.00960	-0.01099	-0.04737
Columella Cylindrical Beads	-0.06173	-0.04088	0.41936	-0.03275
Columella Small Disc Beads	-0.00139	-0.00411	0.95578	-0.00170
Columella Shell Gorgets	-0.04051	-0.01031	-0.01099	-0.00741
Columella Shell Hairpins	0.78987	-0.00904	-0.02285	-0.00842
Turtle Carapace Cup	-0.03961	-0.00803	-0.00383	0.97914
Deer Bone Beads	-0.03401	-0.02234	0.00534	-0.04574
Chipped Stone Projectile Point	0.66703	-0.01004	-0.01601	-0.01235
Chipped Stone Drill	0.96392	-0.00379	0.00166	0.02027
Chipped Stone Flakes	-0.05484	-0.00529	0.00880	-0.00454
Ground Stone Discs	-0.01113	-0.00474	-0.00226	-0.01036
Ground Stone Celt	-0.01368	-0.00739	-0.00626	-0.00701
Hammerstone	-0.01368	-0.00739	-0.00626	-0.00701
Stone/Rock	0.96392	-0.00379	0.00166	0.02027
Red Ochre	0.01559	-0.02475	-0.03158	-0.03230
Clay Pot	0.52134	-0.00998	-0.02317	0.62966
Clay Pipe	0.34872	-0.02726	-0.02073	0.01789
Clay Dipper	-0.01113	-0.00474	-0.00226	-0.01036
Fired Clay Lump	-0.00314	-0.01935	-0.07352	-0.00966
Small Glass Beads	-0.15943	0.05328	0.10702	-0.14250
Large Glass Beads	-0.06667	-0.08262	-0.13795	-0.06825
Brass Gorget	-0.00988	0.33894	0.33186	0.02805
Large Brass Tubes	-0.00793	-0.03507	-0.06454	0.04527
Large Brass Cones	-0.03961	-0.00803	-0.00383	0.97914
Geometric Brass Pendants	-0.03613	-0.03129	0.36434	-0.02968
Brass Animal Effigy	-0.00753	-0.01176	-0.02212	-0.01125
Brass Wire	-0.05782	-0.00763	-0.02174	-0.01817
Small Brass Bells	-0.03778	-0.05005	0.36200	-0.03022
Large Brass Bells	-0.00899	0.00106	-0.06441	-0.00140
Rolled Brass Beads	0.24056	-0.03895	-0.05350	-0.03585
Miscellaneous Brass Fragments	-0.01931	-0.02531	-0.03253	-0.05088
Iron Scissors	-0.00139	-0.00411	0.95578	-0.00170
Iron Knife	-0.00603	0.98588	-0.00603	-0.00383
Iron Hoe	-0.00603	0.98588	-0.00603	-0.00383
Iron Axe	-0.02021	-0.00465	0.00666	0.00432
Iron Spike/Chisel	-0.00603	0.98588	-0.00603	-0.00383
Unidentified Iron Object	0.60409	-0.00916	0.61058	-0.00286
Metal Spoon	-0.02138	-0.00073	0.81051	-0.00266
Lead Shot	-0.01174	-0.02278	-0.04576	-0.00320
Brass Rings	-0.01323	0.80594	-0.01447	-0.01025

TABLE 2B. (continued)

