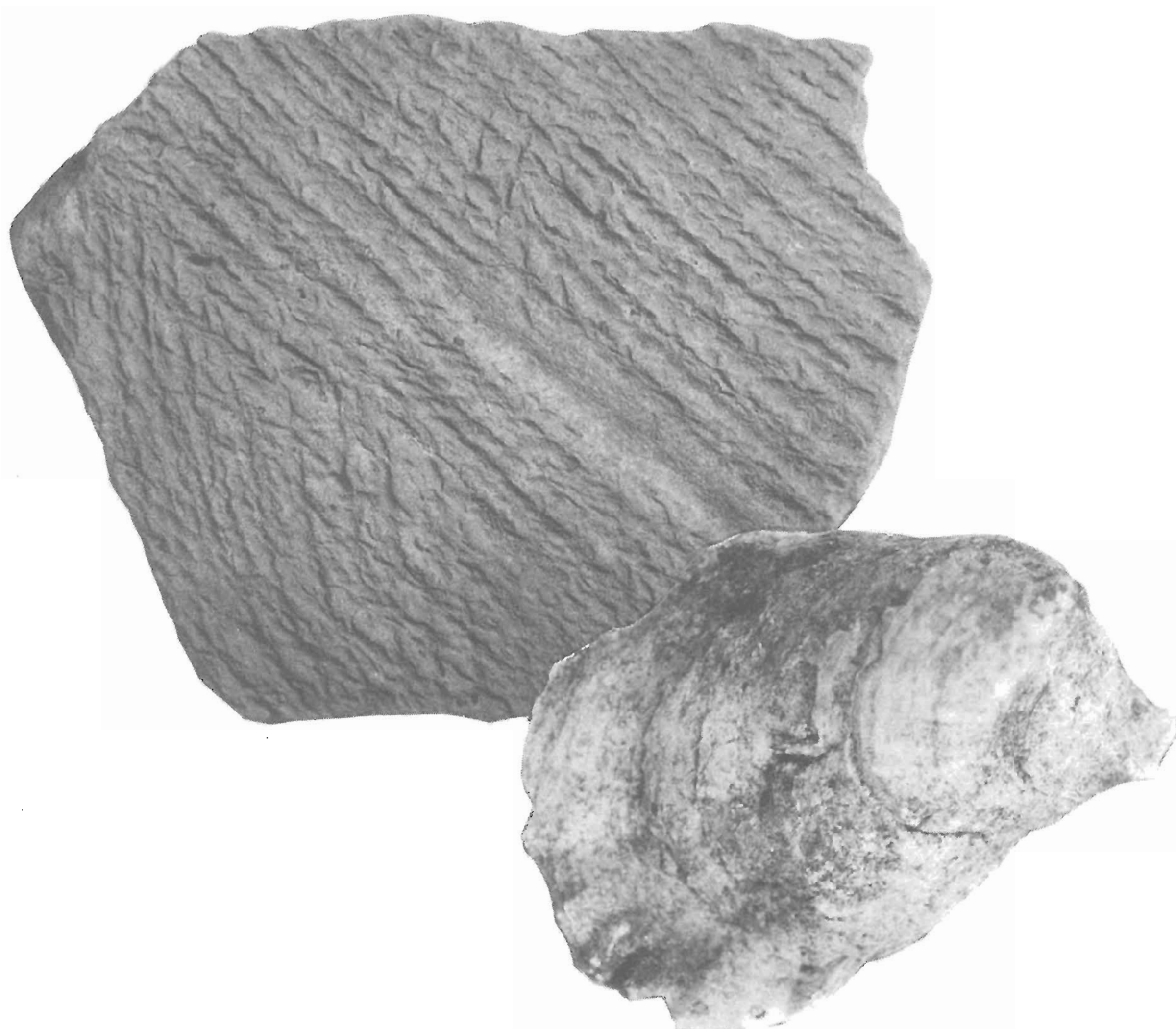
MIDDLE AND LATE WOODLAND LIFE AT OLD HOUSE CREEK, HILTON HEAD ISLAND, SOUTH CAROLINA



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MIDDLE AND LATE WOODLAND LIFE AT OLD HOUSE CREEK, HILTON HEAD ISLAND, SOUTH CAROLINA

Research Series 42

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I don't pretend to understand the Universe -- it's a great deal bigger than I am. . . . People ought to be modester.

-- Thomas Carlyle

ABSTRACT

This study reports on the archaeological data recovery excavations undertaken at the Middle and Late Woodland Period Deptford and St. Catherine's phase shell midden 38BU861 on Hilton Head Island in Beaufort County, South Carolina. The site was previously determined eligible for inclusion on the National Register by the S.C. State Historic Preservation Office and this work was sponsored by Old House Creek Associates, Inc. and the Habit Corporation, Inc. who anticipate developing the property for single family housing.

The site, originally identified by Chicora Foundation's reconnaissance level survey for the Town of Hilton Head Island in 1987, extends from the study tract eastward an unknown distance. These investigations, therefore, have explored only a small part of the total site area. In spite of this, research has been undertaken on a wide range of significant topics, including settlement, subsistence, ceramic typology, and the ecological reconstruction of the site.

Settlement issues included an examination of the individual middens, their relationship to one another, and their formation process. A goal of the research was to explore the shell middens as features of the total village or settlement layout. A second goal was to estimate the period of site formation, using multiple radiocarbon dates. Subsistence issues included a reconstruction of the prehistoric foodways, with detailed examinations of faunal, floral, and shellfish remains. One goal of this research was to determine the season of occupation, since this may provide significant information concerning site function. Ceramic typology studies concentrated on an analysis of the paste or fabric of the St. Catherines pottery, as well as a detailed examination of the cordage impressions. A goal of the research was to determine if differences in pottery surface treatment might be found between individual middens. Ecological reconstruction of the site involved both pollen and subsistence studies, since the goal was to evaluate how local environmental changes might have affected the subsistence quest.

In addition to these relatively site specific questions, the investigations at the Old House Creek site were also intended to test a small array of methodological and data gathering issues, including the use of auger testing and probing at close intervals to define individual middens, the ability to distinguish individual middens using topographic mapping at quarter foot intervals, and the ability to distinguish midden and associated activity areas using computer density mapping. Also explored was the ability of water screening the midden soils through ⅛-inch mesh to improve data collection techniques. An attempt was made to identify a wide range of seasonal indicators which included very fine screening for recovery of the oyster ectoparasite *Boonea impressa*. The research also experimented with different methods of collecting pollen to maximize data return.

Ultimately the goal of Chicora Foundation's research at 38BU861 is to generate information which helps us better understand the lifeways of its occupants. The wide range of methods and analytical techniques have assisted in meeting this goal. But just as importantly, the investigations at 38BU861 are seen as offering guidance on future shell midden research in South Carolina and Georgia.

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ACKNOWLEDGEMENTS

This work was sponsored by the project's owner, Old House Creek Associates, Inc., whose principals are Messrs. Ken Gort, Clif Hopkins, and Frank Habit. I would like to thank them for their support and interest in understanding the history and heritage of Hilton Head Island.

I appreciate the assistance of the S.C. State Historic Preservation Office, especially the cooperation of their Staff Archaeologist, Mr. Lee Tippett. Considerable efforts were necessary to complete the review of the research design, development the Memorandum of Agreement, and review this study.

A number of volunteers participated in the work, offering an exceptionally valuable contribution -- their time. Those participating include Ms. Joyce Albrecht, Ms. Ginger Anderson, Mr. Mark Bumgradner, Ms. Lynn Corliss, Mr. Tom Culligan, Ms. Jennifer Ehlers, Ms. Beth Fox, Mr. Tom Griffin, Mr. and Mrs. Jack Keller, Ms. Kathie Kropschab, Ms. Abby Kunkle, Ms. Cynthia Montgomery, Ms. Coleen Murphy, Ms. Fran Nunno, Ms. T.J. Peckmore, Mr. Dave Vapnitsky, Ms. Mary Walker, and Ms. Gretchen Wood. We would also like to thank both Ms. Margie Tolley and Mr. Tom Griffin for their assistance finding and coordinating volunteers for the project. The Hilton Head Island Chapter of the Archaeological Society of South Carolina shows exceptional interest in helping professional archaeological investigations.

I want to thank Dr. and Mrs. Ronald Schmidt for their conversation and hospitality during our work. We all appreciate their kindness. Others who deserve my notice and thanks include Ms. Gail Krueger of the *Savannah News-Press* for covering our work; Ms. Barbara Lothrop with the Hilton Head Museum for her assistance in curation of the collections; and Mr. Michael Taylor for his excellent news article in the *Island Packet*. I also want to thank Dr. Joel Gunn for his interest in our work.

I also want to thank the crew for this project -- Mr. Ryan Borea, Ms. Lynn Roberts, Ms. Jennifer Schmidt, and the field director, Ms. Natalie Adams. Without their efforts, enthusiasm, and dedication this report would not be possible.

A number of individuals have collaborated in the production of this report. In particular I want to thank the authors, Natalie Adams, Cheryl Claassen, Arthur Cohen, David Lawrence, and Jack Wilson, Jr. Melissa Trushel, a new member of Chicora's team, conducted the initial ceramic analysis. I have had the satisfaction of working with each of these individuals in the past -- some on numerous occasions and it is always a pleasure.

This study has also been sent to a number of peer reviewers, some with special expertise in archaeology, such as Dr. David G. Anderson and Dr. Kenneth Sassaman, and others with expertise in ecology, such as Mr. Skipper Keith . I would like to thank these individuals for their time and labor. I appreciate all of their comments, both generous and critical. I hope that they will see how seriously their suggestions were taken.

Finally, if there is anyone who has been forgotten I apologize and hope that a blanket "thank you" will be some small expression of my gratitude.

INTRODUCTION

Background

Archaeological site 38BU861 was first recorded by Chicora Foundation as a result of a reconnaissance level archaeological survey conducted for the Town of Hilton Head Island in 1986 (Trinkley 1987). Conducted as a pedestrian survey which largely examined eroding bank edges and open ground, the site was described as "a shell midden eroding along [the] marsh edge" (SCIAA 38BU861 site form). The site was estimated to cover an area of 200 feet along the shore and perhaps 30 feet inland, although these boundaries were based on visual inspection alone (see Trinkley 1987:40-41 for a discussion of the methodology employed). No cultural material was collected and the site was recommended as potentially eligible for inclusion on the National Register on the basis on the wide ranging contributions which shell middens can make to our understanding of prehistoric lifeways.

The site is situated on the west edge of Hilton Head Island, off Spanish Wells Road and overlooking Old House Creek (Figure 1). At the time of the initial survey the area was heavily wooded and it was situated in an area which had not yet seen any substantial development. Although an older subdivision was situated about a mile to the east, the site's marsh edge was isolated and no houses were nearby.

Additional survey of the tract containing the site was conducted by Brockington and Associates in 1992 (Jones n.d.), prior to development of the tract. Intensive testing at the site included shovel testing at 100-foot intervals on 100 foot transects. A total of 55 shovel tests were placed within what eventually was defined as the site (Jones n.d.:28), revealing what was termed a "moderately dense" midden. No further information, however, was offered on the midden or its stratigraphy. Eighteen of the 55 shovel tests produced artifacts and Jones divided the site into two "areas," presumably on the basis of artifact density and disperal although no information regarding the areas was provided. Materials recovered during this intensive testing included pottery identified as Stallings, Deptford, and Wilmington wares, and a single lithic. No mention was made of ethnobotanical or faunal remains, excepting the presence of unspecified shell. The site was defined as measuring 450 by 500 feet.

In spite of this seemingly intensive shovel testing, Jones (n.d.:30-31) recommended the site as potentially eligible and suggested additional testing, specifically:

> limited shovel testing in portions of the site to determine more fully the distribution of artifacts within the site. Also, the controlled excavation of six (6) 1 m by 2 m units should be undertaken to determine the stratigraphic nature of the shell middens and their potential to produce ecofacts related to the diet of the former occupants (Jones n.d.:31).

The research context of this work, and the potential eligibility, included the site's ability to answer questions:

> regarding the function or use of the site, or of specific locals within the site . . . . regarding the sites [sic] role in the regional settlement/subsistence pattern of the sea islands . . . [and] the changing patterns of resource procurement through time (Jones n.d.:30).

Eligibility was to be based on:

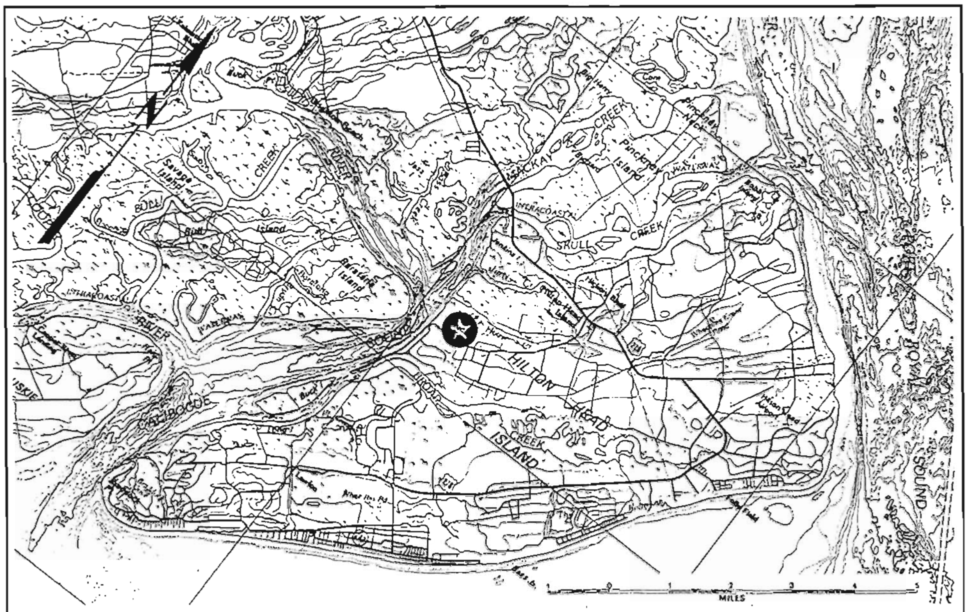

Figure 1. Location of 38BU861 on Hilton Head Island.

an adequate assemblage of artifacts, and/or cultural deposits that can be directly related to specific activities that occurred at the site (e.g., features or occupation horizons), the preservation of ethnobotanical or zooarchaeological remains, or a combination of these. . . . An "adequate" artifact assemblage would include artifact types that can be analyzed to determine how they were used prior to deposition, a large number of artifacts within a single type/class (e.g., lithic waste fragments), and an assemblage with many types/classes represented (Jones n.d.:21).

Other important data sources would be environmental data (e.g., geoarchaeological, palynological) and the "presence of temporally diagnostic remains" (Jones n.d.:21).

In September 1993 Chicora was contacted by Habit Corporation requesting that the foundation further evaluate 38BU861 to determine the site's potential eligibility for inclusion on the National Register of Historic Places. In reviewing our colleague's previous survey and report we found that the recommendations offered provided a reasonable approach to determining eligibility. The goal of the testing program, therefore, was four fold:

- to determine if the shell midden was intact (or alternatively, if it had been plowed),
- to determine the density and diversity of cultural materials (such as pottery and lithics) present,
- to determine if floral and faunal materials were present in the middens, and
- to determine if submidden features could be detected by the additional testing.

Our only changes in the strategy proposed by Jones was to substitute auger testing for additional shovel testing, reduce the excavations from six to four units, and to concentrate on one site area rather than diluting the efforts by attempting to explore what amounted to approximately five acres.

Chicora's proposal for this additional testing was approved by the Habit Corporation in late September 1993 and the test excavations were conducted by the Foundation, with exceptional volunteer assistance provided by the Archaeological Society of South Carolina, in early October 1993.

The results of this intensive testing are available as a *Chicora Research Contribution* (Trinkley and Adams 1993). In brief, the work found that the site consists of extensive plowed areas to the south (inland), as well as apparently intact areas to the north (bordering the marsh edge), with much of the original site boundary representing plow smear. Consequently, the site area was reduced, although distinct areas of intact midden were documented. A combination of fine-scale topographic mapping (contour intervals at 0.25 foot), and close-interval (20 foot) auger testing revealed at least three distinct middens in the test area (approximately a quarter acre) (Figure 2).

The study also found that nearly all of the ceramics identified were St. Catherines wares, dating to the Late Woodland (ca. A.D. 1000-1200). A combination of dry screening through ¼-inch mesh and waterscreening through ⅛-inch mesh resulted in the recovery of both floral and faunal remains. In particular the middens produced evidence of hickory nutshells and also small fish vertebra, although shell remained the visually dominant dietary source. The shell midden, however, revealed a range of macro-species, including oyster, clam, ribbed mussel, and whelk. Also identified from the midden was the impressed odostone, *Boonea impressa* (David Lawrence, personal communication 1993).

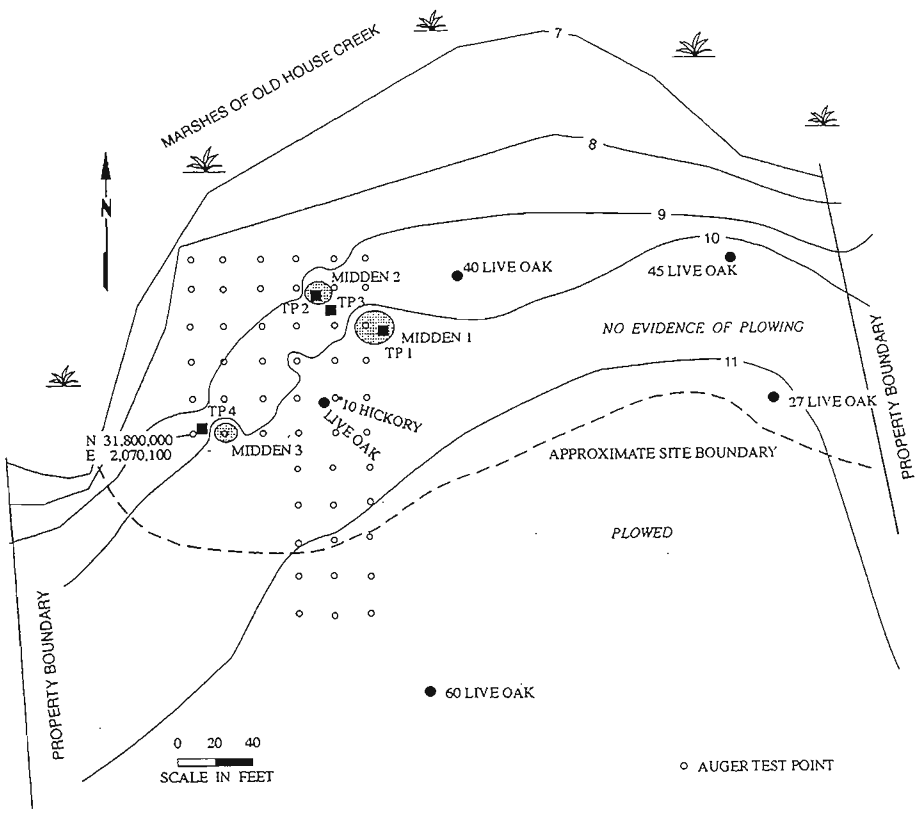

Figure 2. Test excavations conducted at 38BU861 by Chicora Foundation in 1993.

The test excavations at 38BU861 were clearly too limited to offer any realistic synthesis of the site, yet they were sufficient to reveal that the site is dominated by pottery from one ware-group or phase. They further revealed the presence of middens, as well as submidden features. The midden was found to contain both ethnobotanical and faunal remains (in addition to the shellfish remains). Consequently, the data sets present at the site were defined as:

- ceramics, suitable for paste studies and fabric analysis,

- ethnobotanical remains, suitable for microenvironmental reconstructions, seasonality dating, and radiocarbon determinations,

- faunal materials, suitable for dietary reconstructions and possible seasonality dating,

- shellfish, suitable for seasonality studies and also, as an assemblage, for microenvironmental reconstructions, and

- features, potentially offering sealed contexts for cross-checking oyster seasonality using clam data, as well as offering functional data and the ability for sealed context dating.

The auger tests, excavations, and land form evaluation also assisted in better delimiting the site boundaries. Based on the best information available from both the survey and the testing, it appeared that the site core was confined to the area about 200 to 250 feet from the marsh edge.

Figure 3. Auger testing during the 1993 testing phase, showing vegetation.

While shell continued to the south, or inland, this area was found to be plowed, resulting in extensive mixing and a reduction in site integrity. The western boundary, at least for the purposes of this study, appears to be a small slough cutting south into the property at the western edge. The site, as previously discussed, continues to the east, onto an adjacent parcel of land. This area to the east has **not** been examined and is not considered in the assessment of eligibility or the development of the research design.

Based on the testing program, 38BU861 was recommended as eligible for inclusion on the National Register of Historic Places based on Criteria D: that a site may "have yielded, or may be likely to yield, information important in prehistory or history." Eligibility was recommended at the local level, since the information the site can contribute is most meaningful in the development of local syntheses and contexts. The testing program also documented that 38BU861 possessed integrity, defined by *National Register Bulletin* 15 as "the ability of a property to convey its significance."

The broad aspects of location, materials, and feelings are all appropriate to the nature of the property. The study found that there was integrity of location since the site contained discernable middens, features, and artifacts, all in primary context. The portion of the site which evidences extensive plowing, and associated loss of locational integrity, is not considered as part of the eligible site. Setting traditionally includes such elements as topographic features (the adjacent slough, once a freshwater spring), views (especially of the associated Old House Creek marsh), vegetation (which the presenceof several specimen trees protected by the Town of Hilton Head Island), all of which contribute to the site's integrity (Figure 3). There is integrity of materials, based on the presence of features, a single component ceramic assemblage, and presence of floral and faunal materials. Finally, the property has integrity of feeling, since in its current rural, undeveloped state it clearly conveys a historic sense of the property during the prehistoric period. Finally, it may also be argued that the site has clear integrity of association, since there appeared to be a clear connection between the data sets and the importance of this period in South Carolina history.

Goals

The goals of this research were three-fold. First and perhaps most obvious, our goal was to conduct archaeological data recovery requested by the project sponsor to comply with a Memorandum of Agreement between Old House Creek Associates and the S.C. State Historic Preservation Office. The ultimate aim, of course, was to allow construction of the second phase of the Old House Creek subdivision. This goal, however, was contingent upon the second goal -- answering a broad range of research questions concerning the site and its contribution to our understanding of Native American life. The specific research questions will be discussed in more detail in a following section, although in general they deal with *intra-site patterning, midden research, artifact research* and *ecofact research.*

Just as importantly, however, the investigations at 38BU861 were also seen as a test of a new philosophy or attitude toward shell midden research. The State Historic Preservation Office quite correctly had noted that the questions posed, and even the methodology employed, at many shell midden sites had become "stale," and was failing to result in new information. It is perhaps ironic that just as researchers in other sections of the United States are beginning the "deciphering" of shell middens (see Lyman [1991] and Stein [1992] for examples of Northwest Coast research), archaeologists in the South Carolina are finding themselves attempting to justify such research. Regardless, site 38BU861 was seen as an opportunity to redefine midden research, offering new insights on methodological issues, and perhaps even new ways at looking at old shell.

The research questions and data recovery plan which were eventually developed for 38BU861 address both old, but unresolved, questions such as the typological validity of St. Catherines pottery as well as new questions, such as the community patterning of the site. The research design which Chicora proposed for the site also takes common approaches, such as the examination of floral and faunal remains, and adds a "new" dimension, that of an integrated, environmental approach focusing on the total assemblage. The study at 38BU861 also combines methodological approaches to attack research questions from several perspectives, such as using both multiple radiocarbon dates and cordage analysis to investigate occupational patterning. The work undertaken integrated new approaches, such as the use of estimated vessel equivalency, into shell midden work. It also, we hope, challanges assumptions, especially assumptions that shell midden sites are simplistic and offer limited research potential. The data sets defined, the methods proposed and undertaken to explore those data sets, and the research questions outlined, all suggest that shell middens have offered little new information because new approaches have not been integrated into the research.

Curation

The field notes, photographic materials, and artifacts resulting from Chicora Foundation's investigations will be curated at the Hilton Head Museum using that institution's lot provenience system under accession number 1994.1. Catalog numbers are ARCH 3378 through ARCH 3475.

The artifacts have been cleaned and evaluated for conservation needs. The pottery from Feature 5 is very friable, and consolidation of the sherds will be necessary prior to any effort at reconstruction. However, since this feature is unusual, and future investigators may desire to undertake chemical analysis of the pottery, no conservation treatments have been conducted.

All original records and duplicate copies were provided to the curatorial facility on pH neutral, alkaline buffered paper and the photographic materials were processed to archival permanence.

NATURAL SETTING

Physiography

Beaufort County is located in the lower Atlantic Coastal Plain of South Carolina and is bounded to the south and southeast by the Atlantic Ocean, to the east by St. Helena Sound, to the north and northeast by the Combahee River, to the west by Jasper and Colleton counties and portions of the New and Broad rivers (Figures 1 and 4). The mainland primarily consists of nearly level lowlands and low ridges. Elevations range from about sea level to slightly over 100 feet above mean sea level (MSL) (Mathews et al. 1980:134-135). Hilton Head is located between Port Royal Sound to the north and Daufuskie Island to the south. The island is separated from Daufuskie by Calibogue Sound and from the mainland by a narrow band of tidal marsh and Skull Creek. Between Hilton Head and the mainland are several smaller islands, including Pinckney and Jenkins Islands.

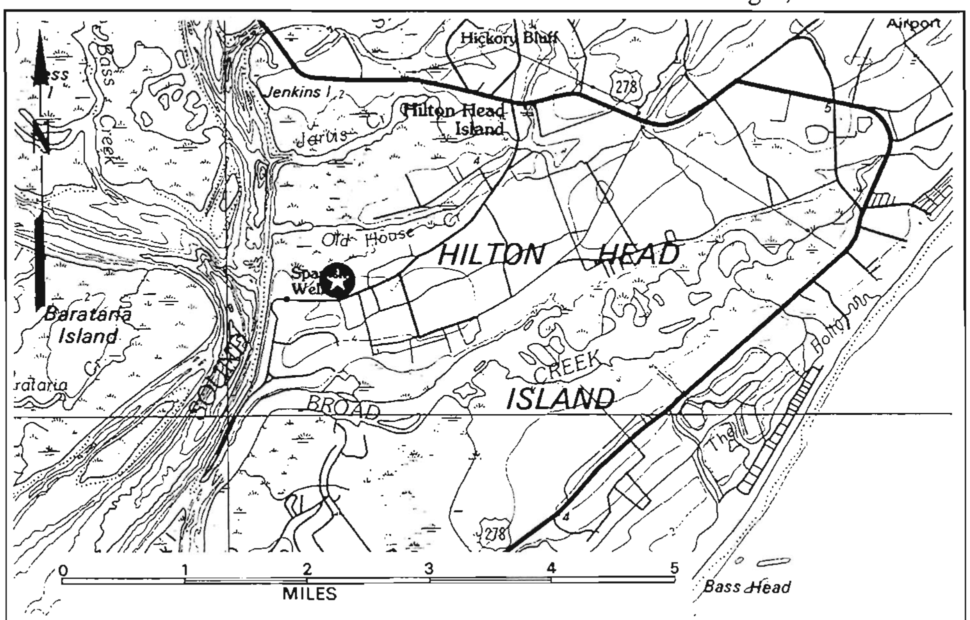

Figure 4. Hilton Head Island, showing the location of 38BU861.

Hilton Head is about 11.5 miles in length and has a maximum width of 6.8 miles, incorporating just under 20,000 acres of highland and 2,400 acres of marsh. Elevations range from sea level to 21 feet above mean sea level (AMSL) on the highest natural beach ridges (Mathews et al. 1980).

Hilton Head is situated in the Sea Island section of South Carolina's Coastal Plain province. The coastal plain consists of the unconsolidated sands, clays, and soft limestones found from the fall line eastward to the Atlantic Ocean, an area of more than 20,000 square miles or about two-thirds of South Carolina (Cooke 1936:1-3). Elevations range from just above sea level on the coast to 600 feet AMSL adjacent to the Piedmont province. The coastal plain is drained by three large through-flowing rivers -- the Pee Dee, Santee, and Savannah -- as well as by numerous smaller rivers and streams. On Hilton Head there are two major drainages, Broad Creek which flows almost due west into Calibogue Sound, and Jarvis Creek which empties into Mackay Creek just north of Broad Creek.

From Bull Bay southward, the coast is atypical of the northern coastline. The area is characterized by low-lying, sandy islands bordered by salt marsh. Brown (1975) classes these islands as either Beach Ridge or Transgressive, with the Transgressive barrier islands being straight, thin pockets of sand which are rapidly retreating landward with erosion rates of up to 1600 feet since 1939. The Beach Ridge barrier islands, however, are more common and consist of islands such as Kiawah and Hilton Head. They are characterized by a bulbous updrift (or northern) end.

Kana (1984) discusses the coastal processes which result in the formation of barrier islands, noting that the system includes tidal inlets at each end of the barrier island with the central part of the island tending to be arcuate in shape while the ends tend to be broken. Hilton Head has the typical central bulge caused by sand wrapping around the tidal delta and then depositing midway down the island. Further, the south end has an accreting spit where sand is building out the shoreline. The central part of the island, however, has experienced a 25-year erosion trend averaging 3 to 10 feet a year (Kana 1984:11-12; see also U.S. Army Corps of Engineers 1971). Research by Hubbard et al. reported that:

> the 25 year trend of the area shows a complex pattern of erosion and deposition along the island's length. Comparison of total volumes of material eroded and deposited along the entire island suggests that sand is not being lost from the island system, but is simply being shifted around from one place to another (Hubbard et al. 1977:23).

More recent work by Kana et al. (1986) confirms considerable shoreline reorientation.

Hilton Head, however, is also a different shape than most of the other islands since it has a Pleistocene core with a Holocene beach ridge fringe. To understand the significance of this situation, it is important to realize that technically the sea islands and the barrier islands are different from a historical perspective. The classic sea islands of colonial and antebellum fame (such as James, St. Helena, and Sapelo islands) are erosional remnants of coastal sand bodies deposited during the Pleistocene high sea level stands. They are crudely elongate, parallel to the present day shoreline, and rectangular in outline. Their topography is characterized by gentle slopes, poorly defined ridges and swales, and elevations from 5 to 35 feet AMSL. Typical barrier islands include Pawleys, Kiawah, and Hunting islands. Some islands, such as Hilton Head, Daufuskie, and St. Catherines, have an oceanward fringe of beach dune ridges which were constructed during the Holocene high sea level stands (Mathews et al. 1980:65-71; Ziegler 1959). Ziegler (1959:Figure 6) suggests that Hilton Head Island is composed of several sea or erosion remnant islands, joined together by recent Holocene deposits.

Site 38BU861 is situated in the western portion of the island, about 0.4 mile east of Calibogue Sound, adjacent to the marsh of Old House Creek (Figure 5). Today Old House Creek (which apparently acquired its name after the Civil War) is recognized as a distinct body of water originating just above Calibogue Sound and flowing southeastwardly, roughtly paralleling Jarvis Creek to the north and Broad Creek to the south. Examination of tidal maps and aerial photographs (Figure 6), however, reveals that the Old House Creek marsh is complex and that while today the creek is about 1300 feet north of the site, it is possible that the two were originally much closer. The geological research necessary to identify the various channels of the creek has not been conducted and we can only speculate on the meanderings of the creek over the past 1000 years.

The topography in the site area is generally level, although the ground does gently slope down to the marsh edge where there is about a 3-foot-high bank, and up to the southeast. At the northwest corner of the tract there is a remnant freshwater slough where the topography again slopes down. As you walk the site, however, there is no real feeling of topographic highs or lows, nor is there any evidence of the dune topography found elsewhere on Hilton Head.

Geology, Soils and Sea Levels

The Sea Island coastal region is covered with sands and clays originally derived from the Appalachian Mountains and which are organized into coastal, fluvial, and aeolian deposits. These deposits were transported to the coast during the Quaternary period and were deposited on bedrock of the Mesozoic Era and Tertiary period. These sedimentary bedrock formations are only occasion-

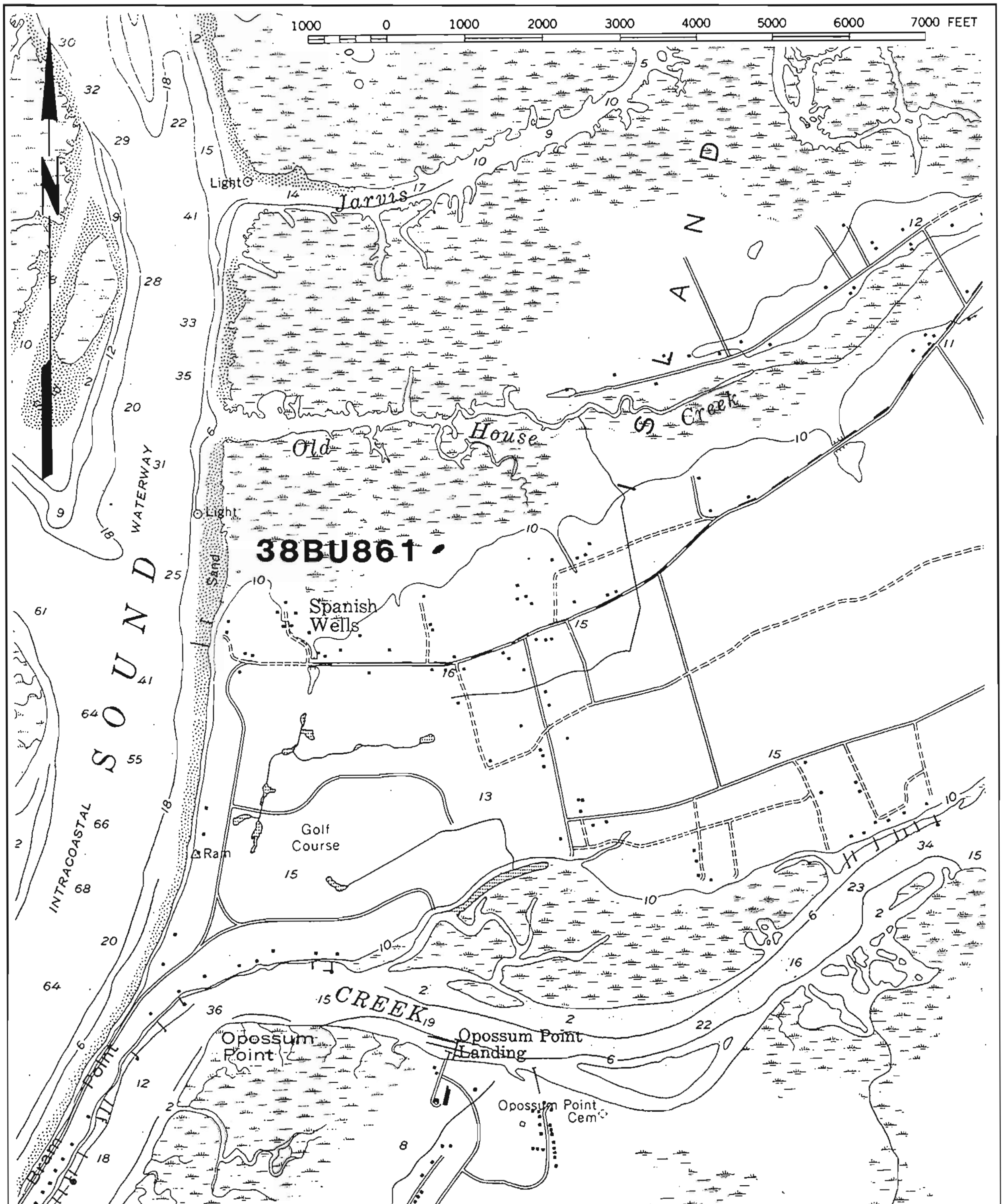

Figure 5. Site 38BU861 on Hilton Head Island (basemap is USGS Bluffton, 1956PR71).

ally exposed on the coast, although they frequently outcrop along the fall line (Mathews et al. 1980:2). The bedrock in the Beaufort area is below a level of at least 1640 feet (Smith 1933:21).

The Pleistocene sediments are organized into topographically distinct, but lithologically similar terraces parallel to the coast. The terraces have elevations ranging from 215 feet down to sea level. These terraces, representing previous sea floors, were apparently formed at high stands of the fluctuating, although falling, Atlantic Ocean and consist chiefly of sand and clay (Cooke 1936; Smith 1933:29). More recently, research by Colquhoun (1969) has refined the theory of formation processes, suggesting a more complex origin involving both erosional and depositional processes operating during marine transgressions and regression.

Figure 6. 1977 USGS aerial photograph of the study tract showing marsh development of Old House Creek.

Cooke (1936) identified most of Hilton Head as part of the Pamplico terrace and forma tion, with a sea level about 25 feet above the present sea level. Colquhoun (1969), however, suggests that Hilton Head is more complex, representing the Princess Anne and Silver Bluff Pleistocene terraces with corresponding sea levels of from 20 to 3 feet. Today the island is usually recognized as a Pleistocene core with a Holocene fringe.

Another aspect of Sea Island geology to be considered in these discussions is the fluctuation of sea level during the late Pleistocene and Holocene epochs. Prior to 15,000 B.C. there is evidence that a warming trend resulted in the gradual increase in Pleistocene sea levels (DePratter and Howard 1980). Work by Brooks et al. (1989) clearly indicates that there were a number of fluctuations during the Holocene (Figure 7). Their data suggests that from about A.D. 300 through about A.D. 900 the sea level was relatively stable at about 2 feet below current levels. By about A.D. 1000 the level began falling to a low of about 4 feet below modern levels at roughly A.D. 1500. Consequently, through most of the Late Woodland St. Catherines phase the sea levels around the site were perhaps 2 to maybe 2.5 feet lower than today (Figure 7).

The effect these lower sea levels would have had on the local environment is hard to gauge, although it seems likely that the estuarine complex of the Old House Creek area would have been somewhat reduced. The steeper gradient of the nearby slough would have allowed fresh water flow, later eliminated as the gradient was reduced by the rise in sea level to modern stands.

Data from the nineteenth and twentieth centuries suggest that the level is continuing to rise. Kurtz and Wagner (1957:8) report a 0.8 foot rise in Charleston, South Carolina sea levels from 1833 to 1903. Between 1940 and 1950 a sea level rise of 0.34 feet was again recorded at Charleston. These data, however, do not distinguish between sea level rise and land surface submergence.

Within the Sea Islands section of South Carolina the soils are Holocene and Pleistocene in age and were formed from materials that were deposited during the various stages of coastal submergence. The formation of soils in the study area is affected by this parent material (primarily sands and clays), the temperate climate, the various soil organisms, topography, and time.

The mainland soils are Pleistocene in age and tend to have more distinct horizon development and diversity than the younger soils of the Sea Islands. Sandy to loamy soils predominate in the level to gently sloping mainland areas. The island soils are less diverse and less well developed, frequently lacking a well-defined B horizon. Organic matter is low and the soils tend to be acidic. The Holocene deposits typical of barrier islands and found as a fringe on some sea islands, consist almost entirely of quartz sand which exhibits little organic matter. Tidal marsh soils are Holocene in age and consist of fine sands, clay, and organic matter deposited over older Pleistocene sands. The soils are frequently covered by up to 2 feet of salt water during high tide. These organic soils usually have two distinct layers. The top few inches are subject to aeration as well as leaching and therefore are a dark brown color. The lower levels, however, consist of reduced compounds resulting from decomposition of organic compounds and are black. The pH of these marsh soils is neutral to slightly alkaline (Mathews et al. 1980:39-44).

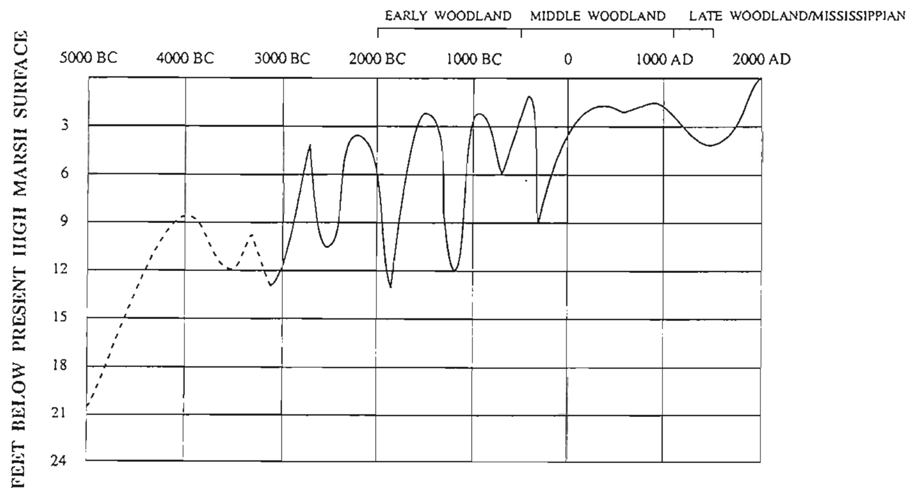

Figure 7. Sea level change curve for South Carolina (adapted from Brooks et al. 1989).

There are three main soil associations on Hilton Head. The Wando-Seabrook-Seewee association consists of excessively well drained to somewhat poorly drained sands found on the interior. The Fripp-Baratari association consists of excessively drained and poorly drained sands found along the Atlantic shore of the island. The Bohicket-Capers-Handsboro association consists of very poorly drained mineral and organic marsh soils (Stuck 1980).

The soils in the immediate vicinity of 38BU861 consist of excessively drained, rapidly permeable Wando Series soils that formed in thick sandy Coastal Plain sediment (Stuck 1980:Map 99). These soils often have an Ap horizon of dark brown fine sand up to 0.8 foot in depth overlying a C1 horizon of brown sand to a depth of 1.6 feet. Where plowing has not occurred the A horizon can be up to a foot in depth and can range from dark grayish brown to brown. Some Wando soils exhibit dark brown iron concretions ranging from ¼ to 1 inch in diameter (Stuck 1980:85).

Climate

The major climatic controls of the area are today the latitude, elevation, distance from the ocean, and location with respect to the average tracks of migratory cyclones. Hilton Head's latitude of about 32° 13' N places it on the edge of the balmy subtropical climate typical of Florida. As a result, there are relatively short, mild winters and long, warm, humid summers. The large amount of nearby warm ocean water surface produces a marine climate, which tends to moderate both the cold and hot weather. The Appalachian Mountains, about 220 miles to the northwest, block shallow cold air masses from the northwest, moderating them before they reach the sea islands (Landers 1970:2-3; Mathews et al. 1980:46).

During the eighteenth century the Carolina low country was described as a paradise, but by the middle of the century South Carolinians had begun to reappraise their environment. A proverb current in England was "They who want to die quickly, go to Carolina," and a German visitor told his readers that "Carolina is in the spring a paradise, in the summer a hell, and in the autumn a hospital" (quoted in Merrens and Terry 1984:5-49). Native Americans, on the other hand, seem to have exhibited few climate-related disease symptoms. Although there is relatively little data, a small population of Late Woodland individuals from 38BU19 was found to be:

> a relatively healthy, robust group that had successfully adapted to the ecological potential of the area. . . . Chronic disease and repeated dietary insufficiencies are not indicted (Rathbun 1982:118).

These findings parallel those from St. Catherines sites in Georgia, where Larsen remarks that the examined individuals "probably enjoyed relatively good skeletal and dental health in association with a physically active lifeway" (Larsen et al. 1982:329).

Consequently, while the Sea Island environment was often deadly to Europeans, as well as their African American slaves, the climate was not noticeably hostile to its Native American occupants. The location of 38BU861 is perhaps carefully selected. Direct marsh frontage offers the benefit of gentle breezes as the tides change, while the distance from the ocean or major water sources tends to moderate those winds, especially in the winter.

In modern times the maximum daily temperatures in the summer tend to be near or above 90°F and the minimum daily temperatures tend to be about 68°F. The summer water temperatures average 83°F. The abundant supply of warm, moist and relatively unstable air produces frequent scattered showers and thunderstorms in the summer. Winter has average daily maximum and minimum temperatures of 63°F and 38°F respectively. Precipitation is in the forms of rain associated with fronts and cyclones; snow is uncommon (Janiskee and Bell 1980:1-2). The wind shifts from the north-northeast in the fall to the west in the winter. By the late spring it has again shifted to the south and south-southwest.

The average yearly precipitation is 49.4 inches, with 34 inches occurring from April through October, the growing season for most sea island crops. Hilton Head Island has approximately 285 frost free days annually (Janiskee and Bell 1980:1; Landers 1970). This mild climate, as Hilliard (1984:13) notes, is largely responsible for the presence of many historic southern crops, such as cotton.

Early efforts to reconstruct regional climate shifts include the research of Kukla (1969) and Bryson (1965). While there are differences even at this level, it is possible to force a generalization beginning with the "Little Climatic Optimum" of about A.D. 800 with mild to warm temperatures. A cooling period did not begin until perhaps A.D. 1600.

Anderson (1990:543-549; 1994:274-283; see also Stahle and Cleaveland 1992) provides an exceptional view of the climate from A.D. 1300 to A.D. 1600, finding four periods of significant drought which lasted from 10 to 45 years. Although perhaps too late for direct relevance to our understanding of occupation at 38BU861, his study provides a linkage between short-term climate changes and possible changes in the distribution and organization of Mississippian populations. This suggests that climatic fluctuations which are too short to be of relevance to paleocl imatic reconstructions (e.g., see the work by Foss in Anderson and Joseph 1988:72) may nevertheless influence specific prehistoric peoples, as well as our interpretation of the past.

Floristics

Kuchler (1964) identifies the natural potential vegetation of the Hilton Head area as primarily Live Oak-Sea Oats, although areas of Oak-Hickory-Pine also existed, especially for areas not dominated by the salt-spray. The physiognomy of the Live Oak-Sea Oats region would have been irregular, varying from open grasslands to dense shrubby areas and groves of low broadleaf evergreen trees (primarily live oaks). In contrast, the Oak-Hickory-Pine area consisted of medium tall to tall forests of broadleaf deciduous and needleleaf evergreen trees. It should be stressed that Kuchler's forests represent what would "exist today if man were removed from the scene and if the resulting plant succession were telescoped into a single moment" (Kuchler 1964:2).

This characterization is useful, of course, only if we assume that the influence of man on the vegetation up until this time has been minimal, since the determination of natural vegetation allows man's earlier activities to stand intact (Kuchler 1964:2). Such a concept, while approximating the forest type present immediately prior to the arrival of European explorers, provides increasingly less secure reconstructions the further one pushes into the prehistoric past, especially since we know that Native Americans have had a pronounced impact on the ecosystem. While it is impossible with this data to reconstruct the local forest environment of 38BU861, it is possible to place the site more securely in a broad environmental framework.

Hilton Head today exhibits four major ecosystems: the coastal marine ecosystem where land has unobstructed access to the ocean, the maritime ecosystem which consists of the upland forest area of the island, the estuarine ecosystem of deep water tidal habitats, and the palustrine ecosystem which consists of essentially fresh water, non-tidal wetlands (Sandifer et al. 1980:7-9).

Mathews et al. (1980) suggest that the most significant ecosystem on Hilton Head is the maritime forest community. This maritime ecosystem is defined most simply as all upland areas located on barrier islands, limited on the ocean side by tidal marshes. On sea islands the distinction between the maritime forest community and an upland ecosystem (essentially found on the mainland) becomes blurred. Sandifer et al. (1980:108-109) define four subsystems, including the sand spits and bars, dunes, transition shrub, and maritime forest. Of these, only the maritime forest subsystem is likely to have been significant to the prehistoric occupants and only it will be further discussed. While this subsystem is frequently characterized by the dominance of live oak and the presence of salt spray, these are less noticeable on the sea islands than they are on the narrower barrier islands (Sandifer et al. 1980:120).

The barrier islands may contain communities of oak-pine, oak-palmetto-pine, oak-magnolia, palmetto, or low oak woods. The sea islands, being more mesic or xeric, tend to evidence old field communities, pine-mixed hardwoods communities, pine forest communities, or mixed hardwood communities (Sandifer et al. 1980:120-121, 437).

Several areas of Hilton Head evidence upland mesic hardwood communities, also known as "oak-hickory forests" (Braun 1950:297). These forests contain significant quantities of mockernut hickories as well as pignut hickory, species which even today are still present at 38BU861. Most areas, however, are more likely to be classified as Braun's (1950:284-289) pine or pine-oak forest. These are typically found on sandy, well to excessively drained soils which have relatively little accumulated organic material. Major constituents include live oak, laurel oak, water oak, and loblolly pine. Wenger (1968) notes that the presence of loblolly and shortleaf pines is common on coastal plain sites where they are a significant sub-climax aspect of the plant succession toward a hardwood climax.

Understory species consist mainly of the canopy species, although sweetgum and red bay may be found on the lower elevations while sassafras is common throughout the area. Vines include catbriar, cross vine, summer grape, virginia creeper, poison ivy, and ocassionally blackberry. The shrub layer is influenced by the amount of sunlight reaching the forest floor, with open canopy and disturbed areas dominated by saw palmetto, wax myrtle, silverling, chinquapin, and yaupon. Like the shrub layer the herbaceous layer is dependent on the amount of light reaching it. Consequently, disturbed ground areas (such as those affected by humans) are often characterized by broomseede, goldenrod, partridge pea, polkweed, ragweed, and dog fennel.

The estuarine ecosystem in the Hilton Head vicinity includes those areas of deep-water tidal habitats and adjacent tidal wetlands. Salinity may range from 0.5 ppt at the head of an estuary to 30 ppt where it comes in contact with the ocean. Estuarine systems are influenced by ocean tides, precipitation, fresh water runoff from the upland areas, evaporation, and wind. The tidal range for Hilton Head Island is 6.6 to 7.8 feet, indicative of an area swept by moderately strong tidal currents. The system may be subdivided into two major components: subtidal and intertidal (Sandifer et al. 1980:158-159). These estuarine systems are extremely important to our understanding of prehistoric occupation because they naturally contain such high biomass (Thompson 1972:9). The estuarine area contributes vascular flora used for basket making, as well as mammals, birds, fish (over 107 species), and shellfish.

The last environment to be briefly discussed is the freshwater palustrine ecosystem, which includes all wetland systems, such as swamps, bays, savannas, pocosins and creeks, where the salinities measure less than 0.5 ppt. The palustrine ecosystem is diverse, although not well studied (Sandifer et al. 1980:295). A number of forest types are found in the palustrine areas which attract a variety of terrestrial mammals. On Hilton Head the typical vegetation consists of red maple, swamp tupelo, sweet gum, red bay, cypress, and various hollies. Also found are wading birds and reptiles. It seems likely that these freshwater environs were of particular importance to the prehistoric occupants, but probably of limited importance to historic occupants (who tended to describe them in the nineteenth century as "impenetrable swamps").

The nearest freshwater resource for 38BU861 was likely the spring head at the west edge of the site. Although recognizable today only as a small depression or slough, this was probably an attractive feature prehistorically, especially when the sea level was lower and the spring was more active.

Subsistence Resources

It is not possible in these few pages to thoroughly cover all of the species present prehistorically in the site area and, in fact, there are a number of references (e.g., Larson 1969) which offer this information. Nevertheless, it is important, especially for later discussions, to have a general understanding of the estuarine resources upon which site occupation was focused. In order to make these discussions managable, only the more common species are included, such as white-tailed deer, raccoon, rabbit, opossum, turtle, turkey, sea catfish, oyster, whelk, ribbed mussel, and hardshell clam.

While population densities and archaeological prevelence are not necessarily related, many of those species found at Late Woodland shell middens are, even today, abundant. For example, a 1965 postal survey of South Carolina hunters found that the five most frequently taken mammals were squirrel, rabbit, raccoon, opossum, and deer (Derrell Shipes, personal communication 1980). Shelford (1963:80) reports that most coastal plain evironments can support upwards of 40 deer per square mile. Other researchers report between 65 and 200 raccoons per square mile (Walker 1968:1182; Shelford 1963:81), 220 opossums per square mile (Golley 1966), and 1280 rabbits per square mile (Golley 1966).

Of the mammals identified from coastal shell middens, virtually all are found associated with either the marshes and creeks, or the adjoining maritime forests. In other words, the procured mammals could all be found relatively close to the midden sites and none represent unusual kills. Many species, such as the raccoon, opossum, deer and rabbit, are nocturnal and solitary (Golley 1966; Larson 1969; Walker 1968) and could have been taken by unattended traps, some perhaps even set in the immediate vicinity of the settlement. There is no evidence that fire drives, or other communal hunting methods were used and most do not congregate in sufficient numbers to warrant such methods. Other species, such as the squirrel, are found throughout the day, although they are more active in the late evening and early morning hours.

Relatively few of these species, however, are good seasonal indicators. One exception is the white-tailed deer. Preserved crania with hard antler development would date from the fall and winter, while shed antler pricked up and used by the Native Americans would date from the late winter through perhaps the early spring. It is unlikely that shed anter not picked up shortly after being shed would be found later in the year (Moore and Beville 1978:8).

Reptiles may not be a significant food source and may represent only chance encounters, but they seem to be fairly common at many Woodland Period sites. The most common species include the Florida cooter, which tends to be found in freshwater ponds and marshes; the mud turtle, found on freshwater and occasionally brackish water pond bottoms; the diamondback terrapin, a salt marsh turtle which often eats shellfish; and the snapping turtle, which is a true aquatic reptile rarely found on leaving the water.