ARTIFACT	Factor 5	Factor 6	Factor 7	Factor 8
Marginella Shell Beads	-0.06484	-0.02737	-0.07239	-0.04874
Columella Cylindrical Beads	-0.03633	-0.03147	-0.13667	-0.17603
Columella Small Disc Beads	0.00601	-0.00057	0.00903	0.07302
Columella Shell Gorgets	0.01383	-0.06205	-0.07449	-0.01773
Columella Shell Hairpins	-0.00942	-0.00594	-0.07721	-0.02680
Turtle Carapace Cup	-0.01019	-0.00550	-0.01071	-0.02076
Deer Bone Beads	-0.08579	-0.01209	-0.03493	-0.12078
Chipped Stone Projectile Point	-0.00642	-0.00951	0.39241	-0.02132
Chipped Stone Drill	-0.00268	0.00060	-0.04295	-0.00527
Chipped Stone Flakes	-0.00464	-0.01040	0.67661	0.00322
Ground Stone Discs	0.98670	-0.00459	-0.01238	-0.01767
Ground Stone Celt	-0.00486	0.99439	-0.01732	-0.01337
Hammerstone	-0.00486	0.99439	-0.01732	-0.01337
Stone/Rock	-0.00268	0.00060	-0.04295	-0.00527
Red Ochre	-0.02465	-0.01934	0.85234	-0.04116
Clay Pot	0.00194	-0.00969	-0.02568	0.02552
Clay Pipe	-0.01578	-0.02170	0.39611	-0.04195
Clay Dipper	0.98670	-0.00459	-0.01238	-0.01767
Fired Clay Lump	-0.00929	0.00033	-0.00139	-0.06267
Small Glass Beads	-0.17259	-0.12883	-0.27126	0.10392
Large Glass Beads	0.22355	-0.06617	-0.13116	0.36914
Brass Gorget	-0.04078	-0.00284	-0.00865	0.29954
Large Brass Tubes	0.31742	-0.02088	-0.03648	0.27076
Large Brass Cones	-0.01019	-0.00550	-0.01071	-0.02076
Geometric Brass Pendants	-0.03287	-0.03066	-0.06097	0.69635
Brass Animal Effigy	-0.00435	-0.01188	-0.01734	-0.00781
Brass Wire	-0.00546	-0.00298	-0.07318	0.00402
Small Brass Bells	-0.00505	-0.02591	-0.07337	0.02842
Large Brass Bells	-0.02188	-0.00773	0.00982	0.84901
Rolled Brass Beads	-0.04576	-0.27168	0.12086	0.20354
Miscellaneous Brass Fragments	-0.05151	-0.03824	-0.08060	-0.05335
Iron Scissors	0.00601	-0.00057	0.00903	0.07302
Iron Knife	-0.00267	-0.00311	-0.00873	-0.00173
Iron Hoe	-0.00267	-0.00311	-0.00873	-0.00173
Iron Axe	-0.01578	-0.01798	-0.00634	-0.07172
Iron Spike/Chisel	-0.00267	-0.00311	-0.00873	-0.00173
Unidentified Iron Object	-0.00830	-0.00825	-0.05217	0.01628
Metal Spoon	-0.00924	0.00046	0.01308	0.03376
Lead Shot	-0.00977	-0.00486	0.06992	-0.04835
Brass Rings	-0.00589	-0.00749	-0.01266	-0.02571

TABLE 2B. (continued)

ARTIFACT	Factor 9	Factor 10	Factor 11	Factor 12
Marginella Shell Beads	-0.02160	-0.02876	-0.19364	-0.08821
Columella Cylindrical Beads	-0.04336	-0.17124	0.33129	0.16129
Columella Small Disc Beads	-0.00823	0.01455	-0.02710	-0.02018
Columella Shell Gorgets	-0.05088	0.04592	-0.11110	-0.03057
Columella Shell Hairpins	-0.03144	-0.00792	-0.05579	-0.00683
Turtle Carapace Cup	-0.04882	-0.01750	-0.01707	-0.03019
Deer Bone Beads	0.82520	-0.02097	0.02210	-0.05661
Chipped Stone Projectile Point	-0.02942	-0.02096	-0.00624	-0.03150
Chipped Stone Drill	-0.00973	-0.00383	0.00438	0.04645
Chipped Stone Flakes	-0.00882	0.01404	-0.08415	0.16375
Ground Stone Discs	0.04961	-0.01085	-0.01643	-0.00657
Ground Stone Celt	-0.01260	-0.00727	-0.02631	-0.00699
Hammerstone	-0.01260	-0.00727	-0.02631	-0.00699
Stone/Rock	-0.00973	-0.00383	0.00438	0.04645
Red Ochre	-0.04857	-0.05636	0.09783	-0.11178
Clay Pot	0.21146	0.02221	-0.03630	0.11375
Clay Pipe	0.03089	-0.04414	-0.09457	0.65790
Clay Dipper	0.04961	-0.01085	-0.01643	-0.00657
Fired Clay Lump	0.00022	0.83986	-0.07163	0.02117
Small Glass Beads	0.06422	0.11683	0.50105	0.11370
Large Glass Beads	-0.20485	0.03850	0.37387	-0.14202
Brass Gorget	0.38773	0.53961	0.23564	-0.03618
Large Brass Tubes	0.78083	-0.02935	-0.08746	0.02552
Large Brass Cones	-0.04882	-0.01750	-0.01707	-0.03019
Geometric Brass Pendants	-0.10674	-0.01649	-0.07128	-0.02761
Brass Animal Effigy	-0.02568	0.00193	-0.07490	-0.05737
Brass Wire	-0.05169	0.01017	-0.01617	0.84042
Small Brass Bells	-0.13323	0.66244	0.14657	-0.03769
Large Brass Bells	0.15727	0.01067	0.01549	0.01870
Rolled Brass Beads	-0.03241	-0.11106	0.15764	-0.02595
Miscellaneous Brass Fragments	-0.06201	-0.02657	-0.28694	-0.14775
Iron Scissors	-0.00828	0.01455	-0.02710	-0.02018
Iron Knife	-0.00112	0.00836	0.01413	0.00207
Iron Hoe	-0.00112	0.00836	0.01413	0.00207
Iron Axe	0.02299	-0.01241	-0.09236	0.00027
Iron Spike/Chisel	-0.00112	0.00836	0.01413	0.00207
Unidentified Iron Object	-0.01605	-0.02150	-0.02469	0.00730
Metal Spoon	0.02546	0.20846	-0.00690	-0.02893
Lead Shot	-0.02016	0.04287	0.78884	-0.10441
Brass Rings	-0.02613	-0.01970	-0.06197	-0.02473