Birds seem rather uncommon, perhaps indicating that they were rarely worth the effort. The only noticeable exception is the turkey. Data on home ranges provided by Moore and Bevill (1978:27, 35) suggest that population densities from 20 to 50 per square mile may be reasonable. Although able to adapt to a range of habitats, the areas normally used include a scattering of mature mast-producing hardwoods with a mixture of understory plants such as dogwood. Turkeys spend the late fall through early spring in flocks of 30 or more. These flocks break up in late March for the breeding season; the young are born in May and reach a weight of about 5 to 10 pounds by October when the birds begin to congregate again. The bulk of the other birds identified from coastal sites would be found primarily in either fresh water or marsh environments, although none are found in numbers suggesting more than an occasional catch.

A number of fish have been identified from coastal sites, with the red and black drum, sea catfish, and gar being among the more common, probably because their skeletal remains are so distinctive. In fact, when detailed studies were conducted at one Georgia site, other common species included the Atlantic menhaden and mullet (Marrinan 1975:77). With but a few exceptions (such as the channel catfish and bowfin) the fish found at coastal shell middens are typical of the intertidal creeks, estuaries, and rivers. Even the channel catfish and bowfin may occasionally enter brackish waters or be caught in estuaries during periods of high freshwater runoff.

The fish species found at middens can usually be characterized as either large predators, such as flounder, drum, and catfish, typically found at the mouths of intertidal creeks or the smaller fish, such as mummichog, menhaden, and spot, which follow the tidal flow and provide food for the predators. These two broad catagories suggest that at least two different methods of procurement were required. The small fish, occupying a shallow water intertidal creek habitat, and tending to occur in small aggregations, may have been most easily procured by using either gill nets or seines. The gill nets would have been anchored in the channel where the fish are forced to move with the tide and would have caught selectively those fish which could pass their head through the net, and entagle their gills. Larson (1969:181) notes that the net-impressed pottery typical along the coast has a mesh size ranging from 4 to 12 mm, too small to have served as gill nets. This size net, however, could function as a seine to be thrown out and pulled in by waders. Such a method would not have selected specific size fish, but would obtain a wide range of species, perhaps even some larger predatory species. Some of the larger specimens may also have been caught by individual hunting techniques, including either hook or spear fishing (see Larson 1969:193). Larsen (1969:189-192) dismisses the use of weirs and traps along the Georgia and lower South Carolina coasts, noting that the magnitude of the flood tide (from 6 to 9 feet) would make such efforts difficult.

While fish are not particularly good seasonal indicators some do have months during which they are more common. A few species, such as the Atlantic croaker and star drum, are relatively good seasonal indicators, being present in the estuarine system from early spring with a maximum availability in the late fall.

The most common marine invertebrates at Middle and Late Woodland site are the common oyster, Atlantic ribbed mussel, and quahog. Minor species include the stout tagelus, common periwinkle, whelk, blue crab, and an ocassional common arc.

Vernberg and Sansbury (1972:275) note that the most common pelecypod mollusk in the Port Royal area is the oyster, with the Beaufort area oyster beds producing approximately 0.25 bushel (about 200) per square yard, of which 39% are over 2 inches in length and 15% are over 3 inches in length. While these data must be carefully interpreted because of commercial oystering pressures, Bearden and Farmer observe that while commercial oyster production has decreased by 56% from 1967 to 1972, the "locations and characteristics" of the beds have "changed insignificantly" (Bearden and Farmer 1972:211). Many other factors must be considered when determining why oyster quality and quantity may have changed. For example, residential and commercial development have likely changed drainage patterns and rain run-off, both of which effect haitat and productivity.

Quahogs, in less dense bed areas, have an average density of one or two clams per square yard, while ribbed mussels have a maximum density of about 10 per square yard. Periwinkle density will range up to 500 per square yard, although 100 per square yard is probably a more average figure (Vernberg and Sansbury 1972:275-276; Ed Cain, personal communication 1980). Whelk and blue crab are highly mobile and are typically found in relatively small numbers on a per yard basis.

An examination of the preferred habitats of the dominant shellfish suggests that they will be found in three relatively distinct areas, all of which were probably used aboriginally: the hard marsh areas characterized by *Spartina* grass, the intertidal oyster bed areas of the marsh, and the mud-sand intertidal beach areas.

Periwinkles are commonly found migrating up and down *Spartina* in rhythm with the tide in the higher regions of the marsh, often near sandy substrate.

In contrast, prime areas for oyster beds are along the outside edge of bends in tidal stream channels (Larsen 1969:123) and areas of tidal marsh with bottoms adequate to support oyster growth. Oysters grown on intertidal mud flats, where the substrate is marginally adequate, have long, slender shells (Figure 8). Larson has observed that:

> within a given locality there are a restricted number of places where it would be possible to collect oysters. Areas where the bottom was too soft or too sandy, where the water was too saline or too fresh, where the temperature was too cold or too warm, where the movement of water was too violent or too stagnant are not productive of oysters (Larson 1969:120).

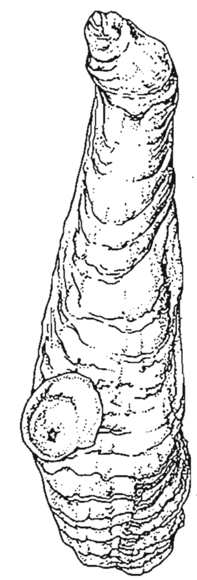

Figure 8. Common oyster grown on soft, muddy bottom (adapted from Galtsoff 1964:Figure 21).

While there are a variety of reasons that the oyster industry has declined so significantly over the past 100 years, perhaps the single reason which can be easily extended into prehistory is the failure to return a portion of the shells harvested back to the growing area, resulting in reduced bottom areas suitable for osyter growth (Harris 1980:10).

Oyster beds, because of their dense mass of shell, are not a likely habitat for many other mollusks, althouth ribbed mussels may frequently be found mingled with clusters of oysters. Additionally, the various species of whelks are predators of oysters and may be found in shallow water on oyster beds. Otherwise, whelks will be found in shallow water on sandy bottoms.

Finally, species such as the quahog, stout tagelus, and ribbed mussel, will be most often found shallowly burrowed in a mud-sand intertidal beach area. The quahog is found just below the surface of the tidal flat (about an inch or more in depth), occuring in concentrations within very restricted areas. It typically prefers a natural substrate which includes dead shells. Consequently, they may often be found adjacent to oyster beds in intertidal areas. While the oyster has fairly wide salinity tolerances (2.5 to 33 ppm), the quahog is limited to those areas with a salinity over 20 ppm, reflecting its more subtidal nature (see Chestnut 1951; Larson 1969:123). The stout tagelus is also

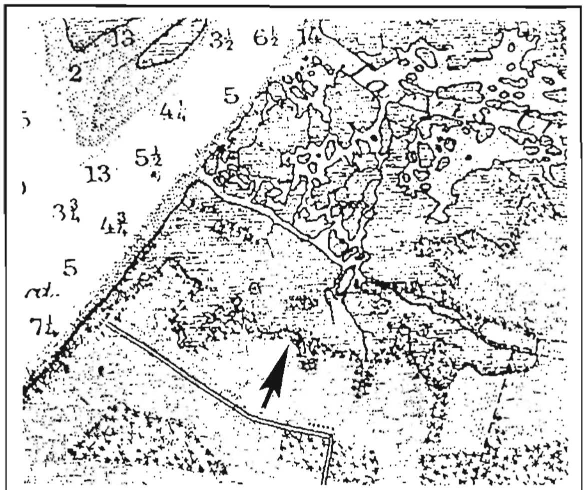

Figure 9. 1873 map of the site area showing cultivation.

found in the intertidal zone burrowed into the bottom, while the ribbed mussel will be only partially buried in mud. Both species prefer salinities above 10 ppm, they can be found in areas where the salinity is much lower -- as low as 2.5 ppm for the stout tagelus and 5 ppm for the ribbed mussel (Castagna and Chanley 1973).

The blue crab is found on mud and sand bottoms over a wide range of salinity. They are especially abundant in estuaries and at the mouths of tidal creeks (where other predatory species congregate). The average size of the blue crab is 5 to 6 inches and they have an average live weight of about a ¼-pound (Freeman and Walford 1976:11; Larson 1969:135). During the warm months crabs frequent the shallow estuarine waters, but during cold months (December through February, when water temperatures are below 50° F) they seek deeper water and would be less available to Native American gatherers.

The only plant food for which there is anything approaching consistent evidence for use during the Middle and Late Woodland Periods is the hickory nut. There are a number of hickories common to the Beaufort area, including the bitternut, water, mockernut, and pignut hickories. These species occur on a variety of soil types, from dry woods to rich or low woods to swamp lands. Along the South Carolina coast they fruit in October, although seeds are dispersed from October through December (Bonner and Maisenhelder 1974:269; Radford et al. 1968:363-366). Good crops of all species are produced at intervals of up to three years when as many as 16,000 nuts may be produced per tree (Bonner and Maisenhelder 1974:271). Complicating this simple seasonality is the ability of the nuts to be stored for up to six months. Hickories were likely an important resource given their high protien and fat yields, providing a caloric value equal to that of many meats (Asch and Ford 1971; Hutchinson 1928:261).

Land-Use History

During the historic period, the site area was likely part of Muddy Creek Plantation. An early, and very detailed, map of the island shows the site area adjacent to the marsh wooded (National Ocean Survey, Chart T803, Sea Coast of South Carolina from Savannah River to May River, 1859-1860). This view is repeated on the 1873 U.S. Coast and Survey Chart 55, Coast of

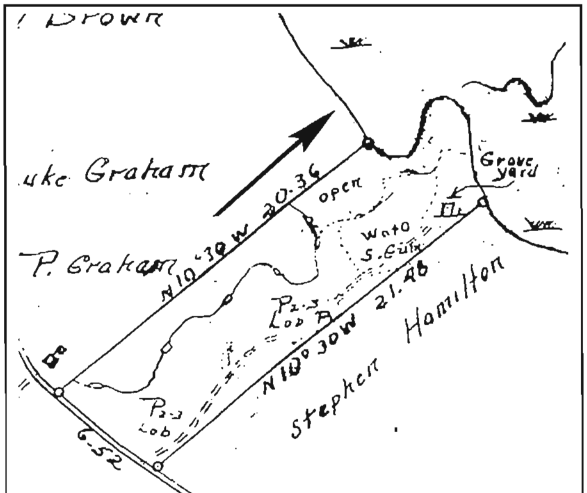

Figure 10. 1950 Timber Map of Honey Horn Plantation showing the location of 38BU861.

South Carolina and Georgia from Hunting Island to Ossabaw Island, although the interior portions of the site are clearly cultivated (Figure 9). While the 1950 Honey Horn Timber Map does not specifically cover the site, an adjacent area to the east is shown as open, again reflecting the intensive cultivation which characterized much of Hilton Head Island (Figure 10). The 1951 aerial photograph GS NV 1-192 shows the site covered in scattered second growth vegetation, with only the area immediately adjacent to the marsh heavily vegetated. The photograph suggests that it was about this time that cultivation declined, allowing vegetation to fill in.

This brief review of even a few archival resources reveals that significant portions of 38BU861 have been subjected to cultivation within the past 150 years. Considering the history of plantation development on Hilton Head Island, it is possible that the site area was first cleared in the first quarter of the nineteenth century. Fortunately, for the first 60-years (perhaps more) of this history cultivation was largely by hand. Later, when the plow was introduced, cultivation was still light, typically not deeper than 0.7 foot, and animal drawn plows often "bounced" over dense shell middens, leaving little evidence of disturbance. While aggressive cultivation practices did occur, they were often limited to those areas where the middens could be mined for either fertilizer or lime.

OVERVIEW OF THE MIDDLE AND LATE WOODLAND

Previous Research in the Vicinity

There have been a number of shell midden studies in Beaufort and the surrounding area. This synopsis is not intended to be inclusive, but only to provide a generalized background in an effort to place the current study in a somewhat wider context. Each of the cited studies can be consulted for a wider, and more extensive list of studies.

Some of the earliest research on Middle Woodland or later shell middens is that by South and Widmer (1976) at Fort Johnson in Charleston County. This site (38CH275) consisted of shell midden and other occupational debris associated with two sand ridges paralleling the Parrot Point Creek marsh. The bulk of the material came from the A horizon and it appears that no stratigraphy existed at the site (South and Widmer 1976:38). All of the pottery was typed as Hanover Fabric Impressed, although the detailed tabulations suggested at least modest amounts of Deptford pottery was also found. Two radiocarbon dates from the site suggested occupation between 280 and 80 B.C. (South and Widmer 1976:45-46).

Beyond the pottery, South and Widmer propose possible use of clam, based on worn edges, and whelks, based on battered knob projections. While use cannot be disproved, it should be accepted cautiously, especially since similar results have not been identified at other sites. It is also very difficult to eliminate accidental, or incidental, damage from the collection.

Subsistence data from the Fort Johnson site indicate 90% of the shellfish recovered were oyster, while only a small quantity of bone (largely deer) was present. The researchers observed that the "vertebrate faunal assemblage represents a very diverse, and sparse utilization of these resources" (South and Widmer 1976:56). Ethnobotanical remains included seven species, including three nuts, one grass, and three herbaceous plants.

Two phases of excavations were undertaken at the Pinckney Island shell midden (38BU67), first in 1978-1979 and again in 1980. In 1980 work was also conducted at the nearby Mackay Creek shell midden (38BU168) and limited testing was conducted at a shell midden on Victoria Bluff (38BU347) (Trinkley 1980, 1981). While the investigations found a near continuous sequence from the Late Archaic Stallings pottery up to South Appalachian Mississippian complicated stamped wares, perhaps the most significant contributions focused on the St. Catherines pottery (at that time attributed to the Middle Woodland).

The study found no evidence of a sharp occupational break or cultural discontinuity between the Deptford and St. Catherines phases, although the abrupt shift from heavy grit tempering to clay particle tempering was clear. Just as Milanich (1971:148-149) and Caldwell (1970:91) saw St. Catherines as a gradual progression from Deptford to Wilmington to St. Catherines to Savannah, the research at these sites suggested an untyped sandy paste ware might represent a transition between Deptford and St. Catherines.

During the St. Catherines phase there appeared to be an elaboration of the cultural pattern begun in the Early Woodland Deptford phase. The economy was based on shellfish collection and there was evidence of a winter-early spring occupation. The subsistence base became more focused than was evidenced by the Late Archaic Thom's Creek phase.

The creation of the shell middens was found to have been a slow process beginning with a scatter of shell pits. These oyster steaming pits were used once, then abandoned, filled in with the refuse from the meal and general midden refuse (Figure 11). Shell piles, about 10 to 20 feet in diameter, began to form as the occupants piled their season's garbage adjacent to a living area. Some evidence of possible "lean-to" structures was

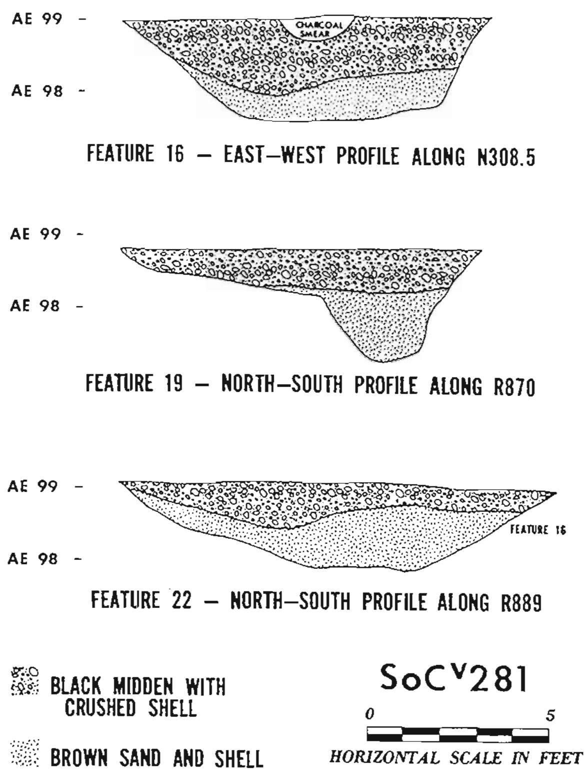

Figure 11. Profiles of Middle Woodland pits from 38BU67 (from Trinkley 1980:Figure 8).

found, although the major finding was an absence of occupation on the middens themselves, as evidenced by the absence of banding or crushing.

A conical sand burial mound possibly associated with 38BU347 may provide evidence of a more permanent, interior settlement. Unfortunately, testing at the site was limited to one area.

This study suggested that the traditional chronology of the Middle and Late Woodland seemed to break down on a regional basis. The Savannah and Irene phases that DePratter (1979) reports for the period from about A.D. 1200 to 1500 were not found in the Victoria Bluff and Pinckney Island area. Instead, the St. Catherines pottery was dated into the fourteenth century on Victoria Bluff and even later on Pinckney Island, suggesting the continuation of essentially a Middle to Late Woodland lifestyle much later than previously anticipated (Trinkley 1980:92).

In 1990 excavtions were undertaken at five shell midden sites on Callawassie Island in Beaufort County (38BU19, 38BU464, 38BU1214, 38BU1249, and 38BU1262) (Trinkley 1991). Pottery, spanning the Middle and Late Woodland periods, was the most abundant artifact. While there is little indication that Deptford potters were intentionally selecting particular clays or modifying those clays, by the Savannah phase there is a consistency which suggests the manufacturing process had been refined. Significantly, it was suggested that "the existing typological constructs represents a continuum of indigenous change along the South Carolina coast" (Trinkley 1991:210).

A detailed examination of the cordage found that the Deptford, St. Catherines, and Savannah fabrics were more alike than different, further supporting the paste analysis. Only simple twisted cordage was found, with the Z or left twist consistently more common than the S or right twist.

Given the similarity in paste and fabrics, it should not be surprising that the study found considerable overlap in the radiocarbon dates. Deptford wares appear to extend to as late as A.D. 930, while St. Catherines dates at the sites ranged from A.D. 750 to 930.

Lithics, while rare, included projectile points typed as the Roanoke Large Triangular (Trinkley 1991:212) and flakes of relatively local materials. The only other artifacts identified were drilled oyster shells, perhaps representing ornamental objects.

The five sites suggested a diffuse faunal subsistence base, with some indication of an increasing focus on fish resources through time. Plant foods, while likely used, were poorly represented. Shellfish, specifically oyster, however represent the greatest contributor of biomass to the diet at the various sites.

Site 38BU464 revealed both features and

a portion of a Deptford phase structure (Figure 12). Likewise, 38BU19 revealed "abundant features, post holes, and daub (probably from structures)" (Trinkley 1991:216-217).

Based on the similarities, and differences between these sites it was suggested that:

> sites such as 38BU19 appear to represent at least semipermanent "collector" settlements or large residential bases. Sites such as 38BU464 may represent base camps for "foragers" or smaller "collector" settlements. Sites such as 38BU1214, 38BU1262, and 38BU1249 all represent temporary encampments for collection/foraging activities (Trinkley 1991:217).

By 1991 a number of Middle to Late Woodland shell middens had been excavated and Kennedy and Espenshade (1991:40) found that at many of the sites oyster shell was the single most abundant cultural remain, with other artifacts (such as pottery or even faunal remains) being very scarce. Structural data, such as post holes or even features, was likewise rare. They proposed that at least some shell midden sites (such as 38BU1270, but clearly not like 38BU347 or even 38BU67) did not represent, "sites which were seasonally occupied by a resident population, consuming the oysters which were collected from the nearby marshes," but instead suggested that the "oysters were collected, shucked, preserved (smoking/drying), and removed from the site" (Kennedy and Espenshade 1991:40). They also suggested, as had Trinkley earlier, that traditional ceramic series such as Deptford and Wilmington overlapped.

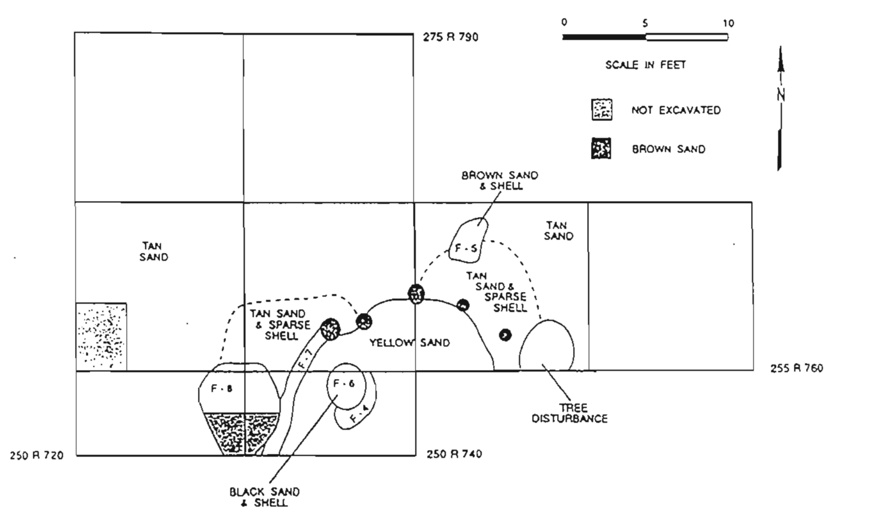

Figure 12. Deptford phase structure identified at 38BU464 (from Trinkley 1991:Figure 15).

These views were further refined and explored by Kennedy and Espenshade (1992) as a result of data recovery excavations at a series of four Middle Woodland sites (38BU132, 38BU372, 38BU1236, and 38BU1241). They noted that although large quantities of shell were found at these sites, artifacts, faunal remains, and ethnobotanical remains were scarse. Further, the investigated sites all lacked (or had very few) post holes or features (Kennedy and Espenshade 1992:92). They note that, "variation between the study sites is quantitative (how many shell heaps/how many episodes) rather than qualitative (i.e., the site assemblages are very similar in diversity and content)" (Kennedy and Espenshade 1992:93). They reaffirm their earlier view that these types of sites "were established for the procurement and processing of a major resource, the oyster," probably during the spring or summer (based on shellfish seasonality data) (Kennedy and Espenshade 1992:94). They suggest that a focus of future research should be the identification of interior sites representing the remainder of the posited seasonal round.

The 1992 excavations at 38BU833 undertaken by Chicora Foundation in many ways reinforced the perception that some shell midden sites were generally "unproductive." Artifacts consisted almostly exclusively of pottery with the observation that:

> the artifact collection . . . suggests a site at which very focused or a narrow range of cultural activities took place. Lithics appear to be relatively insignificant and, when present, to be highly curated. Other artifacts, such as bone or shell tools, are absent. The artifactual assemblage, in essence, provides no evidence of specialized activities and argues against the occupants intending to process any quantity of mammals, such as deer (Trinkley et al. 1992:37).

The subsistence remains were also sparse, reflecting a very focal subsistence quest. Vertebrate faunal species were clearly of secondary importance to the shellfish. Even the invertebrate remains reveal a strong preference for oyster (Trinkley et al. 1992:38).

As a result of additional Early and Middle Woodland excavation on Spring Island, Espenshade et al. offered a further refinement and explanation of their "Woodland Site Types," noting that the "distinctions between these middens types are important to interpreting Woodland settlement" (Espenshade et al. 1994:175). Four specific site types, apparently spanning the Late Archaic and Woodland periods, are identified (see Figure 13).

Attribute	Multi-Family Residential Base	Single Family Shell Midden	Single Family Shell-Less	Oystering Station
Oyster Contribution	High	High	Moderate to Low	Very High
Minority Shellfish Contribution	Moderate	Moderate	Low	Very Low
Vertebrate Faunal Contribution	Moderate	Moderate	Moderate to High	Very Low
Lithic Density	Moderate to High	Moderate	Moderate to Low	Very Low
Lithic Tool Diversity	Moderate to High	Moderate to High	Moderate	Low
Bone Tool Frequency	Relatively High	Moderate	Moderate	Low
Shell Tool Frequency	Relatively High	Moderate	Moderate	Low
Sherd Tool Frequency	Relatively High	Moderate	Moderate	Low
Ideotechnic Items	Relatively High	Moderate to High	Moderate	Low
Sherd Density	Relatively High	Relatively High	Moderate	Low
Human Remains	Relatively Common	Occasional	Occasional to Rare	Very Rare
Structural Features	Relatively Common	Common	Common	Very Rare

Figure 13. Shell Midden Sites Types (adapted from Espenshade et al. 1993:Table 48)

Multi-family residential bases "represent the largest aggregation of coastal residents" and were perhaps occupied year-round. Espenshade et al. remark that sherd density is high, a broad range of artifacts are present, a number of floral and faunal resources were apparently used, and a range of features may be expected. They offer as a Late Woodland example site 38BU19 (Espenshade et al. 1994:176).

Single family shell middens "are generally smaller versions of the multi-family residential bases" with a slightly decreased diversity of remains. They explain, however, that "a good Wilmington/St. Catherines example is not known" (Espenshade et al. 1994:177).

Single family, limited shell sites are thought to represent a seasonal encampment by a small group or perhaps even single family. Shell, while found, is limited to refuse in pits with no discernable midden. Artifact diversity is significantly less than would be found at even single family shell middens and, again, no Late Woodland examples are reported.

Finally, the oystering station was a site "occupied by small work teams for short visits focused on the procurement and processing of oysters" (Espenshade et al. 1994:177). These sites are similar to those discussed by Kennedy and Espenshade (1991, 1992) and are compared to "encampments for collection activities" (Trinkley 1992:39).

Considering some approximation of the total settlement system, Espenshade et al. observe that:

> the oystering stations on Hilton Head, Spring, and Callawassie Islands (and at Colleton River) are all within a four hour canoe trip from the village at Callawassie [38BU19; the authors do not mention the similar village and mound at nearby 38BU347]. The lack of observed single-family shell middens may indicate that aggregated use of the coastal zone (i.e., year-round occupation of residental base camps) precluded the formation of single family sites (Espenshade et al. 1994:178).

Espenshade and his colleagues have clearly provided the discipline with an excellent starting point for additional discussion and further refinement. Viewing the shell middens as part of a larger subsistence system is an important advance over a simple descriptive typology. Yet, it leaves a variety of questions unanswered (as surely any new development in the discipline is likely to). The use of qualitative terms such as "moderate" and "relatively high" begs the question of where an individual site might fit in the scheme. One person's "moderate" is another's "relatively low." When one is dealing with very small sample sizes it is unlikely that the entire site has been examined, suggesting that it may be "relatively" easy to misjudge where a site fits within the scheme. And certainly even the authors would advise caution when using the scheme when relatively little is known about the site (for example, when only survey data are available). In sum, many are likely to consider this modification of a trait list approach unconvincing and/or confusing.

It is also possible to debate whether the "oystering stations" in fact represent the collecting and processing of oysters for smoking, just as it is possible to dispute the spring-summer season attributed to these sites. While Espenshade and his colleagues present very interesting ethnohistoric data to support the contention that smoking oysters is a viable preservation technique, application of the ethnographic data to the prehistoric period is more problematic. So too is even the premise -- that drying oysters is something prehistoric groups would want to do, or even could do effectively.[1]

But most troubling is that while drying using a fire or smoking would both likely require pits, or at least broad hearth areas, and would result in relatively large quantities of wood

[1] It is important to consider what drying and smoking do. The purpose of drying is to take out enough water from the material so that spoilage organisms are not able to grow and multiple during storage. The final moisture content depends on the nature of the food, the processing techniques, and even the local climate. Smoking, usually at temperatures of 70° to 90° F, colors and flavors the tissues, helps retard rancidity, and assists in drying. Shellfish moisture content can rarely be reduced to below 40%, allowing preservation for a relatively short period. For shellfish to have any significant keeping ability the moisture content must be reduced to below 20%. Even at this level the ideal storage temperature is below 50° F (see Hertzberg et al. 1973 for additional information). This information suggests that drying or smoking of shellfish might allow the food to be kept for two or three days, but it is not likely to allow (in South Carolina's sub-tropical climate) the flesh to be stored for longer periods.

charcoal, the posited processing stations have few pits and almost no charcoal. There is, it would seem, no more evidence to support the smoking of oysters than there is to support smoking of fish (see Trinkley 1992:37-38).

These issues aside, the proposed site types provide a valuable heuristic device which may help classify sites, at least once some level of testing or data recovery has been accomplished. Even this brief review of previous research does indicate a seemingly "real" difference between sites such as 38BU19 and 38BU833, representing either extreme of Espenshade et al.'s reconstruction. Sites such as 38BU464 and 38BU1214 seem to fall somewhere between these extremes, representing more than a brief encampment but less than a residental base. Perhaps multi-family shell middens should be considered as a classification during the Late Woodland?

Looking at previous research in a broader context some have argued that at least some shell midden research has become unproductive, stale, or that further research is simply unnecessary (for a synthesis of these discussions see Lawrence 1994, cf. Espenshade et al. 1994). It is likely that there are, or may be, some sites which offer limited potential for answering significant questions. Other sites, however, have no shortage of questions which they may address, including:

▪ The ceramics themselves can be examined for information on kin-based groups using cordage analysis at an intrasite level, comparing materials between a variety of discrete midden piles. Similar analysis can also be accomplished using chemical analyses of the paste, perhaps concentrating on a small array of trace elements.

▪ Chemical analyses of the pottery may provide clues to the clay sources, which in turn may provide information on seasonal (or other) rounds. These analyses may also be able, once there are sufficient data, to project the limits of different groups.

▪ Both chemical analyses and cordage studies may be useful in refining typological issues, especially when conducted with more traditional paste studies. For example, this battery of analytic approaches may be able to refine our understanding of the array of clay and grog tempered Wilmington, Hanover, and St. Catherines pottery. Perhaps there is good reason to review the Mattassee Lake report (Anderson et al. 1979) and adopt a type-variety system.

▪ Even using different analytic approaches, such as the concept of estimated vessel equivalence, may provide a better understanding of inter and intrasite ceramic diversity. Likewise, making complete cordage analysis a standard feature of all studies would assist in allowing others to adopt a colleague's work to new and different theoretical approaches.

▪ Radiocarbon dating, based on relatively large charcoal samples, could be used to date a variety of discrete shell middens within one site, with 10 or 20 dates refining our understanding of site function. It might be possible to identify sufficient charcoal samples from distinct levels within the midden to allow for beginning and ending dates for individual middens (accepting one or two sigma deviations), providing even closer temporal control. Further, each charcoal date could be compared to a shell date from the same midden in an effort to develop better alternatives when there is insufficient charcoal for a reliable date.

▪ Pollen analysis at individual middens could explore the nature of site vegetation, testing for evidence of site disturbance, second growth or weedy species. This information might better help us understand how, and how intensively, sites were used. Such studies could be combined with more traditional ethnobotanical research to identify wood species for cross-checking.

▪ Incorporation of additional shellfish studies may be able to further refine our understanding of seasonal use, especially when several seasonal indicators are used as cross-checks from discrete midden areas. It may also be useful to examine middens on a shellfish assemblage basis in an effort to reconstruct specific ecotonal use areas.

Just as it is possible to point out some potential research questions (even more could be added by including a regional scale of comparative analysis), it is also possible to outline successful research techniques. For example:

- Expanding recovery techniques to incorporate some degree of ⅛-inch and even 1/16-inch screening may allow better dietary reconstructions by providing more complete, and representative, recovery of floral and faunal materials. For example, at several sites our research has shown that it would be impossible to document the presence of fish remains unless ⅛-inch mesh was used. Failure to use this level of recovery would have resulted in a flawed interpretation of site dietetics. We have also found from investigations at several Middle Woodland middens that this level of recovery can be achieved only through water screening.

- Close-interval auger testing is a fast, reliable approach to better understanding intrasite variability and patterning. We emphasize *close* interval, meaning maximally 20 feet, since larger intervals completely fail to identify discrete midden areas.

- Site contour mapping at 0.25 foot intervals, combined with close-interval auger testing, provides a comprehensive view of shell midden dispersal and allows the most accurate site patterning studies. Intervals even of 0.5 foot will often fail to provide the degree of precision essential for this type of study.

- The sample sizes that are often used at shell midden sites are likely inappropriate for the level of precision necessary to address comprehensive research questions. While this has gradually become apparent, it is perhaps best demonstrated quantifiably by O'Neil's (1993) recent investigations. Many of the research questions we have outlined require large sample sizes to be effectively examined. We need to think at the level of minimally 20 to 30% sampling, not at the current levels of 2 or 3% sampling.

- We also believe that the best way to address these significant research topics is through intensive hand excavation. While data recovery programs which rely on large-scale stripping as the primary recovery approach might, in some circumstances, allow features to be rapidly uncovered, such programs also destroy the context of these features, eliminate the small quantity of artifacts typically found at Middle or Late Woodland shell middens, reduce the opportunity to explore intrasite research questions, eliminate the opportunity to explore extensive radiocarbon dating, and seriously contrain the research options at any given site.

Hopefully this overview has made several points. First, there is still much we don't know. This means that we are nowhere near redundancy at any site type in South Carolina. Second, since we can never prove scientific theories, even those concerning cultural behavior, but can only disprove them, continued research is essential for the growth of the discipline. The offeror of a new cultural theorum must be "lucky" every time the theorum is tested, while the researcher seeking to debunk the new law must be "lucky" only once. Third, much research is at the level of only offering "signposts" for those that follow. This is essential and represents the gradual growth of knowledge. Halting research because we have looked at three or thirty sites of a particular "type" also halts our learning process. As long as valid research questions can be posed, or as long as previous research can be refined or further tested, then research at the site is likely in the public interest -- particularly when the site will be destroyed by some development activity.

Prehistoric Synopsis

It seems almost foolhardy, given the previous discussions, to attempt any synthesis of the Middle and Late Woodland -- and in fact none will be offered. It is appropriate, however, to provide a very general overview. It is also appropriate to view the Middle and Late Woodland from several vantage points, noticing the similarities even across space.

Sassaman et al. (1990:14-15) provide a synoptic overview of the Late Woodland in the Savannah River valley, noting that the period "is difficult to delineate typologically from its antecedents or from the subsequent Mississippian period." They observe that cord marking, present during the Middle Woodland, cannot be used as a marker, suggesting instead that the break should perhaps be accepted as the decline in Deptford wares about A.D. 500 to 550.

While Late Woodland sites are perceived as numerous in the Coastal Plain, there are relatively few indentified in the Piedmont, perhaps because earlier simple stamped wares continue into the second millennium (Sassaman et al. 1990:14). They note that Stoltman's work on Groton Plantation offers about the only information on Late Woodland site distribution available for the region. The pattern of dispersed upland settlement (suggested by Stoltman to be associated with the beginnings of slash and burn agriculture) may also be interpreted as evidence for intensification of upland resource procurement. The corresponding increase in the number of small and dispersed Coastal Plain sites is suggested to represent "a decrease in settlement integration over the Middle Woodland Period" (Sassaman et al. 1990:14). Of equal interest is the observation that the transition from Late Woodland to Mississippian is suggestive of considerable indigenous development, perhaps helped by the imposition of a chiefly elite (Sassaman et al. 1990:15).

While not intended to be synoptic, Anderson et al. (1982) provide considerable information on the Woodland in the Lower Santee River area of South Carolina. In particular, Anderson suggests two phases, McClellanville (A.D. 500 to 700) and Santee I (A.D. 700 to 900) form the Late Woodland, characterized by Wilmington, Cape Fear, Yadkin, and Santee pottery (Anderson et al. 1982:250). Again there appears to be a gradual, indiginious change from the Middle to Late Woodland, with a number of the wares continuing uninterrupted. In fact, the Wilmington wares, originating in the late Early Woodland (ca. 400 B.C.) continue into the Early Mississippian (ca. A.D. 1100). The shift into the Mississippian, however, is foretold by the development of the carved-paddle Santee Simpled Stamped wares.

Moving into North Carolina the Late Woodland Period is briefly summarized by Phelps (1983:36-47) who notes that, "from A.D. 800 onward archaeological assemblages of the Late Woodland period in the North Carolina region can be related to ethnohistoric information and studies" (Phelps 1983:36). Consequently, the pebble tempered Cashie Series was likely produced by the Tuscarora, the shell tempered Colington Series was likely produced by the Carolina Algonkians, leaving the poorly understood shell tempered Oak Island wares to be attributed to the Siouan groups on the southern North Carolina coast. Outside of the presence of burial mounds there seems to be little connecting the North Carolina and southern South Carolina Late Woodland assemblages.

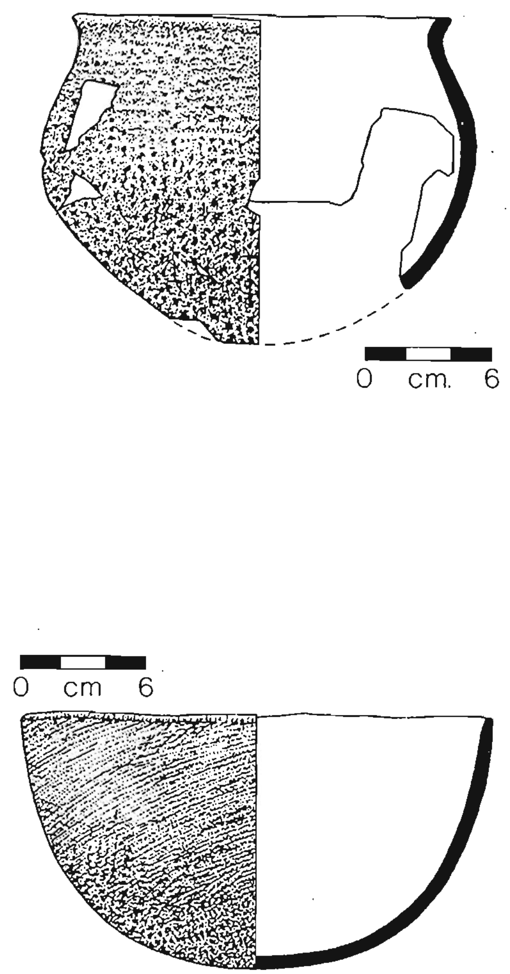

Figure 14. St. Catherines Cord Marked vessel (top) and Savannah Fine Cord Marked vessel (bottom) from Marys Mound, St. Catherines Island, Georgia (adapted from Larsen et al. 1982:Figure 9).

Perhaps the most succinct summary of the Georiga Late Woodland St. Catherines manifestation is that offered by DePratter and Howard (1980:16-17). Significantly, they note that most of the Georgia data comes from burial mound excavations, "because only limited village [and presumably shell midden] excavations have been conducted" (DePratter and Howard 1980:16). Even with burials there is a limited range of artifact types -- shell beads, worked whelk shell bowls or drinking cups, bone pins, and triangular projectile points. Not only is little known about village life, nothing is known concerning residential structures and there is no good evidence of agricultural crops. Once again the Late Woodland is presented as little more than an extension of the previous Middle Woodland lifeways.

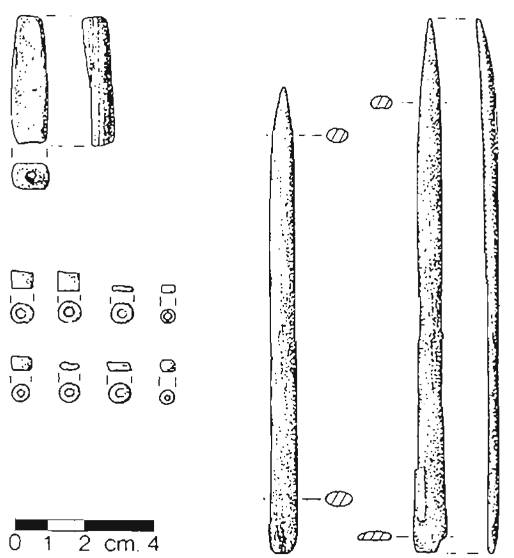

Figure 15. Whelk columella bead, shell disk beads, and bone pins from Johns Burial Mound, St. Catherines Island, Georgia (adapted from Larsen et al. 1982:Figure 28).

Some additional information, albeit from burial mound sites, is offered by Larsen et al. (1982) in their examination of mortuary data from the Marys and Johns mounds on St. Catherines Island. Figure 14 illustrates St. Catherines Cord Marked and Savannah Fine Cord Marked vessels from Marys Mound, while Figure 15 illustrates a variety of shell beads and bone pins recovered from Johns Mound.

DePratter (1979:119) provides a generalized introduction to the Late Woodland St. Catherines phase, noting its original definition by Caldwell (1971) and remarking that the ceramics are:

> characterized by finer clay tempering than that of preceeding Wilmington types and by the increased care with which the ceramics were finished. The lumpy, contorted surface of Wilmington types was replaced by carefully smoothed and often burnished interiors and exteriors. St. Catherines Burnished is characterized by careful exterior burnishing, whereas surfaces of St. Catherines Plain are simply smoothed. St. Catherines Fine Cord Marked has more carefully applied and more consistently spaced cross cord impressions than did its predecessor, Wilmignton Heavy Cord Marked (DePratter 1979:119).

DePratter also notes that the temper in the St. Catherines pottery consists of "crushed sherd or crushed, low-fired clay fragments" (DePratter 1979:131). One of the few detailed studies of prehistoric temper included a sample of six St. Catherines sherds (Donahue et al. n.d.). The study found that the trend toward decreasing grain size of the aplastic component, begun in the Middle Woodland, continues. The grain size distribution was found to be unimodal, with 96% of the grains less than 0.3 mm in diameter. None of the grains was larger than 0.9 mm. They suggest that the paste represents locally gathered clay, perhaps marsh clay, with no additions of sand. In constrast, the grog inclusions are coarse, ranging from about 2 to 3 mm, and they contain quartz grains (perhaps reflecting tempering in crushed sherds). The average composition of the St. Catherines sherds is 71% paste, 25% grog inclusions, and 4% voids.

If this coverage of the St. Catherines phase appears uneven and perhaps even a little unfulfilling, it is not surprising. It illustrates one of the most fundamental issues in South Carolina -- our lack of clear and concise information on the various Native American cultural groups. Hopefully, the current study will help provide a little better understanding of the Late Woodland along the southern South Carolina coast.

RESEARCH STRATEGY AND METHODS

Proposed Research Questions

The 38BU861 site testing report by Trinkley and Adams (1993) touched on a wide range of research questions the site was likely to address, including issues associated with intrasite patterning and organization , the artifacts present at the site, and the ecofacts primarily associated with the middens. This section of the final study details those which were addressed, and how they were addressed and analyzed.

Intrasite Patterning

It seems unlikely that the placement of middens is totally random. Their absence on the poorly drained soils bordering the tract to the west offers the clearest example of this patterning -- based at least on topographic position. However, it was impossible to determine the complete nature of the patterning, much less its meaning, without an effort to plot the location of individual middens. Consequently, one research goal of the current study was to identify the shell middens present on at least a portion of the property under investigation. It seemed likely that expanding the existing auger test grid (originally conducted over a 100 by 100 plus foot area on west side of the site) to the east to incorporate approximately an acre would allow an adequate sample of the site to be explored.

Although this represents perhaps only 10% of the total site area, it will represent approximately 50% of the estimated site area within the study tract. The large sample size was recommended on the basis of O'Neil's (1993:527-528) work at southern California shell middens where a sample size of 40 to 50% was found essential for something approaching a clear understanding of chronology and activities at the site.

The previous investigations revealed that an auger test interval of at least 20 feet, and possibly as close as 10 feet, is necessary to achieve this goal. It was also clear from the previous research that the site is sufficiently intact to reveal individual midden locations through a combination of augering, topographic mapping, and probing.

This level of auger testing was not expected to be adequate for any conclusions regarding cultural associations, or even the nature of their associated ecofacts. The recovery rate was, however, anticipated to be sufficient to allow density data on shell midden and artifacts to be collected.

The auger testing would also allow a series of three middens to be selected for more intensive investigation (discussed below). Of equal importance it would provide a view of a major site area, allowing estimates of total number and content of middens, distance from each other, distance from the marsh/water source, and orientation. For the first time we hope that it would be possible to estimate, on the basis of a realistic sample, the total number of middens and their probable relationships. In the past the location of discrete middens composing the larger site complex have not been explored (or have only been briefly investigated, see Trinkley 1991:84-91).

Consequently this research would offer a unique opportunity to refocus on the concept of Trigger's (1978:176) community layout or organization. Trigger points out that the investigation of such community layouts is essential if the archaeologist wishes to understand the total cycle of settlement patterning based on complementary distributions.

Midden Research

Site 38BU861 offered the potential to extend research topics at the midden level through more detailed radiocarbon dating tied to specific middens with specific cultural remains, through larger excavation areas incorporating both midden and non-midden areas, and by careful control of artifact and ecofact recovery.

The goal of the radiocarbon dating was to determine the range of occupation dates from several discontinuous middens. A site occupied for only a short period of time should evidence dates falling within at least one- or two-sigma deviations of each other. A site occupied by a number of groups over a longer period of time will exhibit a greater range of dates. It was hoped that the radiocarbon dating would allow a cross-check of conclusions drawn from detailed analysis of the cordage associated with the pottery (discussed below).

The goal of incorporating both midden and adjacent non-midden areas into the excavation was to explore the settlement at a micro-community level, approaching that of an individual household, or episodal level. Obvious questions included the distribution of artifacts around and in the midden and the dispersion of shell which might suggest reoccupation of the site. The former is useful to identify specific activity areas and reconstruct various activities or actions (such as the breakage and scattering of a vessel), while the latter is useful to explore the deposition and growth of the midden.

The goal of controlling artifact and ecofact recovery was obviously to maximize data return. This could be achieved by appropriate use of the most cost-effective recovery techniques which are adequate to address the questions outlined. Specifically this would include ¼-inch dry screening of midden soil followed by water screening subsamples through ⅛ or 1/16-inch mesh; excavation of at least a sample of features; and collecting a wide range of potential (but thus far largely unexplored) data sets, such as pollen samples.[1]

The presence of carbonized materials in the midden indicates that radiocarbon dating can be pursued on charcoal, rather than on what we believe to be less reliable shell.[2] Consequently, the research goal of additional dating was thought to be achievable at 38BU861. Likewise, the site exhibited few, if any, areas lacking integrity. Consequently, we felt that it would be possible to examine adjacent midden and non-midden areas virtually anywhere on the site. However, the close interval auger testing was intended to provide additional assurances that areas of disturbance would not accidently be incorporated. Finally, the testing also demonstrated that ⅛-inch mesh water screening was feasible (there is a source of water and it can be adequately transferred to the site) and prudent (if it were not for the fine screening, **<u>no</u>** fish remains would have been recovered) Consequently, integration of this methodology into the project was of considerable concern.

Artifact Research

Since the primary artifact present at the site is pottery it stands to reason that ceramic analysis should be thorough and comprehensive. Recent investigations by Chicora Foundation in Florence at 38FL249 reaffirm the potential of ceramic analysis to offer new information about seemingly traditional sites (Trinkley et al. 1993). One specific research topic at 38BU861 included an intensive investigation of ceramic fabric or paste using macro-analytic techniques[3] for information on typological refinement, correlation with radiocarbon dating, and functional interpretation of the pottery vessels. Perhaps the most valid typological question is whether the St. Catherines

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[1] Our colleagues Espenshade et al. (1994:179) suggest that pollen studies are unproductive and should be discontinued, citing the potential for pollen to migrate through profiles and poor preservation. We believe that the solution is to explore additional techniques and approaches, not abandon the data set on the basis of only *three* attempts. In order to control migration we have selected closed or limited environments, specifically seeking soil from within the body whorl of whelks on the advice of our palynologist, Dr. Arthur Cohen. While we can't control preservation, we can allot additional funds to processing larger numbers of pollen samples.

[2] Obviously another research goal could be the comparison of shell and charcoal dates, in order to verify and control differences, or alternatively to demonstrate that no statistically significant differences occur during this period. It seems appropriate to address substantive issues of temporal dating prior to moving on to methodological questions.

[3] While a variety of chemical and compositional analysis techniques are both appropriate and useful, it seems reasonable to first "wring" as much data as possible from less costly approaches such as fabric analysis first -- thus the approach suggested for the study of 38BU861.

ware can be convincingly separated from the other grog, clay, and sherd tempered wares such as Wilmington and Hanover, or whether a type-variety system as suggested by David Anderson is the most appropriate and logical means of bringing order to the existing typological constructs.[4] Other questions, however, involve the function of the vessels, based on the presence of interior or exterior smudging and carbon deposits, a clear understanding of exactly what is being dated, and any possible typological associations with seemingly earlier or later wares.

Associated with this would be an equally intensive investigation of the cordage elements found on the pottery. Using the techniques of cordage twist, angle of twist, and tightness of twist, it is possible to document the manufacture and use of fabric materials no longer present in the archaeological record. Other researchers have argued that cordage may be distinct by ethnic, social, or kin groups, perhaps suggesting that the diversity observed in the archaeological record may reflect social organization. At 38BU861 we believed it was appropriate to conduct such studies for comparison within individual middens, between middens, and to other sites.

The presence of ceramics, principally St. Catherines and almost entirely cord marked, ensured that these research goals can be addressed by the data likely present at 38BU861. Although the quantity of pottery is not exceptionally great in those areas tested, we believed that adequate samples could be obtainable for the various studies and levels of comparison suggested.[5]

[4] One approach toward resolving this issue might be to determine whether neutral outside researchers are able to distinguish the various wares. Such a test would involve sending selected colleagues samples of Hanover, Wilmington, and St. Catherine's type materials and asking them to sort the wares using type descriptions synthesized from published sources. It is, however, not expected that 38BU861 will present such a range of collections.

[5] Typically only sherds over 1-inch in diameter are subjected to detailed analysis. If this approach unreasonably limits the sample size we anticipated incorporating smaller sherds, perhaps down to ¾ or ½-inch in diameter.

Ecofact Research

The research goals for the faunal collection would include documentation of species used, biomass, seasonality, diversity, and equitability as appropriate for the nature of the eventual collection. These data sets, however, represent research goals essential to our understanding of prehistoric subsistence strategies. Too often faunal studies of similar sites have offered relatively modest conclusions, failing to identify fish by species, or failing to incorporate diversity studies. Of course some of the problems are associated with the unavoidably small sample sizes, yet others reflect nothing more than a failure to obtain the greatest amount of information possible from the resources at hand.

Species identification is of particular concern since an overall goal of this research is to incorporate all of the ecofact research into an environmental perspective. It is obviously essential to identify faunal materials to the species level if we are going to fully understand the environmental implications of the assemblage. Simply put, "a fish is a fish" only when gross level analysis will suffice. There is a big difference between predatory fish found singly and schools of small fish feeding on algae. These differences influence methods of capture, areas being exploited, preparation techniques, and scheduling of time and resources.

Our level of ethnobotanical sophistication is not as great, but careful analysis of collections can still yield important data on tree types associated with the site area and seasonality based on food remains present. Continued identification of hickory nutshells may serve as an indicator of site type, season, and/or scheduling to maximize resource use. While no major questions were posed for the ethnobotanical materials, their collection not only allows secondary questions to be addressed, but also ensures the availability of materials suitable for radiocarbon dating.[6]

[6] We have traditionally selected carbonized hickory nutshell for radiocarbon dating in order to control additional variables, such as the affect of different wood species on the dating, as well as to minimize the chance that non-cultural wood charcoal was being incorporated in the material being dated.

A wide range of research questions are appropriate to the shellfish and other invertebrates present at the site. The most common question, of course, is seasonality of the remains. Issues of over-exploitation and environmental niche are equally important, as are questions concerning collection methods and evidence of preparation. What should be done at this site, however, is to combine these questions into an assemblage wide approach. While oyster may be the most common shellfish, and offer the greatest body of previous research, the other species would also be incorporated. The entire assemblage likely represents materials gathered by the prehistoric occupants in the course of some rational, organized effort. Consequently, the assemblage should be examined for the evidence it can contribute to that collection effort. The collection should be examined from the perspective of new collection techniques and what they can contribute to our understanding of subsistence strategies.

This represents a refocused effort to examine the collection from a solid environmental footing. Where researchers having expertise with a particular species can be identified, they will be used, where no experts can be immediately identified the scientific literature will be reviewed for information which may be relevant. Where no such literature exists, the goal of this research will be to highlight the need for further inter-disciplinary investigation. It might be appropriate to involve individuals in the research with a broad background in coastal and marsh ecology to provide a synthetic overview.[7]

Proposed and Implemented Methodology

The first activity at the site, prior to any archaeological investigations, was to be a light bush hogging of the study area (initially proposed to measure about 200 by 200 feet or approximately one acre) by the property owner or his agent. This would allow easy access to all parts of the site and, of greatest importance, would permit easier gridding and topographic mapping -- essential aspects of the data recovery plan. The bush hogging was accomplished by the developer, although we modified the area of investigations from a 200 by 200 foot square to a somewhat irregular rectangle measuring approximately 260 feet east-west by 140 feet north-south. This modification was undertaken to maximize our ability to explore marsh edge features and minimize the inclusion of plowed and/or low density remains as identified during the testing phase (located inland, away from the marsh). The total area investigated remains essentially 1 acre.

The site would be tied into a permanent grid to provide both horizontal and vertical control. In order to maintain consistency, the grid used during the testing phase was re-established, allowing horizontal control to be tied to the S.C. State Plane Coordinate System[8] and vertical control tied to a mean sea level survey datum.[9]

As initially proposed the minimal excavation unit was a 5 by 5 foot unit, and the 10 by 10 foot units used for the investigation of middens (discussed below) were consistently divided into quadrants for additional control of artifact distribution.