TABLE 2B. (continued)

ARTIFACT	Factor 13	Factor 14	Factor 15	Factor 16
Marginella Shell Beads	-0.06825	-0.04075	-0.65736	-0.15772
Columella Cylindrical Beads	-0.13476	0.21693	0.08240	0.06102
Columella Small Disc Beads	0.00522	-0.01143	-0.00578	-0.00750
Columella Shell Gorgets	-0.06036	0.81058	-0.06271	-0.05831
Columella Shell Hairpins	-0.03350	-0.02242	-0.03078	-0.01380
Turtle Carapace Cup	0.00365	-0.00538	0.00760	-0.00087
Deer Bone Beads	0.04977	-0.05282	0.00554	0.00326
Chipped Stone Projectile Point	0.00528	0.11472	0.01943	0.00577
Chipped Stone Drill	0.01514	0.00447	0.00537	0.00136
Chipped Stone Flakes	-0.00833	-0.13643	-0.01292	-0.01083
Ground Stone Discs	-0.00146	-0.00217	0.01503	-0.00032
Ground Stone Celt	-0.00638	0.00829	-0.00215	-0.00641
Hammerstone	-0.00638	0.00829	-0.00215	-0.00641
Stone/Rock	0.01514	0.00447	0.00537	0.00136
Red Ochre	0.00699	0.09658	0.03099	0.00256
Clay Pot	-0.04406	-0.02088	-0.01118	-0.02102
Clay Pipe	-0.06114	-0.01379	-0.01318	-0.02846
Clay Dipper	-0.00146	-0.00217	0.01503	-0.00032
Fired Clay Lump	-0.01495	0.08251	0.04722	0.04035
Small Glass Beads	0.24492	-0.09469	0.27912	0.19499
Large Glass Beads	0.37483	-0.23578	-0.10911	-0.11047
Brass Gorget	-0.04652	0.00169	0.00846	-0.04480
Large Brass Tubes	-0.06180	-0.01509	-0.03119	-0.03364
Large Brass Cones	0.00365	-0.00538	0.00760	-0.00087
Geometric Brass Pendants	-0.01800	-0.10135	-0.01797	0.00166
Brass Animal Effigy	-0.04014	-0.05119	0.00639	0.93084
Brass Wire	0.01600	-0.02561	0.00802	-0.03417
Small Brass Bells	0.01234	-0.12631	-0.05048	-0.04110
Large Brass Bells	-0.03280	0.14035	0.04626	0.00855
Rolled Brass Beads	0.40058	0.58827	0.08263	0.02107
Miscellaneous Brass Fragments	-0.11397	-0.10968	0.70612	-0.24534
Iron Scissors	0.00522	-0.01143	-0.00578	-0.00750
Iron Knife	0.00587	-0.00565	0.01043	0.00334
Iron Hoe	0.00587	-0.00565	0.01043	0.00334
Iron Axe	0.89286	0.02702	-0.00035	-0.02824
Iron Spike/Chisel	0.00587	-0.00565	0.01043	0.00334
Unidentified Iron Object	0.01456	-0.02407	0.01218	0.01146
Metal Spoon	0.00501	-0.02737	-0.01248	-0.01835
Lead Shot	-0.11399	-0.04282	-0.03256	-0.11861
Brass Rings	-0.02933	-0.00831	-0.02821	-0.01430