The excavations were to be by the natural soil zones -- anticipated to be the shell midden, non-shell A horizon, and possibly areas of old A horizon preserved by the middens. The excavations revealed that these zones were essentially correct, although we failed to identify preserved A horizon soils underlying the middens (in each case the midden was founded on and extended into yellow subsoil). Some areas of the site (essentially the more eastern tests) were found to be plowed. Consequently, throughout the site there was Zone 1 (which may be either plowed or intact A horizon development), Zone 1a (shell midden) and subsoil. Some of the eastern units exhibited thin lenses of intact Zone 1a shell midden underlying the Zone 1 plowed soils. We found, however, that it was consistently possible to identify plowed midden through a combination of plow scars, erosion of

[7] To that end, we have sought out several such individuals who were willing to serve as peer reviewers.

[8] Auger Test 107 is at South Carolina Plane Corordinate position N31,800,000 E2,070,100.

[9] The southeast corner of original test pit 1 is marked with a rebar datum, the top of which is 10.57 feet AMSL, based on a datum on Ainsley Court.

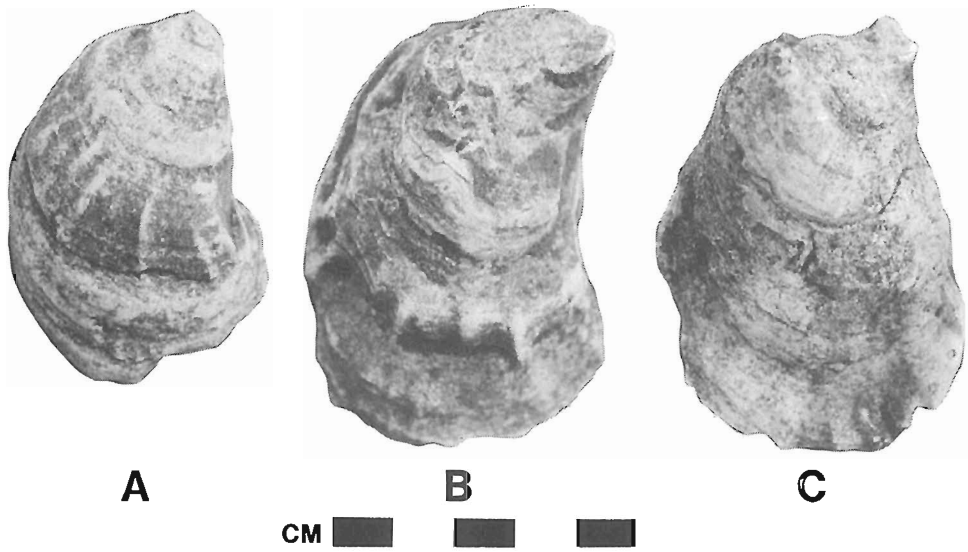

Figure 16. Soil effects on oyster shell surface detail. A, shell from midden context and alkaline environment; B, shell from midden toe, exposed to more acidic soils; C, shell from plow zone context with neutral to slightly acidic soil pH.

surface details on the associated shells, and fragmentation of the shell. These plowed areas were anticipated based on the previous land use history research and the testing program at the site. It may be helpful to other researchers to note that rarely did we identify plowscars. Figure 16, however, illustrates the exterior of three oyster shells, illustrating the effects of plowing and soil erosion.

Excavation was to be by hand with all fill dry-screened through ¼-inch mesh to ensure the recovery of cultural materials. A third of all ¼-inch screened material would also be water screened through ⅛-inch mesh for recovery of floral and faunal material. A third of all ⅛-inch waterscreened material was also to be waterscreened through 1/16-inch mesh for the recovery of small snails (*Boonea impressa*) useful in seasonal dating. The waterscreening was to be accomplished using a water supply to be provided by the property owner or his agent. The only modification of this approach was undertaken at the direction of our shellfish consultant (Dr. David Lawrence) who requested that we ***not*** screen the soil through 1/16-inch mesh for his use. Instead, we developed a method of collecting a 5-gallon volume of soil, screened only through ¼-inch mesh. He would then be responsible for the fine screening necessary for the recovery of the impressed odostome (*Boonea impressa*). In all other respects, however, the methodology was consistently employed. Flotation samples (typically 5 gallons in size) were to be collected from areas which exhibited a high potential for the recovery of ethnobotanical remains. The mechanical water flotation would be conducted in the field -- maximizing the opportunity for the recovery of additional fill if necessary. A 5% sample of shell midden from each excavation unit would be collected for information on species diversity, midden density, and shellfish analysis. The remaining shell would be weighed, and discarded, in the field. This methodology was accomplished with only one modification. Because of the reduced numbers of volunteers present for this project, it was not possible to accomplish all of the work necessary *and still conduct the flotation in the field*. It was decided that the range of data being collected over-rode the importance of field flotation. Consequently, the flotation was conducted at Chicora's laboratories in Columbia within a week of the conclusion of the field investigations (allowing only enough time for the soil samples to thoroughly dry). To maximize the amount of charcoal from the samples, the heavy fraction was refloated using a method recommended by Dr. Gail Wagner with excellent success.

Each unit was to be troweled at the top of subsoil, photographed in b/w and color slide film, and have profile and plan views drawn. Drawings and/or photographic documentation would occur more frequently if conditions warranted. This was accomplished without modification.

Features encountered during the excavations would be plotted and photographed. Features, or samples of redundant features, would be bisected to provide profiles, photographs, and drawings. All excavated feature fill would be screened through ⅛-inch mesh. Samples retained would minimally include a soil sample and flotation sample. This aspect of the investigations was also accomplished. The only modification was that all features, and not simply samples, were investigated.

Site Specific Methodology

To achieve the proposed research goals at 38BU861 it was necessary to complete the following detailed field tasks.

Auger Testing. Once the site area had been bushed hogged and the grid re-established, a 200 by 200 foot area would be gridded to allow detailed auger tests at 20-foot intervals. This grid was to be laid "over" the work previously accomplished, so that only approximately 120 new auger tests will be required. The decision to decrease the interval to 10-feet was to be made in the field, based on the time available. In other words, the auger testing interval would be decreased for at least a portion of the study area *if there was sufficient field time to do so.*

As previously discussed, the grid coverage was changed to allow greater exploration of near creek areas, although the sample size was not dramatically affected. In addition, the previous grid and current grid were tied together, allowing easy integration of the data from the testing and data recovery phases. We found that there was not sufficient time to decrease the entire grid to 10 foot intervals, although a 60 by 60 foot area was tested at 10-foot intervals for comparison of data results.

Mapping and Identification of Site Areas. The bush hogging was intended to allow the property to be carefully examined for evidence of shell middens. In addition, information for a detailed topographic map of the property[10] was to be collected during this phase of the investigation. The pedestrian survey, combined with the topographic mapping, was to be used to identify specific middens for further investigation. As the middens are identified each will flagged in the field. Probing would be used to reveal the approximate boundaries of the midden (defined on the density of shell present and revealed by the probing). These boundaries would be reflected on the topographic map. Non-midden areas adjacent to the middens will be identified at the same time.

These tasks were accomplished without modification. A series of eight potential middens were identified through a combination of pedestrian survey, auger testing, topographic mapping, and probing. Elevations for the topographic map were obtained and a base map of the site was generated.

Midden and Non-Midden Excavations. Three middens would be randomly selected for excavation. The only factor to be considered would be preservation (i.e., middens which evidence damage from forces such as plowing or tree throws will be excluded). There would be no effort to either select middens close to one another or which evidence clear dispersion within the site area. At each of the three selected middens up to 200 square feet of excavation would be undertaken.[11] As previously discussed we anticipated using 5-foot units as the minimal unit size to increase control over artifact recovery. At two of the three middens investigated we would also examine the associated non-midden area. This was to be defined as the area within a 50 foot diameter of the midden center, or effectively 35 feet around each midden fringe. Investigation of these areas

10 This map will be prepared with a contour interval of 0.25 foot. Elevation points were be taken every 20 feet, on the auger test grid, with supplemental elevation points at midden locations (revealed as topographic highs by the bush hogging).

11 Our goal was competent, thorough excavation without attention to specific square footage "quotas." In other words, if a midden was found to be particularly complex, or if there is unexpected rain, it would be necessary to excavate less than 200 square feet. Alternatively, if it was possible to increase the sample size without lowering strict standards of recovery, larger areas would be excavated.

would rely on a combination of 2 and 5-foot units.

This work was conducted with only minor modifications. Three middens were selected, although we were forced to integrate into our decision process the midden size. We found during the investigations that middens at the site fall into two generalized size ranges -- those which are under about 15 feet in diameter and those which are larger, often much larger. These latter middens are possibly "clumps" of smaller middens. However, with the time available for this study and the broad range of previously defined research questions, it was not possible to integrate this additional research question into the field work. Consequently, a conscious decision was made to exclude the largest midden from investigation.[12] This is not a statement that the midden formation process is unimportant. Nor does it reflect a failure on our part to realize the potential significance of this research. Rather, it was a decision to remain focused on the initial research questions and attempt to achieve reasonable answers on the defined questions, rather than allow ourselves to be enveloped in additional research questions which could not possibly be addressed with the time and resources available.

At the three major middens selected, 200 square feet were excavated at two and 175 square feet were investigated at the third. Two plowed middens were also investigated through the very modest excavations of 75 square feet at one and 50 square feet at the other. Areas adjacent to three of the middens were investigated, although we found that the 50 foot diameter "rule" is likely too broad and that near midden areas may be more accurately identified as perhaps 10 to 15 feet around the toe of the midden.

Excavation of Isolated Non-Midden Areas. The artifact density data gathered from the auger tests would be used to identify non-midden areas which have dense concentrations of artifacts.[13] If such areas were found to exist at least one would be selected for block excavation of up to 200 square feet. This work was accomplished without modification.

Feature Excavation. Features identified by these investigations were to be examined at the conclusion of all block excavation activities. Although feature excavation was recognized as very important, it was to be delayed until the end of the excavations to ensure that all other outlined tasks have been achieved. The time remaining in the field investigations would determine the level of feature study possible. Minimally all features will be plotted and photographed. Ideally all features will be excavated.

When we realized that relatively few volunteers would be available, we decided to modify our approach and integrate feature excavation into the general schedule of work. This would help ensure that at least a sample of the features were investigated. This modification ensured that all of the identified features were examined and that all potential post holes were investigated.

Additional Methods

Several additional research goals were independently added to those initially proposed in order to expand the potential significance of these investigations. They include the measurement of soil pH for middens and features, the collection of clams for seasonality information, and the collection of pollen samples for comparison of pre-midden and midden environmental data.

In addition, we sought to obtain the input of a geologist with experience in microstratigraphy to examine the shell midden profiles for any evidence of site abandonment or similar short-term episodal changes.[14] We were not, however,

[12] One reviewer has suggested that, where a midden such as this will be destroyed by development, it might be appropriate to excavate a narrow trench through the deposit in order to document the midden structure and stratigraphy, without processing (i.e., screening or sampling) the soil. This approach should be considered for future midden research since it would allow a significant research question to be addressed in a cost-effective manner.

[13] Based on the initial survey work we will use a density of 3 artifacts per cubic foot as the threshold level.

[14] Our colleagues Espenshade et al. (1994:180) have questioned the need for this expertise, commenting that "a geomorphologist should not be necessary to recognize humus, plowzone, and intact shell midden." We are less certain than

successful in finding individuals with both the experience and expertise necessary to assist in this line of research. This failure again points out both the need for interdisciplinary research, and the inherent problems with such efforts.

Laboratory Methods and Analysis

Most of the artifacts were rough cleaned on Hilton Head, although final cleaning and cataloging of the collections was conducted at Chicora's Columbia laboratories immediately after the completion of the field work. The only major concern in cleaning the specimens was to avoid removing any encrusted carbon deposits on either the interior or exterior of the recovered pottery. Consequently, both the field and final cleaning was done without brushes, using only a soft stream of water to remove adhering sand and rootlets. As previously mentioned, the collections have been cataloged for curation at the Hilton Head Museum.

On the Nature of Analysis

Analytic approaches tend to raise strong emotions in archaeologists. Colleagues tend to either strongly agree that an approach is the only appropriate one, or that its use will lead to such erroneous results that the entire project might better have never been undertaken. Some view analysis as the worst possible drudge work, only slightly better than washing the artifacts to begin with. While others view each artifact as capable of unlocking the past, if only one listens well. To others the key is not the artifact, but rather the quantification process. Into the midst of these different ways of looking at the world is thrown yet another variable -- project funding, whether it be a grant or compliance archaeology.

Often the role, perhaps even the goal, of "good analysis" will be simply "to set up signposts for future research" (Orton et al. 1993:34). In fact, for even exceptional analytical approaches to yield information on cultural behavior it will likely be necessary for a relatively large number of sites to be similarly investigated. This implies that a number of researchers must all agree to both fund and conduct their studies using virtually identical approaches. Of course new approaches will be added, and old ones will be refined or perhaps even discarded, but there must be a consistency not often found. One important underlying assumption is that work and conclusions should be constantly re-evaluated and re-examined. Orten et al. remark that:

> in archaeology there are no last words, all is provisional, and if no-one ever improves on our work it is not because it is perfect but more likely because it is terminally boring (Orten et al. 1993:35).

Consequently, those looking for the writing of Kent Flannery's "Grand Synthesizer" will be disappointed. While we offer ideas and possible explanations whenever possible, and while we have tried to reconstruct life as it most likely was at the portion of 38BU861 investigated, it seems foolish to suggest that the research has reached the stage of redunancy and we can now close the book. We have instead attempted to conduct our analyses with precision and with purpose, realizing that at the very least they will offer a "signpost" for others.

While not much as been written about St. Catherines pottery, what has been produced is fortunately clear and concise. The pottery description by DePratter (1979) is commonly accepted and, to our knowledge, no modifications have been proposed. Espenshade (1985), however, provides some interesting information on the Savannah series from the Kings Bay locality in Georgia. He notes that small amounts of clay grog tempered cord marked pottery were found in association with the Savannah wares. In an effort to explore the differences he measured both cord diameters and the space between cords for a

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they that the stratigraphy of shell middens is simple and straight forward, although certainly the complexity varies from midden to midden. Stein and her colleagues (Stein 1992) present a wide range of stratigrpahic and sediment data to help explain Northwest Coast shell middens. While arguably different from the Late Woodland shell middens often encountered in South Carolina at a variety of levels, it seems reasonable to explore a wide range of analytical techniques, such as grain size, organic matter content, carbonates, and microstratigraphic facies at several different site types and with wide peer review prior to discounting the approach. We hope that other researchers will agree and come forward with both the research designs and the expertise to explore these issues.

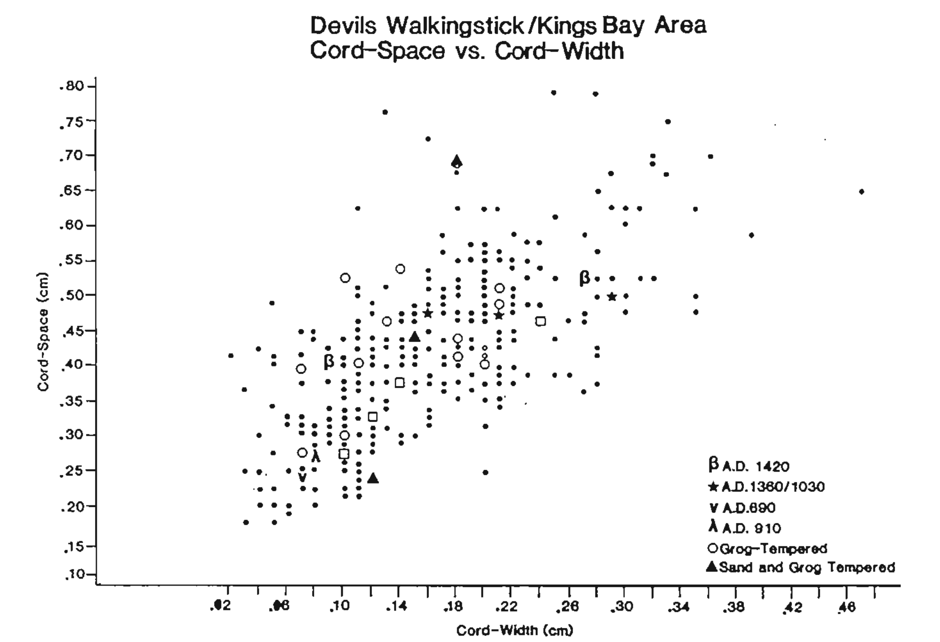

Figure 17. Cartesian graph of cord diameter and spacing for various cord marked sherds, and radiocarbon dated specimens (adapted from Espenshade 1985:Figure 8.10).

sample of nearly 400 sherds, including representatives which had been radiocarbon dated. The resulting graph (Figure 17) revealed that there were no definable clusters, suggesting that if two types of cord marking were present there was considerable overlapping of the examined attributes. The study also revealed no clustering of radiocarbon dates, indicating no general trend through time for smaller, more closely packed cords. The study also revealed that the clay-grog tempered sherds were also scattered in the graph, suggesting that the tempering technique was a minority varient occuring throughout the period from A.D. 690 to A.D. 1420 (Espenshade 1985:307). The work by Donahue et al. (n.d.) on St. Catherines paste has been previously discussed and provides information on the nature of the grog inclusions and their density within the paste.

In addition to these technological issues quantification of the collection is essential. Without some way of measuring ceramic quantity it is impossible to move on to other issues, such as paste content or typological validity. Orten et al. (1993:4) suggest that archaeologists typically fail to examine the theoretical issues of quantification, instead asking whether the proposed quantification is "easy," or whether it will provide the "correct" answer. To these it seems appropriate to add that archaeologists tend to be a methodologically conservative bunch, sticking with old, true, and tried (especially if it also happens to be easy). This is certainly the case with counting potsherds, the technique used by most of our colleagues in South Carolina (cf., Espenshade et al. [1994:180] and Sassaman [1993] where the use of minimum vessel counts have been used as an alternative).[15]

Curiously, there is mounting evidence that counts are the least accurate way to quantify prehistoric pottery. Weight is actually a more accurate representation of the proportion of types present in an assemblage. But apparently the least biased, most accurate approximation of the proportion of the different types in an assemablage is derived from estimated vessel equivalents (eve). Orton explains that to calculate the eve:

> we have to find a part of the pot that can be measured as a frac-

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[15] One reviewer emphasized the potential for minimum vessel counts to offer very significant data on technofunctional interpretations for the vessels and taphonomic data on the site. The MNI approach has been widely used by zooarchaeologists for years, but even they have noted that there are a variety of problems inherent in the approach (see Grayson 1973:438, 1984:28-92; Klein and Cruz-Uribe 1984:26-32). How one aggregates the MNI will affect the number of individual vessels calculated. If MNI is calculated based on the entire site, the number will be smaller than if it is calculated for each excavation unit and totaled for the site. This is not to imply that the approach is inappropriate, or necessarily flawed — only that archaeologists should carefully document, in print, the methodology they have used to calculate MNIs, if this approach is used and is to be more generally accepted.

> tion of some whole. The most obvious is the rim; by using a rim chart [the common vessel diameter chart to which is added the ability to measure a rim sherd as a percentage of the whole] one can, unless a rim sherd is very small, abraded or not truly circular . . . measure it as a percentage of the whole pot and use this figure as the eve (Orton et al. 1993:172).

In analysis, eves are one of the few unbiased quantification techniques for the proportions within an assemblage and for comparing different assemblages. Eves, however, are not the same thing as minimum number of vessel counts (for a more extensive discussion see Orton et al. 1993:171-175). We have integrated eves into our analysis of the pottery from 38BU861. However, to ensure that our efforts continue to be compatable with other researchers, we are also providing counts.

Moving into the realm of actual analysis, we have chosen to concentrate on what Orton et al. (1993) term fabric (what Americanists call paste) analysis, coupled with detailed surface treatment analysis (i.e., the textile fabric itself), and form (i.e., the shape of the vessel). Each of these areas has been shown by a host of other reseachers to be of particular importance in understanding pottery wares. We have chosen to emphasize visual analysis, over petrological and compositional analysis for two reasons. The first, and fundamental, is cost. For more advanced approaches to yield meaningful data would require studies beyond the funding level of this project. Related to the issue of cost is our second reason: such work requires an interdisciplinary approach and we have not yet developed a team in chemistry and geology with the background and interests to contribute to such a project.

We have, we hope, begun the process by implementing limited X-ray fluorescence study of samples of St. Catherines pottery and the grog inclusions from the pottery. Small portions sherds without grog inclusions and seperate grog inclusions were ground into a fine powder and examined using X-ray spectrometry. This allowed determination of bulk mineralogy for each sample. It was our belief that if the grog consisted only of the inadvertant mixture of dried clay into the moisture clay matrix then there should be no statistical differences between the sherd paste and the grog inclusions. Alternatively, if the grog consists of ground sherds, there may be a difference in bulk mineralogy simply through different source selection.

The visual paste studies have concentrated on a relatively few additional areas:

▪ *Temper size*, based on the U.S.D.A. standard sizes for sand grains and are defined as:

very fine - up to 0.1 mm
fine - 0.1 to 0.25 mm
medium - 0.25 to 0.5 mm
coarse - 0.5 to 1.0 mm
very coarse - 1.0 to 2.0 mm
granule - 2.0 to 4.0 mm

with the dominant size range given and the ranges shown in brackets. This was calculated for any sand inclusions and also for the grog itself.

▪ *Temper Shape*, also known as "rounding," with the inclusions defined as:

angular - convex shape, sharp corners
sub-angular - convex shape, rounded-off corners
rounded - convex shape, no corners.

▪ *Frequency of Inclusions*, using a three point scale of abundant, moderate, or sparse. These can be estimated by reference to percentage inclusion estimation charts (see Mathew et al. 1991), with 30% or more being abundant, ranges of 10 to 20% being moderate, and 5% being sparse.

▪ *Core Cross-Sections*, consisting of a visual observation of a freshly broken edge. There can be at least five different cross-sections for coarse tempered pottery: (1) oxidized with no core (organics may or may not have originally be present), (2) oxidized with diffuse core margins (organics originally present), (3) reduced with black or gray extending through the sherd, leaving little or no lighter colored core (organics not originally present), (4) reduced, being dark

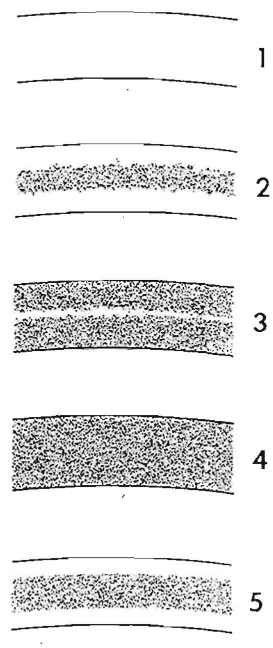

Figure 18. Stylized cross sections comparing variations in the appearance of firing cores in coarse-textured clays. The numbers correspond to descriptions in the text (adapted from Rye 1981:104).

throughout with no core (organics may or may not have been present originally), and (5) reduced then cooled rapidly in air leaving very sharp margins on the interior dark core (see Rye 1981:Figure 104; Figure 18).

Other vessel studies, such as form, function, and decorative motif examinations will concentrate on a smaller constellation of essential features:

- *Interior Treatment*, using the definitions developed by Blanton et al. (1986:183) for interior coastal plain pottery: (1) tool marks present, (2) no tool marks, no visible temper, (3) no tool marks, some temper visible but not protruding, and (4) no tool marks, temper protruding.

- *Exterior Smoothing*, was rated as either absent (when the exterior stamping was clean and sharp or plain sherds had a rough, non-compacted surface), moderate (when exterior stamping was slightly blurred and plain sherds had a regular, but not glossy surface), or high (when exterior stamping was almost totally obliterated and plain sherds had a semi-glossy finish).

- *Overstamping*, classified as either present or absent with no effort to quantify degree or nature.

- *Rim Diameter*, measured in centimeters when a reliable arc was present. At the same time the eve was recorded as a percentage.

- *Thickness*, measured in millimeters and taken 3 cm below the lip of the rim. When this portion of the vessel was not present no thickness measurement was taken. Clearly, much of the diversity in thickness found in the literature is likely from measurements taken on body sherds, which may represent virtually any part of the vessel.

- *Shoulder Form*, defined as (1) slightly flaring, (2) slightly restrictive at the rim, (3) straight sided, (4) hemispherical, and (5) flaring on straight-sided bodies.

- *Cordage Diameter*, measured as mm and including both warp and weft as appropriate.

- *Angle of Twist*, designated as loose (not exceeding 10°), medium (11° to 25°) and tight (usually 26° to 45°).

- *Twists per Centimeter*, also measured as twists per 0.5 cm and extrapolated when necessary.

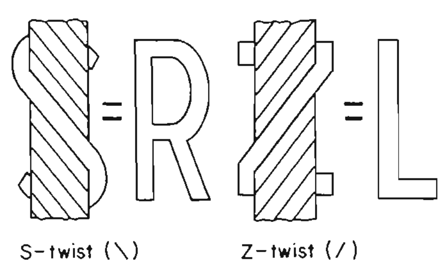

Figure 19. Criteria for identifying the direction of twist (adapted from Hurley 1979:Figure 5).

- *Direction of Twist*, which is a description of the slant of the segments, either sloping from the upper right to the lower left (Z twist) or from the upper left to lower right (S twist) (Figure 19). This is uniformly recorded not from the sherd, but from an impression of the sherd (i.e., it is based on the plasticine impression or positive image).

▪ *Distance Between Cords*, measured in mm and representing the distance to the nearest parallel cordage impression. Measurements were taken between four different cords and averaged for each sherd.

While all of the materials from 38BU861 were evaluated for conservation needs the vast majority of the artifacts were found to be stable. The only exceptions were a small number of sherds, most from Feature 5, which were incompletely fired and which easily crumbled during handling. While these sherds would benefit from impregnation with a reversible acryloid such as B-72 (and such a step would be essential if the vessel from Feature 5 were to be reconstructed), a less drastic measure was to simply pad the materials so they could better resist mechanical damage. Consequently, the only "conservation" treatment was packing with Ethafoam™. Other areas of analysis, such as the ethnobotanical or zooarchaeological methodology will be dealt with the following sections of this study as appropriate.

THE EXCAVATIONS

Site Areas

Figure 20 illustrates the auger test numbering incorporating the initial testing phase (Trinkley and Adams 1993) and the subsequent expansion of that grid by the data recovery phase. Numbering runs from north to south and west to east, for a total of 151 auger test points. The figure also reveals the topography of the site area at 0.25 foot contour intervals.

While the topographic mapping reveals several middens (such as those in Areas 2 and 5), a number of additional site areas have been defined on the basis of surface indications or probing.

In all, a total of nine site areas were defined during the field investigations. At each of these areas probing was used to identify the "core" of the supposed midden, as well as its outer limits. Admitedly these are subjective, based on a single individual's probing ability. On the other hand, comparison of these estimations with unit profiles reveals a strong degree of correlation.

Auger Testing

Figures 21 and 22 illustrate the results of mapping shell weight and artifact density using GeoView™.[1] The shell weight map clearly indicates the presence of midden areas 1, 2, 3, 4, 5, 8, and 9. Areas 6 and 7, among the smallest of those identified, can not be clearly identified in the density mapping.

[1] GeoView™ ver 3.1 by Computer Systemics uses an algorithm derived by Pelto et al (1968) for the interpolation of values at grid-points, using irregularly spaced observations. The gridding procedure is a first-degree, moving, weighted, least-squares function which gives a continuous smooth surface and behaves exceptionally well in regions of the map where observed data are sparce or nonexistent.

Artifact density throughout the site area explored tends to be low. Consequently, while there are several seemingly dense areas of artifacts, only those at Areas 3 and 5 tend to stand out with any prominence.

Excavation and Midden Areas

Area 1 represents an intact midden with no evidence of plowing or disturbance and measuring about 24 by 50 feet (920 square feet). During the testing of the site, Test Pit 1 was excavated in this midden. During these investigations two 10-foot units, Units 17 and 21, were excavated in this area (Figure 23). These excavations have examined approximately 22% of the midden. The maximum depth of this midden was 1.0 foot in Unit 21. One feature (Feature 6) and one post hole were encountered in the excavations. A series of seven 5-foot units (six from these excavations and one from the previous testing phase) surround this midden on two sides. One, Unit 15, produced Feature 6, initially thought to represent a pot burst.

Area 2 represents an intact midden measuring 15 by 20 feet (252 square feet). During the site testing phase Test Pit 3 was excavated in this midden. During the current investigations two 10-foot squares, Units 25 and 26, were placed to explore the northern two-thirds of the midden (the maximum depth of which was 0.6 foot). Figure 24 illustrates these units and a series of three post holes identified during the work. Several of the 5-foot units surrounding Area 1 also provided coverage of near midden area south of Area 2. In addition, Units 24 and 27 were excavated to the north and west. Unit 27 was excavated as a deep test to verify that no deep deposits were present at the site.

Area 3 is a small midden measuring about 12 by 10 feet (92 square feet) which was investigated through the excavation of Units 1 and 7

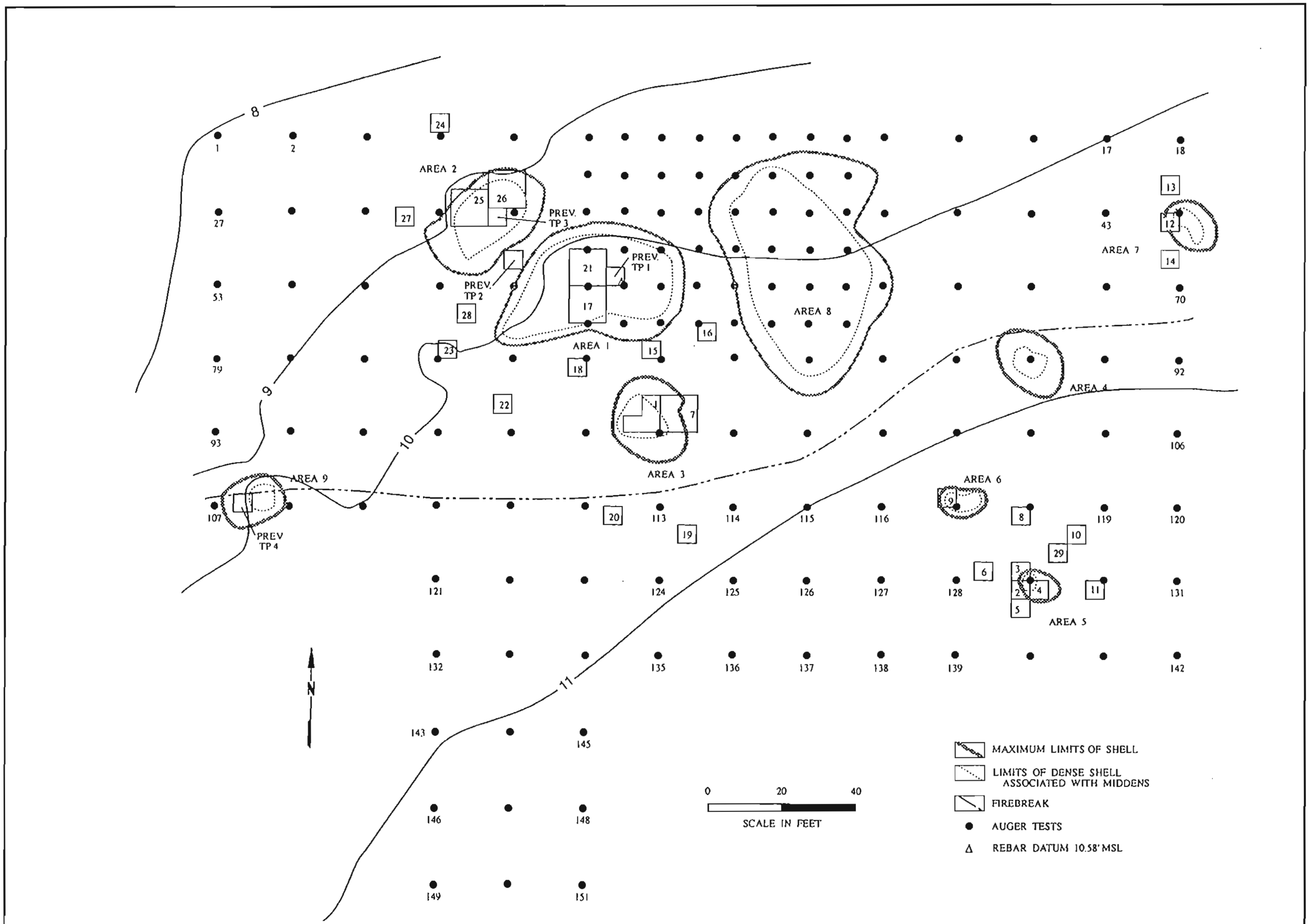

Figure 20. 38BU861 site plan, showing auger tests, excavations, and contours.

Figure 21. Shell distribution at 38BU861, weight in pounds.

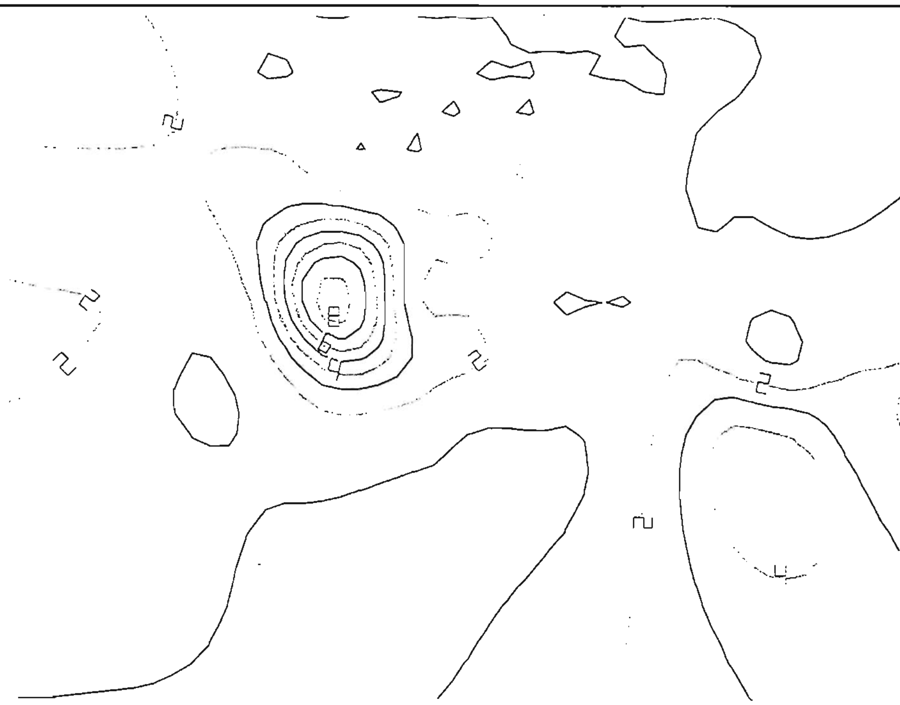

Figure 22. Artifact density at 38BU861.

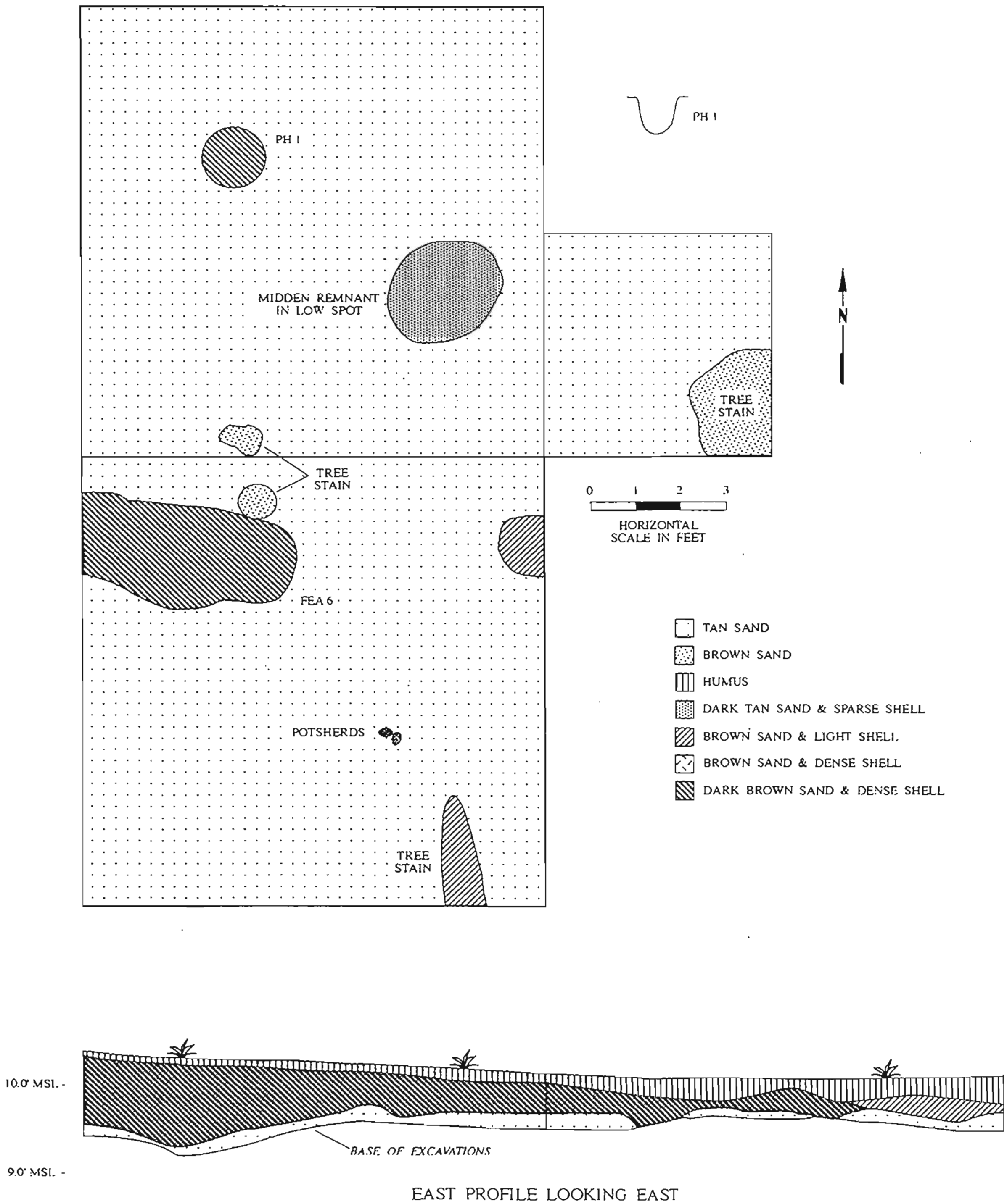

Figure 23. Plan and profile views of Midden 1.

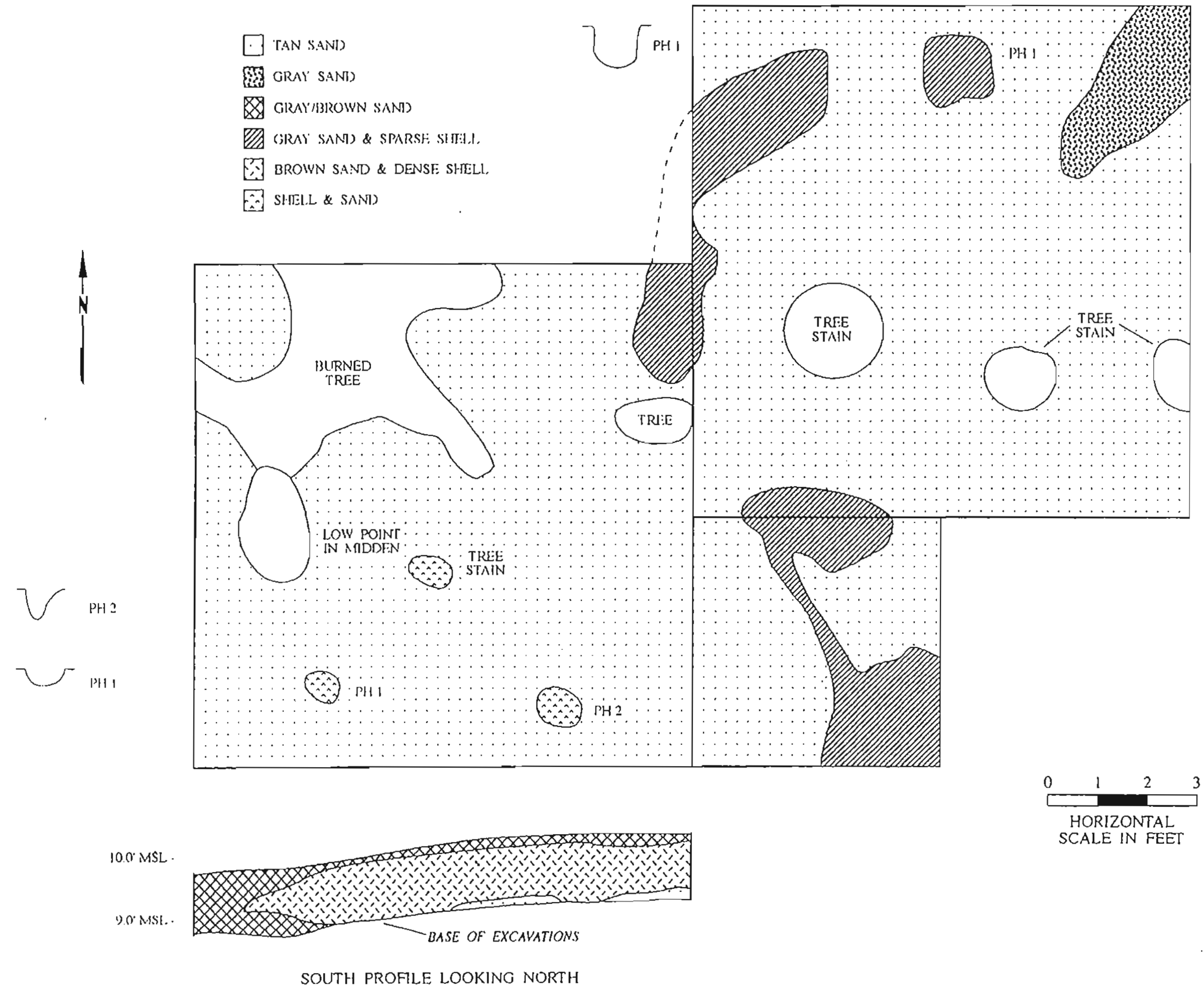

Figure 24. Plan and profile views of Midden 2.

(Figure 25). Unit 1 was placed in the densest portion of the midden, although the northwest quadrant could not be excavated because of a large tree. Unit 7 identified only the eastern toe of the midden, revealing that while some shell is scattered around each of these piles, the middens are fairly discrete. These investigations succeeded in excavating nearly 90% of the midden, which was found to have a maximum depth of 0.6 foot. The north near-midden area was investigated by Units 15-16, 18, and 22, while Units 19 and 20 were excavated to the south.

Table 1.
Shell Midden Content and Density, weight in pounds

			Percent by Wt.					Total	
Midden and Unit	Shell:Soil	pH	Oyster	Clam	Mussel	Tagelus	Cockle	Wt.	Wt./Ft³
Area 1, Unit 17	1:3.6	8.1	93.3	4.5	2.2	-	-	930	10.0
Area 1, Unit 21	1:2.0	8.2	97.9	1.9	0.1	-	0.1	1938	27.7
Area 1 mean	1:2.8	8.2	95.6	3.2	1.2	-	0.1	-	18.9
Area 1 SD	0.8	0.05	2.3	1.3	1.05	-	-	-	8.85
Area 2, Unit 25	1:1.4	8.6	95.4	2.5	2.1	-	-	865	14.1
Area 2, Unit 26	1:2.1	8.2	97.2	1.3	1.5	-	-	1072	19.1
Area 2 mean	1:1.8	8.4	96.3	1.9	1.8	-	-	-	16.6
Area 2 SD	0.35	0.2	0.9	0.6	0.3	-	-	-	3.53
Area 3, Unit 1	1:1.2	7.6	98.4	1.4	0.2	-	-	984	18.7
Area 3, Unit 7	1:11.2	6.9	98.3	1.6	0.1	t	-	435	5.8
Area 3 mean	1:6.2	7.3	98.4	1.5	0.2	-	-	-	12.3
Area 3 SD	5.0	0.35	0.05	0.1	0.05	-	-	-	6.45
Combined mean	1:3.58	7.9	96.8	2.2	1.0	-	-	-	15.9
Combined SD	3.49	0.54	1.8	1.1	0.9	-	-	-	7.0

Area 4, another small midden measuring about 9 by 9 feet (52 square feet), was not investigated during this research.

Area 5 was initially identified as a very small midden, although the excavation of Units 2-5 revealed that the identified shell was actually the remnant of two plowed features (Features 1 and 2) (Figure 26). Additional units were excavated in the cardinal directions from this block excavation. Two units, 10 and 29, identified a series of post holes interpreted to represent a temporary St. Catherines structure about 7 feet in diameter (Figure 27).

Area 6, explored by a single 5-foot square (Unit 9), was found to be a small remnant midden almost completed destroyed by plowing. The estimated remaining size is 5 by 10 feet (36 square feet) and only 0.2 foot of midden depth was found intact.

Area 7 represents another plowed midden, with the remnant measuring 9 by 4 feet (36 square feet). Three 5-foot units were excavated in this area, revealing two post holes but no other features.

Area 8 represents a very large midden measuring about 56 by 31 feet (1,272 square feet) situated just east of Areas 1-3. This midden was so large that it was not investigated by this research, beyond the auger testing at 10 foot intervals.

Area 9 represents a midden measuring about 8 by 9 feet (36 square feet) at the southwest edge of the study area. While this midden was not investigated during the data recovery efforts, a 5-foot test pit was excavated on its edge during the testing phase. No further work was conducted in this area because of the extensive disturbance caused by the fire plow.

Table 1 provides information on the content of the various middens explored, including the density of shellfish and the species present. The table reveals that there is some diversity in the proportion of shell to soil, although only Area 3, where Unit 7 was placed on the toe of the midden rather than in the midden, is there significant variation within any individual midden (notice, for example, that the standard deviations for Areas 1 and 2 are quite low). While taken as a whole there is considerable variability, if Unit 7 is excluded from the overall calculations the ratio is 1:2.06 with a standard deviation of only 0.84.

Soil pH generally reflects density of shell midden, with the denser middens having more alkaline (i.e., higher) pH readings. Only in Area 3

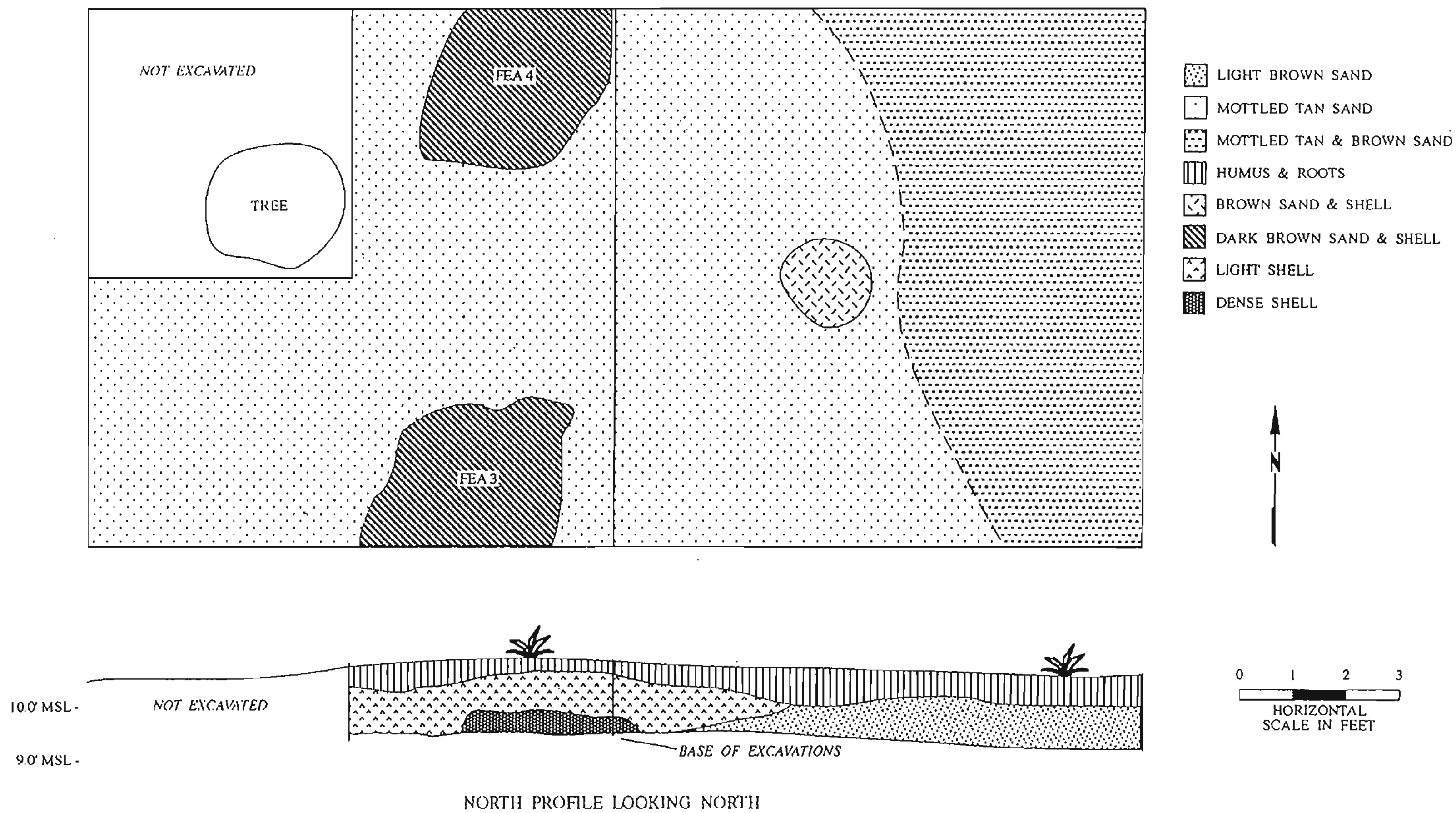

Figure 25. Plan and profile views of Midden 3.

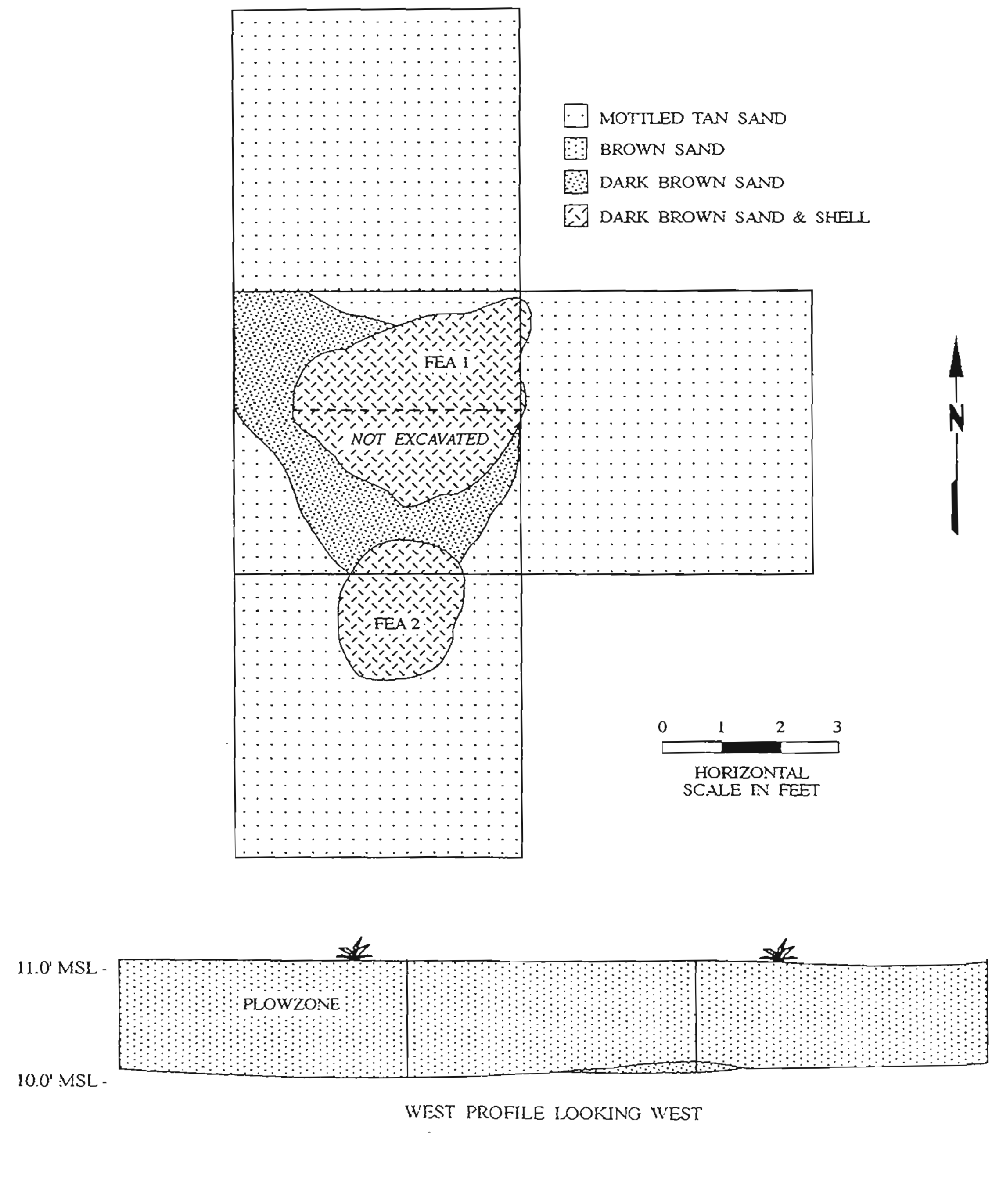

Figure 26. Midden 5 plan and profile drawings.