APPENDIX C

STATISTICS USED TO SELECT THE OPTIMUM CLUSTER SOLUTIONS.

SECTION 1.

STATISTICS USED TO DETERMINE OPTIMUM NUMBER OF CLUSTERS USING WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS.

To determine the optimal number of clusters it is best to ". . . look for a consensus among the three statistics, that is, local peaks of the CCC and pseudo F statistics combined with a small value of the pseudo t^2 statistic and a larger pseudo t^2 for the next fusion cluster." (SAS Institute 1985:67). The CCC statistic is the cubic clustering criterion of Sarle (1983). In the following two lists of statistics for each of the samples, there are no local peaks for the CCC and pseudo F statistics. Therefore, the optimum number of clusters in taken to be the fusion cluster where the pseudo t^2 statistic declines and is then followed by a larger pseudo t^2 for the next fusion cluster.

CRITERIA USED TO DETERMINE BEST NUMBER OF CLUSTERS FOR WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS OF THE SHANNON SITE DATA.

Number of Clusters	CCC	PSEUDO F	PSEUDO T**2
19	97.8752	46.69	9.65
18	89.1114	38.58	27.59
17	76.1002	29.61	31.26
16	63.0295	23.43	6.52
15	52.8523	19.48	26.50
14	44.3846	16.66	20.77
13	37.1074	14.52	14.14
12	30.8491	12.87	12.79
11	24.9789	11.44	12.19
10	20.0530	10.33	10.81
9	15.8824	9.45	9.74
8	12.3375	8.75	8.88
7	9.3373	8.19	8.17
6	6.8283	7.75	7.57
5	4.5881	7.36	7.28
4	2.5665	7.00	7.06
3	0.6438	6.60	6.95
2	0.0869	6.23	6.60
1	0.0000	.	6.23

NOTE: A "." indicates that a statistic could not computed for that fusion cluster.

CRITERIA USED TO DETERMINE BEST NUMBER OF CLUSTERS FOR WARD'S MINIMUM VARIANCE CLUSTER ANALYSIS OF THE UPPER SARATOWN-LOCALITY 2 DATA.

Number of Clusters	CCC	PSEUDO F	PSEUDO T**2
22	99.3963	44.54	15.09
21	96.0650	41.11	17.66
20	91.3866	37.16	10.59
19	87.2756	34.03	16.37
18	83.1073	31.23	15.02
17	74.7826	26.78	21.29
16	64.4559	22.81	.
15	55.8969	19.96	12.57
14	47.9511	17.59	23.75
13	40.9868	15.72	19.47
12	35.1642	14.31	69.17
11	29.8564	13.12	1.24
10	25.2475	12.17	14.93
9	20.7432	11.26	12.80
8	16.5483	10.44	10.34
7	12.8294	9.75	9.70
6	9.3688	9.11	9.09
5	6.3569	8.56	8.79
4	3.6149	8.03	8.46
3	1.3128	7.57	7.97
2	0.5689	7.19	7.52
1	0.00000	.	7.19

NOTE: A "." indicates that the statistic was not computed for that fusion stage.

SECTION 2.

STATISTICS USED TO DETERMINE BEST NUMBER OF CLUSTERS FOR WISHART'S CLUSTAN MONOTHETIC DIVISION USING THE RULES PROCEDURE

The following discussion of the use of the Procedure Rules in Clustan to determine the optimum number of clusters for monothethic division is based directly on Wishart's (1982:14-17) detailed discussion of the technique. This technique tests for a significant number of clusters for monothetic divison cluster analysis.