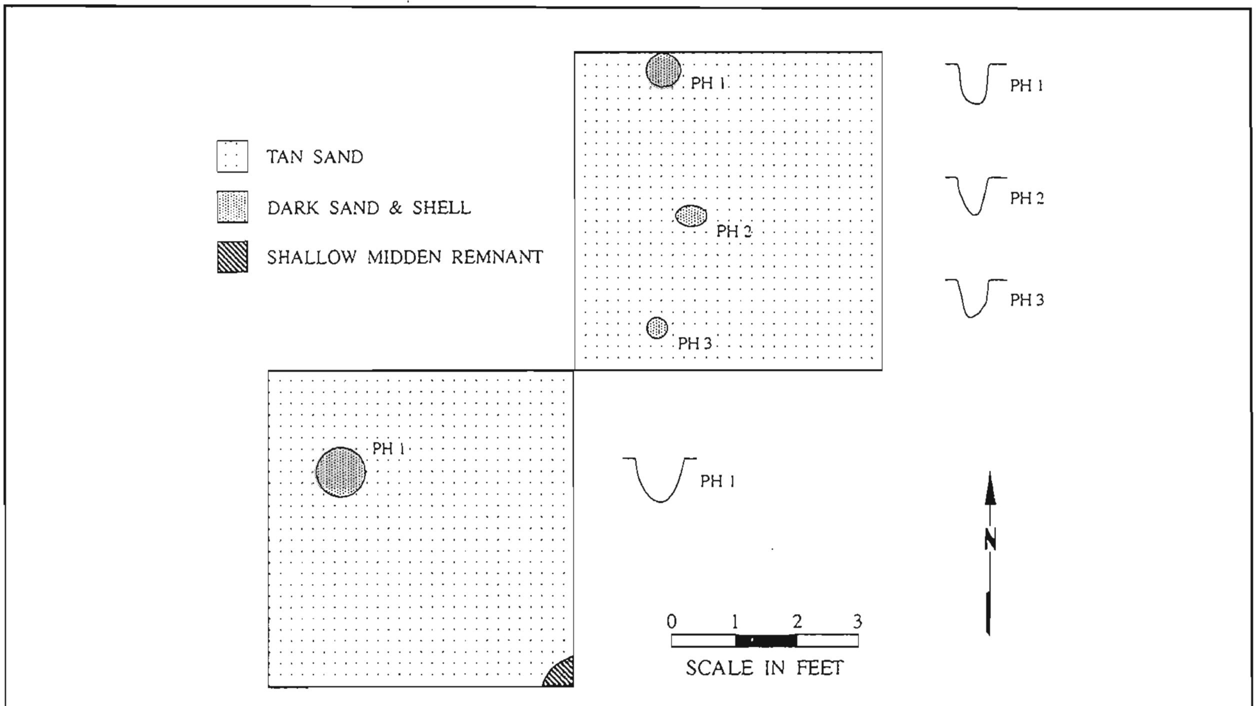

Figure 27. Units 10 and 29 illustrating the post hole pattern associated with the St. Catherines structure.

is this not consistent. While the low pH for Unit 7 clearly reveals the domination of the acidic soil over the alkaline midden, the relatively low reading in Unit 1 cannot be readily explained. The percentage by weight of oyster shell is relatively consistent, both within individual middens and also among the three areas (in fact, the standard deviation for the combined areas is only 1.8). Understandably the standard deviations for the other shellfish are higher, but still there is considerable uniformity.

The weight of shell midden per cubic foot of excavation provides a different estimate of midden density, revealing more deviation around the mean than might be expected (7.0 standard deviation around a mean of 15.9 pounds). As with the shell:soil ratio, if Unit 7 is discounted, the mean is 17.9 and the standard deviation is 5.9 -- representing less variation.

If the shell content is examined, the oyster component is relatively consistent, having a mean of 96.8% and a standard deviation of only 1.8%. Clearly oyster is the dominant shellfish in all of the middens. The other shellfish species tend to be more variable, suggesting a more localized occurrence, especially for the tagelus and cockle species, which are found in only two proveniences.

Table 2.
Midden Sizes

Midden	Dimensions	Square Footage
Midden 1	24x50	920
Midden 2	15x20	252
Midden 3	12x10	92
Midden 4	9x9	52
Midden 6	5x10	36
Midden 7	4x9	36
Midden 8	31x56	1272
Midden 9	8x9	36

The Middens

If the middens are plotted by dimension (Figure 28; see also Table 2) there is a cluster of relatively small middens, including numbers 3, 4, 6, 7, and 9. Three middens, numbers 1, 2, and 8 are distinct from this cluster.

When the square footage values of

Middens 3, 4, 6, 7, and 9 are examined the arithmetic mean is 50.4, with a relatively large sample standard deviation of 24.3. The mean size of middens 1, 2, and 8 is 814.7 square feet, again with a large stan dard deviation of 518.09 square feet. These large stan-dard deviations may be attrib-uted to at least three factors. The sample sizes are very small -- five and three middens respec tively. In addition, it is likely that at least Midden 8, the largest of those identified, represents the blending, or blurring, of several smaller middens. Not all of these larger middens, however, can be discounted as representing multiple middens. Excavations at Midden 2 and examination of its profiles suggest that it represents one depositional episode. Just as some middens are composed of smaller middens, causing an increase in the sample standard deviation, it is also possible that at least some of the smaller middens are underestimated as a result of plowing disturbance. For example, Midden 6 has been impacted by agriculture, perhaps reducing its original size. But, like the larger middens, not all of the smaller middens can be discounted. Midden 3, at 92 square feet, is clearly intact, with a well defined toe area.

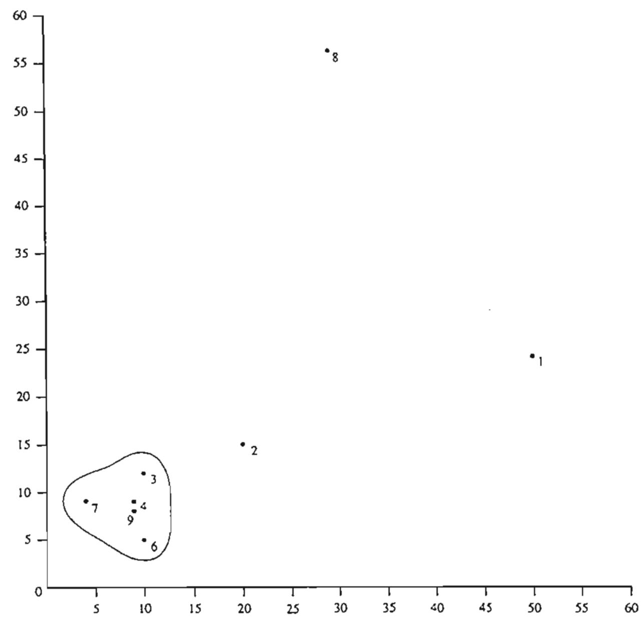

Figure 28. Clustering of shell midden dimensions.

What this means is that while we can see some range in size, it is very difficult to statistically interpret this range. Not only is the sample size inadequate, but there remain unanswered questions regarding some of the middens. The two best preserved middens investigated reveal sizes ranging from 92 to 252 square feet.

It was hoped that these studies would allow micro level spatial analysis or statistics to explore the proxemics of the individual midden piles. The resulting sample will not allow this detailed a level of investigation and, after conversations with Mr. Jim Scurry, an expert in geographical analysis at the S.C. Department of Natural Resources (personal communication 1994), there appear to be two options. Either much larger samples are necessary from future research or alternatively, a number of small samples, collected in a uniform manner, must be combined.

At an intuitive level, however, even this research may be useful. It suggests that a wide range of midden sizes may be present on one site. It also reveals that even single episode deposits may have a large range in size -- from 92 square feet to at least 252 square feet. And it suggests that some middens were situated to blur together, forming larger amorphous piles -- a feature noted years ago by other researchers. The study also suggests that these middens will be at a minimum elevation of about 10 feet AMSL, with the lower elevations being too wet. Middens also seem to be clustered within the first 100 feet back from the marsh, although even this must be carefully accepted since marsh movement is not currently documented.

When data are added from sites 38BU833, 38BU1214, and 38BU1262, the sample size can be increased to 29, still too small for meaningful geographical analysis, but sufficient to suggest that

Table 3.
Middle and Late Woodland Middens in Beaufort County

Site	Midden	Shell:Soil	Dimensions	ft^2	Projected Shell Weight
38BU861	1	1:2.8	24x50	920	13193
	2	1:1.8	15X20	252	2421
	3	1:6.2	12X10	92	1207
	4		9x9	52	
	6		5x10	36	
	7		9x4	36	356
	8		56x31	1272	
	9		8x9	36	
38BU833	1	1:1.7	20x20	400	8336
38BU1214	1		7x7	49	
	2		6x10	60	
	3		6x10	60	
	4	1:1.3	17x17	314	5808
	5	1:1.5	17x17	314	3287
	6	1:3.0	9x9	79	355
	7		10x8	80	
	8		10x10	100	
	9		9x10	90	
	10		10x12	120	
	11		11x10	110	
	13	1:3.0	9x9	79	538
	14	1:7.6	4½x4½	20	75
	15	1:1.1	13x13	177	7685
	16	1:4.1	12x7	75	522
	17		10x7	70	281
38BU1262	1		16x16	256	
	2		15x10	150	
	3	1:0.4	15x15	225	
	4	1:1.7	20x20	400	

the 38BU861 data are representative. Table 3 and Figure 29 shows that the clustering of this larger data set is very similar to that shown in Figure 28. Although the cluster parameters have increased, there are only two out of 29 which may be considered outliers.

The larger data set also suggests an inverse relationship between the shell:soil ratio and the midden size in square feet, with the areally larger middens tending to have lower shell:soil ratios and the larger middens tending to exhibit fill dominated by soil. While cultural factors may be involved, it seems likely that natural features, such as the formation process of the middens and their ability to collect wind blown sand may be more responsible.

While we might expect a linear relationship between shell midden size and shell midden weight, the available data suggest that this correlation is relatively weak. It seems that the larger middens are at least partially larger because only a slightly greater volume of shell has been spread out to cover a much larger area. One explanation of this phenomenon is that the larger middens have been impacted by greater pedestrian activity, spreading the piles. An alternative, of course, is that the data are biased since investigators tend to excavate on the edge of large midden piles, rather than in their centers. This aspect of midden content, however, is easily testable given additional investigations.

Features

Six features (not including post holes) were identified and excavated during this research. These features are shown on the block excavation plan views (Figures 23 - 27) and profiles are illustrated in Figure 30.

Feature 1 was first encountered in an auger test which unfortunately penetrated the entire pit. It is situated at the base of the plowzone in the northeast corner of Unit 2 in Area 5. Excavation of the north half revealed a pit measuring 4 by 3 feet with a depth of 1.6 feet. The central portion of the feature is filled with discarded shell, while the outer margins are a dark brown sand. The feature is interpreted to represent a shellfish steaming pit with the shell consisting of a single episode of cooking.

Feature 2 is situated in Area 5, bisected by the Unit 2 and 5 line. The south half was excavated to reveal a pit about 2.1 by 2.5 feet in diameter and 1.5 feet in depth. This feature is interpreted to represent a steaming pit which had been re-used on at least two and possibly three occasions. Shell was observed scooped up along the east margin with two distinct burn lenses found in the west half of the pit.

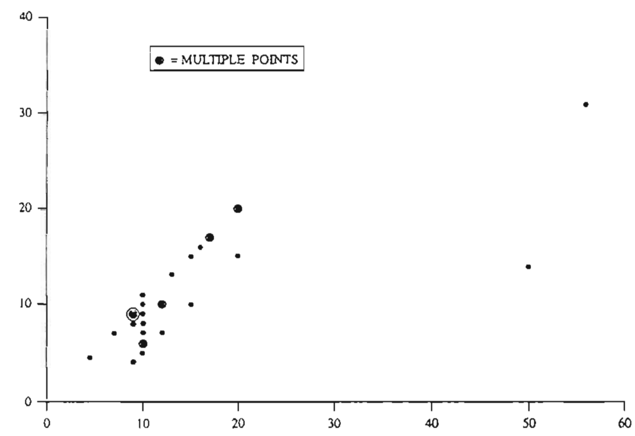

Figure 29. Clustering of shell midden dimensions from 38BU861, 38BU833, 38BU1214, and 38BU1262.

Feature 3 is found at the base of the Zone 1a shell midden in Unit 1 (Area 3). The pit is situated in the southeast quadrant and is bisected by the south wall of the unit. The observed portion of the pit measures 3.6 by 2.8 feet and the maximum depth of the feature is 1.9 feet. This pit suggests possible re-use since at its base was a dense pocket of stout tagelus and charcoal, representing an initial steaming deposit of these bivalves. Above are burnt and crushed shells, perhaps representing a second use period associated with the overlying dense deposit of shell, likely representing refuse thrown back into the pit.

Feature 4 was found in the northeast quadrant of Unit 1 and is bisected by the north profile of the square. It measures 3.3 by 2.9 feet but is only 0.5 foot deep. Being so shallow the feature might be interpreted as a low spot in the midden, rather than a cultural feature; however the profiles suggest that the pit was intentionally dug. A more likely scenario is that the feature represents the base of a pit originating higher in the midden.

Feature 5, found at the base of Zone 1 in the northeast corner of Unit 15, was initially thought to represent a pot bust. Examination of the recovered pottery revealed mending fragments of a single vessel, although all of the recovered sherds had coil fractures. In addition many of the sherds were very friable, almost dissolving during even gentle washing. It appears that the vessel broke during firing and many of the sherds are incompletely fired, representing little more than low-fired clay. The presence of evidence that vessels were being manufactured and fired on-site suggests that occupation was for longer periods than a few days.

Feature 6 was encountered at the base of Zone 1a in Unit 17. It was located in the northwest quad of the unit and is bisected by the west wall of the unit. Unlike the other features examined (which tend to be roughly circular), Feature 6 is oval to linear, measuring at least 5 feet in length

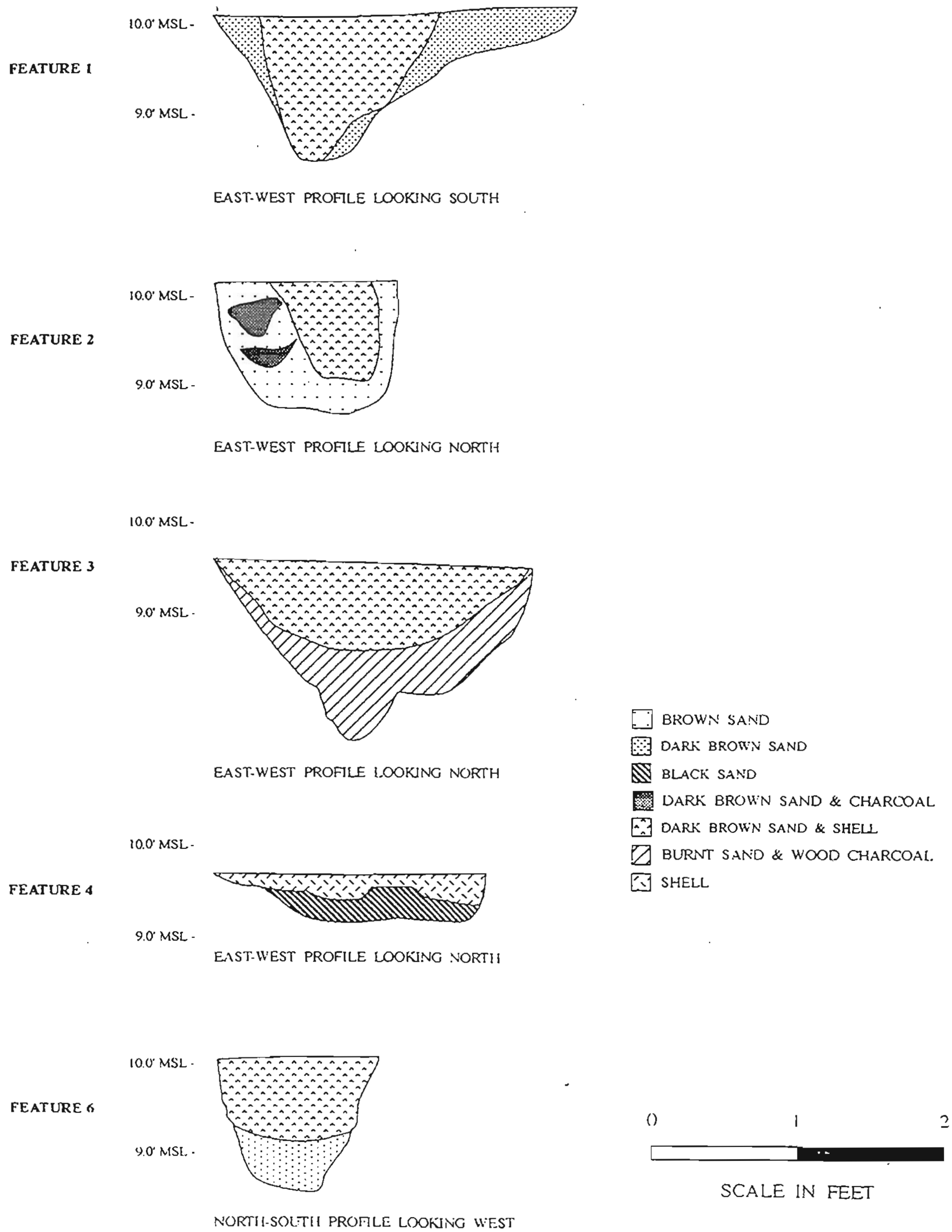

Figure 30. Profiles of features from 38BU861.

Figure 31. Features 1 and 2, before excavation.

Figure 32. Feature 3. south half excavated, view to the north.

Table 4.
Shell Content of Features, weight in pounds

Feature	Weight	Percent by Weight					
		Oyster	Clam	Mussel	Tagelus	Periwinkle	Whelk
Feature 1	78.5	81.4	14.3	4.0	-	0.3	-
Feature 2	36.5	92.8	2.7	4.2	-	0.3	-
Feature 3	195.0	80.8	15.2	2.0	1.0	-	1.0
Feature 4	60.0	91.9	5.4	2.7	-	-	-
Feature 6	81.0	77.7	5.6	16.7	-	-	-
Combined mean	-	84.2	8.6	5.9	-	-	-
Combined SD	-	6.2	5.1	5.4	-	-	-

Mussel = Ribbed Mussel; Tagelus = Stout Tagelus

and 2.8 feet in width. The feature is 1.5 feet in depth and consists of a sand and shell fill overlying a brown sand lens. While ambiguous, the feature may represent a steaming pit.

Table 4 provides information on the shell content of the various features. In each case oyster was the dominant shellfish, ranging between 77.7% and 92.8% by weight. Clam was consistently the next most common shellfish when the combined mean is considered, although several features exhibited significantly more ribbed mussel by weight than clam. Periwinkles are found as components in two features, while stout tagelus and whelk are each found in one feature. When these data are compared to the content of the various middens, it is immediately obvious that minority shellfish, especially shellfish which are inherently fragile such as stout tagelus and ribbed mussel, are more common in feature contexts, possibly because of better preservation and less damaging excavation techniques. In spite of this the features should not be taken as representative of routine exploitation. For example, periwinkles are found in only two features -- and in both cases as a very small proportion of the assemblage. These shells are relatively durable and easily recognizable. Yet they were not found in any of the midden excavations, suggesting that while they were found in two features they do, in fact, represent a very limited portion of the site occupants' diet.

The shellfish recovered reflect a rather uniform marsh habitat -- the typical mud flats were oysters and ribbed mussels are commonly found, occasionally with whelks as predators. Even the smaller clams tend to be found near the oyster beds in sands and muds which contain a high percentage of dead shell. The juvenile clams require this shell cover for survival from the extensive crab predation. Large, or more fully grown, clams may sometimes be found isolated in mud or sand, but are rarely found as beds with large numbers of individuals (Skipper Keith, personal communication 1994). Additional ecological research will explore the habitats used by the site's inhabitants.

ARTIFACT ANALYSIS

Pottery

A total of 1368 sherds were recovered from the excavations at Old House Creek. Of these, 236 or 17.3%, were over 1-inch in diameter and were considered of adequate size for further analysis. Those under 1-inch take considerable effort to process and identify. Further, Orton et al. remark that "in most quantification methods [these sherds] will make little difference to the overall statistics of an assemblage" (Orton et al. 1993:47). The very large quantity of highly fragmented sherds (approximately 80% of those under 1-inch were also under ½-inch in diameter) suggests that there was considerable pedestrian traffic at the site, and specifically on and around the various shell piles, which reduced the size of the pottery.

Pottery density at Old House Creek is approximately 1.2 sherds per square foot in the excavation areas, or about 1.4 sherds per cubic foot of excavation. This seems to fall within the mid-range of other Beaufort County shell middens. For example, Kennedy and Espenshade (1991) report a density ranging from 1.2 to 5.8 sherds per square foot during data recovery at 38BU1270, a Wilmington phase shell midden. Densities ranging from about 0.1 to 5.1 sherds per square foot are reported by Kennedy and Espenshade (1992:56) at four Middle Woodland shell middens on Colleton Neck in Beaufort County. At four Middle to Late Woodland shell midden sites on nearby Callawassie Island, sherd densities were found to range from a low of 0.6 sherds per square foot (at a site in which the excavations incorporated a large area of non-shell midden) to 3.0 sherds per square foot (Trinkley et al. 1991). There appears to be considerable uniformity, with the majority of the sites producing between one and three sherds per square foot. Some of this variation is likely the result of specific site areas (and relative proportion of different site areas) actually sampled in the excavations.

The analysis identified sherds belonging to four series: six (2.5%) are Thom's Creek wares, all plain; 116 (49.2%) are Deptford, including Deptford Plain (n=57, or 49.1% of the Deptford assemblage), Deptford Cord Marked (n=48, or 41.4%), Deptford Simple Stamped (n=6, or 5.2%), Deptford Check Stamped (n=3, or 2.6%), and Deptford Fabric Impressed (n=2, or 1.7%); one (0.4%) Wilmington Cord Marked; and 113 (47.9%) St. Catherines sherds, including St. Catherines Cord Marked (n=86, or 76.1% of the St. Catherines assemblage), St. Catherines Plain (n=19, or 16.8%), and St. Catherines Net Impressed (n=6, or 7.1%). This analysis will deal with only the Deptford and St. Catherines wares which together comprise 97.1% of the identifiable pottery. In the most general of terms, one ware (the Deptford) consisted of a relatively coarse sand tempered paste, while the other ware (St. Catherines wares) consisted of pottery with sparse to abundant grog inclusions in a typically fine sandy paste.

Deptford

The 116 Deptford sherds are dominated by plain and cord marked motifs. Check stamping, fabric impressing, and simple stamping are all minor components of the assemblage at Old House Creek and will receive only minimal attention in this study. This assemblage is similar to that associated with the Deptford II phase, dating about A.D. 300 to A.D. 500 along the Georgia coast (DePratter 1989:111).

Both the Deptford Plain and Deptford Cord Marked exhibit very similar paste. While the size of the sand temper ranges from very fine to very coarse, coarse sand is found in 49.1% of the plain sherds and 31.2% of the cord marked sherds. The sand shape is typically sub-angular (56.1% of the plain sherds and 35.4% of the cord marked sherds) to rounded (35.4% of the cord marked wares). Both wares have a moderate amount of sand inclusions, although even here the cord marked sherds show considerably greater diversity (with 33.3% having abundant sand inclusions, 45.8% having moderate inclusions, and 20.9% having only sparse inclusions). Overall, the data suggest that the clay used for the Deptford ware contained sand inclusions, with little (if any) sand added.

This diversity is further evident when other features, such as core cross-section and interior treatment are considered. The most common (35.1%) cross-section for the plain sherds was one which is oxidized, with diffuse core margins. This is typical of firing clay with organic matter under conditions of incomplete oxidation, leaving a black or gray core distinct from the surface color. The next most common (26.3%) cross-section was one totally reduced, indicative of firing in a reducing atmosphere. Also fairly common (22.8%) were sherds with cross-sections evidencing complete oxidation. The least common cross-section was one exhibiting a thin "core" of oxidation with a diffuse margin separating the core from the outer layer. This effect is common when completely oxidized vessels are used for cooking, with the outer layer blackened by reducing gases from the cooking fire. The cord marked pottery shows greater variation in cross-sections with over a third of the sherds (35.4%) evidencing oxidized surface layers and a sharp. well defined reduced core. This is typical of vessels fired in a reducing fire, but taken out and allowed to cool in the open. Nearly as common (31.2%) were sherds completely reduced. Completely oxidized cross-sections accounted for only 18.8% of the sherds. The vast majority of the plain sherds (64.9%) evidence no interior tooling or treatment, allowing at least some temper to protrude. This is compared to only 37.5% of the cord marked sherds, which were more commonly smoothed or tooled (39.5%).

In both cases exterior smoothing is classified as moderate (with some blurring of the stamp, or a regular finish on plain sherds) to high (plain sherds have a semi-glossy finish and stamped sherds have the cord marking almost totally obliterated). Likewise, evidence of vessel use is relatively limited. Only 28.1% of the Deptford Plain sherds show signs of internal carbon deposits and 22.8% show evidence of external smudging or deposits. Over a third (35.4%) of the Deptford Cord Marked sherds show indications of internal carbon deposits and 22.9% show signs of sooting or smudging. Orton et al. (1993:222) caution that carbon evidence of food preparation may be removed during post-excavation processing, unlikely in the case of this collection considering that special care was taken to preserve such evidence throughout the excavation and analysis process. Consequently, it seems reasonable that around a third, or less, of the vessels provide good evidence of being used for cooking. In addition, very few of the cross-sections suggest use over fire. This leaves open the possibility of other uses, such as water or food storage.

Turning to the cordage itself, the vast majority of the pottery (72.9%) evidences a right, or S-twist using cord ranging in diameter from 1.65 to 4.95 mm (with a mean diameter of 2.64 mm). Not surprisingly, the fabric impressions found on two Deptford sherds indicate an almost identical warp and weft diameter of 2.21 mm and 2.20 mm. Most of the examples revealed a medium twist (11° to 25°). Greater variation was found in the twists per centimeter, with 58.3% of the sherds exhibiting 6 twists per centimeter, followed by 18.8% having 4 twists per centimeter. The average distance between the cords was 2.28 mm, with a range of 1.43 mm to 5.79 mm.

Regrettably few Deptford rims were recovered in these excavations. The Deptford Cord Marked wares yield an eve of 35, the Deptford Plain yield an eve of 10, and the Deptford Check Stamped yield an eve of 5. These provide sample sizes too small to allow effective use of this technique, or even comparison with more traditional counts. The rims, however, suggest vessels measuring 35 to 45 cm in diameter. Vessel wall thickness average 6.8 mm and the only recovered shoulder forms are slightly out flaring to straight, suggestive of relatively deep, large pots.