> Two statistical stopping rules are provided: the "upper tail" rule, and the "moving average quality control" rule.
>
> The rules procedure can be called after any hierarchical cluster analysis has been completed, including monothethic division. It reads the dendrogram data stored during the most recent cluster analysis in the current CLUSTAN job and prints relevant statistical indicators depending on the stopping rule selected.
>
> Most hierarchical classification methods produce a sequence of criterion values corresponding to the level of the custering criterion at each of N-1 fusions. The sequence referred to here is of the form $\underline{z} = [z_1, z_2 \ldots z_{N-1}]$, where z_j is the value of the criterion of the jth fusion stage.
>
> RULE 1: Upper Tail Rule
>
> This rule selects the partition corresponding to the first stage j in the cluster sequence j=2 .. N-2 satisfying
>
> $$z_{j+1} > \bar{z} + ks_z$$
>
> where $\bar{z}$ and s_z are the mean and unbiased standard deviation of the distribution of N-1 values, and k is the standard deviate.
>
> This simple rule defines a "significant" classification as one for which the following

criterion value z_{j+1} is significant, ie z_{j+1} lies in the upper tail of the distribution of criterion values $\underline{z}$. The rule thus predicts N-j clusters as best for the first z_{j+1} which satisfies the rule. If no z_{j+1} satisfies the rule, one cluster is judged to be the best: ie, it can be concluded that there are no significant classifications in the hierarchical clustering sequence.

In practice it is best to make the rule independent of k by computing the realised deviate k_j at each stage, where k_j is given by:

$$k_j = (z_{j+1} - \bar{z}) / s_z$$

The distribution of k_j values is sorted into descending order so that the 'best' partitions can be more easily identified.

An example of the output produced by RULES for a hierarchical classification of 12 cases is given below. This output indicates that the 2 cluster partition is the most likely candidate for consideration as a 'natural' break in the hierarchy; in this case the value of the criterion for the final fusion z_{n-1} is found to exceed the mean criterion value by more than two and a half times the standard deviation s_z.

STOPPING RULE ONE EXAMPLE:

Mean = 3.698
Std. Dev. = 1.593

Realised Deviates	Predicted Clusters
2.53	2
0.62	3
0.62	4
0.03	5
0.00	6
-0.23	7
-0.37	8
-0.67	9
-0.73	10
-0.81	11

A t-statistic with v=(n-2) degrees of freedom can be computed by multiplying the realised deviate k_j by the square root of (n-1), the number of criterion values. In this case the test statistic would be 3.32 x 2.53 = 8.39 which is significant at the 1% level for 10 degrees of freedom.

It should be noted that there are problems with this test. Firstly, the (n-1) criterion values cannot be considered to be normally distributed. They are usually bounded (eg all must exceed zero for Ward's method). More important however is the fact that the mean $\bar{z}$ and standard deviation s_z are both computed using all z_{n-1} values, including the value z_{j+1} being tested for significant departure from the common mean. If the value being tested were to be excluded from the estimation of mean and standard deviation, however, the test statistic would be even greater under normal circumstances.

RULE 2: Moving Average Quality Control Rule

This rule selects the partition corresponding to the first stage j in the partial cluster sequence j=r, r+1, .., N-2 satisfying:

$$z_{j+1} > \bar{z}_j + L_j + b_j + ks_j$$

where r is the number of items in the moving average; $\bar{z}_j$ is the moving mean in stage j; l_j is the correction for trend lag in stage j; b_j is the moving least squares slope in stage j; and s_j is the moving unbiased estimate of the population standard deviation in stage j. If no value for z_{j+1} satisfies this rule one cluster is assumed to be the best.

Rule 2 treats $\underline{z}$ as a quality control series with linear trend where the upper control limit is given by the right-hand side of the above inequality. Note that $\bar{z}_j + L_j$ represents the expected value of z_j and $\bar{z}_j + L_j + b_j$ is the expected value of z_{j+1}.

For a theoretical series characterised by a ramp with constant slope b_j, it can be proved that the expected moving standard deviation is constant and the trend lag is given by

$$L_j = (r-1)b_j/2$$

Statistically this rule is superior to Rule 1 because candidates for significance do not influence the sample statistics. However, the user must decide the value for 4, the number of criterion values to be included in the moving average. This is done by specifying a range and step for r as a proportion of the number of criterion values (n-1). The range is specified by minimum and maximum proportions PMIN and PMAX, and a step of PSTEP.

For example, in the case of a hierarchical classification on 12 cases, involving 11 criterion values, if PMIN=0.3 PMAX=0.8 and PSTEP=0.3 rule 2 will be evaluated for 2, 6 and 10 criterion values contributing to the moving average. A typical output for the second test is as follows:

STOPPING RULE TWO EXAMPLE:

```
Moving Average Proportion     =0.500 (6 items)
Mean Forecast Error           =0.129
Absolute Mean Forecast Error =0.249
Number of Forecasts           =4
```

Realised Deviates	Predicted Clusters
3.94	2
1.12	4
0.40	6
-0.14	3
-0.28	5

As with Rule 1, the realised Deviates are ordered by numerical value to enable candidates for significant partitions to be chosen. The above example shows that criterion value for the 2 cluster partition is nearly 4 standard deviates than the mean of the prededing 6 criterion values in the cluster sequence.

For this study the results of the Stopping Rule Two tests were utilized to determine the optimum number of clusters, primarily because of the problems noted above for the Stopping Rule One test. The default values for r (PMIN=0.4, PMAX=0.8, and PSTEP=0.2) provided by CLUSTAN were used to specify the number of criterion values to be included in the moving average. A two cluster solution would have been accepted as the optimum division of the sample only if no other cluster solution was indicated by any of the Stopping Rule Two test results. When a two cluster solution was produced in conjunction with n+2 cluster solution(s), the two cluster solution was rejected because it would only have divided the sample into those individuals with artifacts and those individuals without artifacts. For each monothethic cluster analysis a solution other than a two cluster solution was indicated at least once by the Stopping Rule Two test results.

CRITERIA USED TO DETERMINE BEST NUMBER OF CLUSTERS FOR WISHART'S MONOTHETHIC DIVISION CLUSTER ANALYSIS USING STOPPING RULE TWO FOR THE SHANNON SITE DATA

Moving Group Proportion = 0.400 (8 items)
Mean Forecast Error = 6.075
Absolute Mean Forecast Error = 6.075
Number of Forecasts = 10

Realised Deviates	Predicted Clusters
7.84	11
4.46	2
3.80	4
2.12	3
1.49	10
0.78	9
0.76	6
0.15	12
0.14	7
0.07	8

Moving Group Proportion = 0.600 (12 items)
Mean Forecast Error =10.849
Absolute Mean Forecast Error =10.849
Number of Forecasts = 6

Realised Deviates	Predicted Clusters
5.14	2
3.52	4
2.46	3
1.24	6
0.71	7
0.58	8
0.47	5

Moving Group Proportion = 0.800 (16 items)
Mean Forecast Error =29.219
Absolute Mean Forecast Error =29.219
Number of Forecasts = 2

Realised Deviates	Predicted Clusters
5.88	2
3.84	4
3.00	3

CRITERIA USED TO DETERMINE BEST NUMBER OF CLUSTERS FOR WISHART'S MONOTHETHIC DIVISION CLUSTER ANALYSIS USING STOPPING RULE TWO FOR THE UPPER SARATOWN-LOCALITY 2 DATA

Moving Group Proportion = 0.400 (6 items)
Mean Forecast Error = 5.096
Absolute Mean Forecast Error = 5.096
Number of Forecasts = 8

Realised Deviates	Predicted Clusters
4.24	5
3.45	2
1.95	6
1.01	9
0.72	7
0.46	4
0.35	10
0.33	3
0.21	8

Moving Group Proportion = 0.600 (10 items)
Mean Forecast Error =14.762
Absolute Mean Forecast Error =14.762
Number of Forecasts = 4

Realised Deviates	Predicted Clusters
4.57	5
4.14	2
2.04	6
1.27	4
1.08	3

Moving Group Proportion = 0.800 (13 items)
Mean Forecast Error =20.188
Absolute Mean Forecast Error =20.188
Number of Forecasts = 1

Realised Deviates	Predicted Clusters
4.67	2
1.52	3

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