The collections of Deptford Fabric Impressed, Check Stamped, and Simple Stamped are too small to be compared to the plain and cord marked specimens. Likely because of the small sample size, there is considerable diversity or range in virtually all of the measured features. The six simple stamped sherds exhibited a range in groove width from 2.9 to 3.7 mm.

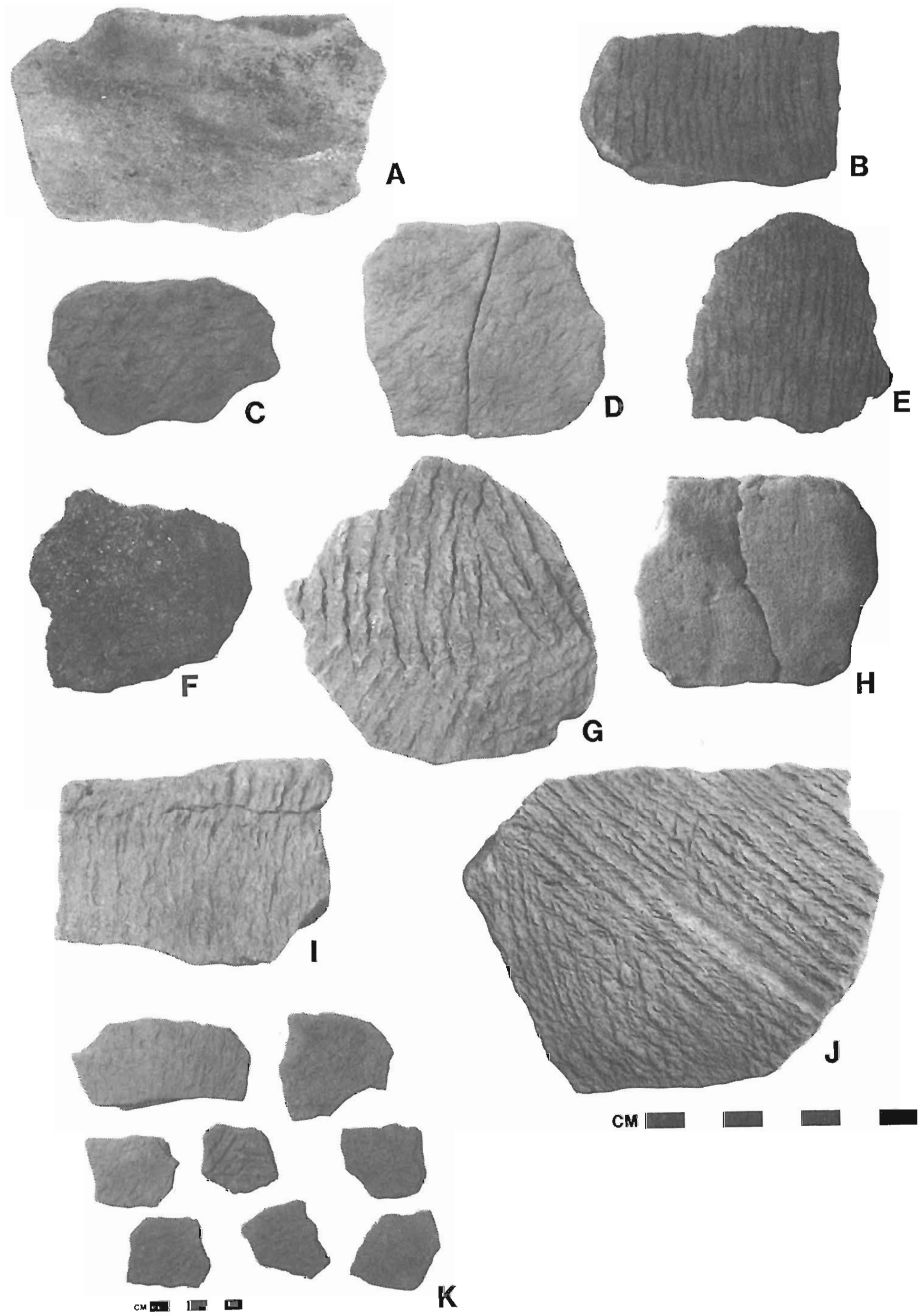

Figure 33. Deptford and St. Catherines pottery from Old House Creek. A, Deptford Plain; B-D, Deptford Cord Marked sherds with Z twisted cordage; E, Deptford Cord Marked sherd with S twisted cordage; F, interior of Deptford sherd showing protruding sand grains; G, St. Catherines Cord Marked with Z twisted cordage; H, Interior of St. Catherines sherd showing tooling, probably with shell; I, St. Catherines Cord Marked with S twisted cordage; J, Deptford sherd hone (cord marked with Z twist); K, St. Catherines Cord Marked pottery from Feature 5.

This assemblage may be compared to that described by Espenshade et al. (1994) from their excavations at 38BU2 on Spring Island, although tabulations and discussions are not provided by type, only ware. There the Deptford wares typically contained coarse sand inclusions occurring in moderate densities. Interior treatment was found on all of the observed material from 38BU2, although "the degree of smoothing and pre-smoothing methods (i.e., scraping and check stamping) varied" (Espenshade et al. 1994:112). Unlike the Old House Creek samples, Espenshade and his colleagues report that most of the cores from 38BU2 exhibited reduction, although there is no detailed information discussing the range of variation. They similarly mention that "few" of the sherds exhibited fire clouding or sooting, but do not provide a percentage. They offer considerable information on vessel form and size, working with a larger collection than present at Old House Creek. On Spring Island the Deptford wares included what are described as nine deep bowls and three bowls. Vessel diameters ranged from 24 to 48 cm, with an average of 33 cm.

Kennedy and Espenshade (1992:68) comment that the Deptford potters used a heavy cord (ranging from 8 to 20 mm and averaging about 13 mm). Virtually all of the identified specimens were Z or left twisted cords. In addition, they observed the Deptford potters used a relatively loosely spaced cord on their paddles (the study reports spacing at 42 mm, although it seems more likely that this should read 4.2 mm). Their analysis presents a dramatically different view of Deptford wares -- the cordage is significantly heavier than that found at Old House Creek and different twists were used. Spacing, likely correlated with the size of cordage, was greater than found at Old House Creek. At 38BU2 on Spring Island, 60% of the vessels evidenced a Z or left twist and the cordage diameter ranged from 1.1 to 2.0 mm, with an average of 1.5 mm (Espenshade et al. 1994:Appendix B). Again the predominant direction of twist is different and the cordage tends to be even finer than that found at Old House. At 38BU464, producing a collection of over 4000 sherds, the 197 analyzable Deptford Cord Marked sherds were only examined for cordage twist and general statements on the nature of the cordage (79.2% evidenced a Z or left twist with a soft cord) (Trinkley et al. 1991:82). Very similar, and sketchy, results were reported from the analysis of the cordage at 38BU833, a Middle to Late Woodland shell midden along Skull Creek on Hilton Head Island (Trinkley et al. 1992:27) where Z twisted cords dominated the collection and resulted in the conclusion that:

> the Deptford Cord Marked type consists entirely a Z or left twist. . . . In the Deptford collection there is considerable diversity in both the cordage diameter and the number of twists. The range in cordage diameter for the Deptford wares is 1.0 to 2.0 mm, with the number of twists ranging from a low of three to a high of eight. As a consequence, soft, medium, hard, and very hard twists were found in the collection (Trinkley et al. 1992:27).

While none of these sites offer particularly detailed comparative information, what is offered suggests that there is some considerable internal variation within the Deptford wares. It also indicates the importance of consistent, and thorough analytical techniques, if the data from a number of sites are to be suitable for comparative studies.

St. Catherines

As previously mentioned, 113 examples of St. Catherines pottery were identified (representing 47.9% of the total analyzable collection). This ware included primarily cord marked examples (86, or 76.1% of the collections), although small quantities of plain (n=19), and net impressed (n=6) were also found. Previous research (e.g., DePratter 1979) has not subdivided the St. Catherines phase, so this collection would typically be dated from about A.D. 1000 to A.D. 1150.

Very small portions of the St. Catherines pottery contained sand inclusions as well as grog. Only 3 of the 19 plain sherds (15.8%) were found to contain sand and all of the samples exhibited only fine, rounded sand particles. In each case the sand comprised between 10 and 20% of the paste. Thirty-one, or 36%, of the cord marked examples also contained sand inclusions. Perhaps because of the larger sample, the cord marked specimens exhibited greater diversity. While the most common sand inclusion size was fine (found in 18 sherds or 58.1% of the sherds with sand), very fine sand (4 sherds or 12.9%), medium sand (8 sherds or 25.8%), and even coarse sand (one sherd or 3.2%) was encountered. While rounded sand inclusions dominated the cord marked, just as they did in the plain collection, six examples each were found on angular and subangular inclusions (together accounting for 38.7%). Like the St. Catherines Plain wares, the paste of the majority of cord marked sherds contained 10% to 20% sand, although eight examples (or 25.8%) were found to contain only sparse amounts of sand (around 5%).

Of course, St. Catherines pottery is typically defined as containing "crushed sherd or crushed, low-fired clay fragments" (DePratter 1979:131). Usually these fragments are described as being "smaller" than the temper encountered in Wilmington wares. The ambiguity, quite naturally, makes definition or identification of the type somewhat problematical. Our "smaller" is not necessarily your "smaller," especially if there is no inherent difference in the nature of the inclusions (either broken sherds or simply clay). Both of these differences are exceedingly important and worthy of discussion.

While the size (or more properly the size range) of the inclusions has a relatively clear impact on the typological definition, the nature of the inclusions is perhaps even more important. Grog is typically defined as crushed sherds (see, for example, Rye 1981:33). It is commonly perceived as having a number of advantages over natural tempers: it is usually abundant, either as waster sherds or as broken pottery in refuse; it is easier to crush then most natural tempers, such as rock; and since sherds have already been fired once and possess the same general properties as the fabric into which they are introduced, they are stable during the firing process. Grog tempering, by definition, can be inferred to be temper rather than a natural inclusion. In contrast, if the inclusions are not grog, but perhaps simply sun-dried clay fragments, they may be either natural (the result of poor clay preparation or even allowing the clay to sit too long and "crust over") or intentional (added to the moist clay).

Both the St. Catherines Plain and Cord Marked sherds exhibit grog/clay averaging 4.3 mm in diameter (with a standard deviation of 0.9 mm). There is considerable range in the quantity of grog/clay. In the sample of plain sherds, four specimens (21.1%) evidenced 30% or more inclusions, seven (or 36.8%) evidenced moderate inclusions (10% to 20%), and eight sherds (42.1%) evidenced less than 5% inclusions. The cord marked wares include 16 with abundant inclusions (18.6%), 43 with moderate inclusions (50%), and 27 with sparse inclusions (31.4%).

One St. Catherines Cord Marked sherd, defined has having a moderate amount of inclusions, was mechanically broken apart, separating out the identifiable inclusions in the process. This sherd, by weight, was composed of 91.9% paste (17.70 g) and 8.1% inclusions (1.55 g). The 38 identifiable inclusions, of considerable variation in shape, ranged in size from 1.19 mm to 9.12 mm, but had a mean diameter of 3.22 mm with a standard deviation of 1.59 mm.

When the grog/clay inclusions are examined microscopically (at 7x to 30x power), they almost fade into the paste. They may be mechanically separated from the paste with only great difficulty. They present very few flat surfaces suggestive of crushed sherds. In many cases they seem to "disappear" into what may be described as a "contorted" or "swirled" paste.

The inclusions, therefore, tend to have a relatively constant apparent size, although actually defining the inclusion is more difficult and there is likely some over-estimation of inclusion size. This is possibly caused by the investigator subconsciously avoiding the smaller particles since they are more difficult to measure. Alternatively, the smaller particles may be more easily hidden in the paste, allowing them to be overlooked. Regardless, the quantity of these inclusions may vary considerable from sherd to sherd, or even from edge to edge. It seems reasonable, however, to suggest that most sherds (and hence vessels) have a moderate amount of inclusions, forming somewhere between 10 and 20% of the vessel. While the macro- and microscopic evidence is not conclusive, there is relatively little evidence that these inclusions are crushed sherds. In most respects they appear better described as clay fragments, leaving open the possibility that they are simply bits of sun-dried clay added to the mixture.

To further investigate this possibility a sample of the paste and the inclusions from one sherd were examined using X-ray fluorescence. It seemed likely that if the aplastic inclusions represented only dried clay, having the same general source as the plastic component, there would be little or no difference in the chemical signatures. If, on the other hand, the aplastic inclusions were grog from ground sherds, there would be a greater potential for minor differences, caused by different initial source locations.

X-ray fluorescence (XRF) is one of a number of X-ray spectrochemical analytical techniques, including spectrometry and atomic absorption spectrophotometry, used in trace element analysis of geological and ceramic specimens. In XRF the sample is irradiated with X-rays which are absorbed and then re-emited with lower energy and frequencies specific to each element. Perhaps the most significant disadvantage is the considerable "matrix effect" common to XRF. Reeves and Brooks note that:

> a significant proportion of secondary (and primary) X-rays is absorbed by major constituents of the matrix and, unless standards are close in composition to the samples, the accuracy will be poor. . . . When several elements are to be determined, internal standards may be used . . . . Alternatively, use may be made of previously analyzed standards of similar composition to the sample. A working curve can be constructed from these standards, minimizing the matrix problem (Reeves and Brooks 1978:244-245).

Regardless, XRF is useful in that it is non-destructive, allowing multiple runs on the same sample. It allows solids to be directly sampled, and it permits study of a number of trace elements difficult to otherwise sample. Perhaps of equal importance is the comment by Orton et al.:

> it will be relatively rare that a pottery worker will be faced with the problem of choosing between competing techniques . . . . More often the choice of laboratories able to participate in a project will be strictly limited, the choice of technologies and procedures will already have been made, and it will be a question of integration with an existing research program (Orton et al. 1993:145-146)

Certainly this was the case here. With limited funds and the ability to conduct only the simpliest of studies, many of the analytical choices were unavailable. An alternative deserving very close attention, however, is ICP spectrometry.

The specific results of the XRF studies are discussed in a following section of this study.

The St. Catherines Plain pottery was dominated by sherds with totally reduced cross-sections (52.6%). The next most common cross-section was one exhibiting complete oxidation. In contrast, the cord marked sherds most often exhibit oxidized surfaces with an incompletely oxidized core. The next most common cross-section exhibited complete oxidization, while the third most common cross-section exhibits oxidation on the surface with an interior core of incomplete oxidation having very sharp margins. This is often found in pottery fired in the open air and then very rapidly cooled. Only 5.3% of the plain sherds and 9.3% of the cord marked sherds exhibit a cross-section typical of pots used in cooking fires.

Interior treatment on both plain and cord marked sherds was minimal, but present. Tooling marks were visible on 31.6% of the plain sherds and 41.9% of the cord marked examples. Only 5.3% (n=1) of the plain sherds and 5.8% (n=5) of the cord marked sherds had temper visibly protruding on the interiors. On the other hand, 36.8% of the plain sherds and 31.4% of the cord marked sherds evidenced temper inclusions which were not protruding. Both plain and cord marked sherds typically exhibit moderate smoothing (57.9% of the plain and 55.8% of the cord marked). Exterior smoothing was characterized as moderate on 57.9% of the plain sherds and 55.8% of the cord marked sherds, and heavy on 42.1% of the plain and 29.1% of the cord marked sherds. To further make cordage identification difficult, 93% of the cord marked sherds evidenced overstamping.

Cordage impressed into the St. Catherines ware ranged in size from 1.29 to 4.55 mm, with a mean diameter of 2.59 mm. A full 79% of the sherds (n=68) exhibited an S or right twist. Only 4.7% of the cordage was identified as left or Z twists (with the remaining 16.3% unidentifiable). The twists per centimeter exhibits a unimodal distribution, peaking at 6 twists/cm (55.8%), declining to 11.6% at four twists and 14% at eight twists. The bulk of the collection (62.8, n=54) revealed a moderate angle of twist. The distance between the cords on the paddle ranged from 1.21 to 5.4, with a mean 2.59 (representing a nearly identical pattern as the cordage diameter itself).

The pottery found in Feature 5, interpreted to represent the remains of an incompletely fired St. Catherines Cord Marked vessel offer an opportunity to explore the diversity found within a single vessel. The cordage diameter, measurable on 12 different sherds, averaged 2.07 mm, with a standard deviation of 0.51 mm. The spacing between these cords, measurable on 11 sherds, averaged 2.58 mm, with a standard deviation of 1.12 mm. These sherds also offer another avenue to explore the diversity of grog inclusions in the St. Catherines pottery. The mean size of the measured inclusions was 3.90 mm, with a standard deviation of 0.84.

Even fewer St. Catherines rims were found than Deptford. The St. Catherines Plain wares yielded an eve of 8 and the St. Catherines Cord Marked an eve of 25. These provide sample sizes too small to allow effective use of this technique, or even comparison with more traditional counts. The rims, however, suggest vessels measuring 33 to 45 cm in diameter. Vessel wall thickness average 7.2 mm and the only recovered shoulder forms are slightly out flaring to straight, suggestive of relatively deep, large pots.

Very few of the St. Catherines Plain sherds (21.1% of the interiors and 5.3% of the exteriors) exhibited any evidence of carbonized material. A more significant number of the interiors of cord marked sherds (63.4%) showed signs of carbonized material or sooting, compared to only 4.7% of the exteriors.

Only eight fragments of St. Catherines Net Impressed pottery were identified in the collection. The fabric comprising the nets ranged in diameter from 3.38 mm to 4.79 mm. In all respects it appeared to represent the same cordage used on the paddles to create cord marked pottery.

While there are a number of studies which provide comparative data for the Deptford wares, there are fewer which have examined St. Catherines pottery in any detail. For example, at 38BU833 on Hilton Head Island:

> the preference for Z twisted cordage continues into the St. Catherines and Savannah periods. In the St. Catherines collection the bulk of the cordage was loosely or softly twisted, with the average cordage diameter of 2 mm (range of 1.0 to 2.0 mm) and the average number of twists per cm being four. Another characteristic of the St. Catherines pottery from 38BU833 is the very poor condition of the cordage. A very large percentage of the collection evidenced frayed or otherwise damaged cordage. The St. Catherines pottery consistently evidences a highly contorted paste with abundant clay inclusions ranging in size from 1 to 4 mm. (Trinkley et al. 1992:27).

At 38BU464 there were 333 St. Catherines sherds suitable for cordage analysis. The vast majority (88.6%) exhibited a Z or left twist, with most soft or loosely twisted and the conclusion was drawn that "there seems to be very little difference between the cordage used by the Deptford, St. Catherines, and Savannah groups" (Trinkley 1991:83).

Comparing Deptford and St. Catherines wares at Old House Creek

There seems to be relatively little

difference between the cordage used by the Deptford and St. Catherines potters. The range of cordage diameters, mean cordage diameter, direction of twist, and even distance between the cords are all very similar (see Table 5). Regardless of the exact nature of the temper inclusion (sand or clay/grog) it is typically found in moderate amounts (i.e., ranging between 10% and 20%) in both wares. Both the sand inclusions and the clay/grog inclusions are characteristically sub-angular to rounded. Combined with the previous discussions of the clay inclusions found the St. Catherines paste, there is evidence that the inclusions in both wares may be natural, rather than intentionally added. In sum, if the exact nature of the aplastic temper were ignored it would be difficult, perhaps impossible, to separate these two "types" -- at least at Old House Creek. Consequently, the suitability of maintaining distinct single-tier types for the Deptford and St. Catherines wares, at least in this one example, may relate only to the degree of temporal (or perhaps even spatial) discreetness evidenced by the two. While this study is certainly provisional, it strongly suggests the wisdom of adopting a two-tier system of "type" and "variety."

Table 5.
Comparison of Deptford and St. Catherines Cordage

	$\bar{x}$ cord diameter	cord diameter range	% R twist	$\bar{x}$ distance between cords	distance between cords range
Deptford	2.64	1.65-4.95	72.9	2.28	1.43-5.79
St. Catherines	2.59	1.29-4.55	79.0	2.59	1.21-5.40

Comparing the Wares of Specific Middens

When the three most thoroughly investigated middens (numbers 1, 2, and 3) are examined, there is considerable similarity in the proportion of Deptford and St. Catherines wares in each. Deptford consistently varies from 52% to 62% of the total sherds, while St. Catherines wares account for 38% to 48% (considering only these two types).

Some attributes are more likely to be controlled by the cognitive definition of the "type" than others or by the resources themselves. For example, the amount, size, and shape of sand inclusions are likely controlled (or at least strongly affected) by the source of the clay. As would be expected, these are fairly consistent both between the Deptford and St. Catherines wares and also between the three middens. Subangular medium coarse to coarse sands occurring in moderate amounts are most typical of the Deptford ware in all three middens. Similarly, a moderate amount of clay/grog temper is characteristic of the St. Catherines pottery in all three middens.

Other attributes are likely to be controlled to a greater extent by the potter. Examples might include the firing of the pottery, as evidenced by the core cross-section. The Deptford ware in each midden is dominated by a different core cross-section. But perhaps significantly, the Deptford and St. Catherines sherds exhibit nearly identical proportions of cross-sections by specific midden. The sherds in Midden 1 are primarily oxidized with a diffuse core. Those in Midden 2 are primarily reduced, while those in Midden 3 include nearly equal amounts of oxidized and reduced cross-sections. Likewise, there is considerable uniformity in the cordage diameter between middens, and even within the different wares within the same midden.

Finally, some attributes may be very idiosyncratic or individualist. We have previously suggested that the direction of twists may fall into this category. While in all three middens, the Deptford and St. Catherines pottery exhibits a similar dominance of moderate twist and three twists per centimeter, there is considerable diversity of direction of twist. For example, in Midden 1 the Deptford pottery is nearly equally divided between right and left twists, although the St. Catherines ware contains only sherds impressed with right-twisted cords. In Midden 2 both the Deptford and St. Catherines pottery exhibits only right-twisted cordage. In Midden 3, 77% of the Deptford and 100% of the St. Catherines cordage

Table 6.
Deptford and St. Catherines Pottery in Middens 1 - 3

	Midden 1	Midden 2	Midden 3
Deptford %	52	54	62
St. Catherines %	48	46	38
Deptford			
Number	42	15	28
Sand Size	C-M	C	C-VC
Sand Shape	SA	SA	SA .
Frequency	M-A	A	S-M
Core	2	4	1-3
Interior Treatment	3-1	3-1	3-1
Exterior Smoothing	H-M	H-M	H-M
Cordage Diameter	2.53	2.62	2.66
Angle of Twist	M	M	M
Twists per Centimeter	3	3	3
R Twists %	36	100	77
L Twists %	45	0	23
Spacing of Cordage	2.52	1.70	3.26
Carbon on Interior %	21	27	21
Carbon on Exterior %	31	0	4
St. Catherines			
Number	39	13	17
Grog Size	4.48	3.75	4.21
Frequency	M	S-M	M
Core	2	4	1-4
Interior Treatment	1-2	3	3-4
Exterior Smoothing	M	M-H	M-H
Cordage Diameter	2.66	1.96	2.16
Angle of Twist	M	M	M
Twists per Centimeter	3	3	3
R Twists %	100	100	100
L Twists %	0	0	0
Spacing of Cordage	2.41	2.43	3.89
Carbon on Interior %	90	62	41
Carbon on Exterior %	8	8	6

Sand size, grog size, cordage diameter, and spacing of cordage are in millimeters. Attribute designations for frequency, core, interior treatment, exterior smoothing, and angle of twist see "Laboratory Methods and Analysis" in **Research Strategy and Methods**.

exhibits a right twist. Similarly idiosyncratic may be the wrapping of cords on the paddles. There was greater variation here than in the diameter of cordage itself. The Deptford cordage spacing varies from 2.52 mm in Midden 1, to 1.70 mm in Midden 2, to 3.26 mm in Midden 3. The St. Catherines cordage spacing varies from 2.41 mm in Midden 1, to 2.43 in Midden 2, to 3.89 mm in Midden 3.

Consequently, while the samples are exceedingly small (as little as three Deptford sherds in Midden 2 and as small as four St. Catherines sherds in Midden 3), there is some evidence that the wares in individual middens are distinct in at least some of the categories most likely affected by the individual potter.

Lithics

Introduction

A total of 27 lithic artifacts were recovered during the investigation of 38CH861. Of those artifacts 12 are lithic debitage or tools, 10 are soapstone fragments, three are fossilized wood fragments, and two are small quartz river pebbles.

This section will briefly describe the lithic debitage and tools, followed by an examination of lithic reduction at the site and its implications for raw material procurement. Finally, the horizontal patterning of lithics will be discussed.

Hafted Bifaces

Of the lithic collection, only one is a hafted biface. This specimen, made of a buff colored Coastal Plain chert, exhibits heavy resharpening and reworking. At some point an ear snapped off and the edge was reworked. There is a small notch in at the conjunction of the haft and ear which appears to have been unintentional. This notching seems to have been caused by a large inclusion or flaw. Because of the heavy resharpening and reworking, the hafted biface could not be classified.

This point has a length of 34 mm, a blade length of 25.35 mm, a blade width of 24.60 mm (projected original width of 32.12 mm), haft width of 12.66 mm, and a thickness of 9.11 mm. These measurements suggest that the specimen was a small Savannah River Stemmed. Oliver (1981:124) describes the small Savannah River Stemmed as a "small to medium-sized broad triangular bladed point with a square to rectangular stem and a straight or incurvate base." These are smaller in size than the Savannah River Stemmed, and the Gypsy Stemmed point is yet smaller. According to Oliver (1981:125) the width of the Small Savannah River Stemmed point may range from 24 mm to 35 mm. with the mean being 30.2 mm. Only one specimen examined by Oliver was complete enough to provide length, and this specimen was 43 mm long. Although this specimen is much shorter (34 mm), this is probably due to the heavy reworking of specimens in areas far away from abundant raw material resources.

Table 7.
Lithic Debitage from 38BU861

Unit	Material	Color	Category	Platform Type	Flake Size
1	CPC	buff	bifacial thinning	single facet	5
10	CPC	gray/white	flake fragment	N/A	6
11	PR	gray	shatter	N/A	5
11	PR	gray	flake fragment	N/A	5
11	BR	gray	flake fragment	N/A	5
11	BR	gray	percussion flake	?	3
17	CPC?	gray/tan	cortex chunk	N/A	10
26	CPC	gray/tan	bifacial thinning	bifacial	6
28	CPC	tan/pink	unspecialized	bifacial	7
29	CPC	tan	secondary	N/A	11

Key: CPC=Coastal Plain Chert, PR=Porphyritic Rhyolite, BR=Banded Rhyolite.

There is relatively little temporal information for the Small Savannah River point in South Carolina, although elsewhere it is typically associated with the early portion of the Late Archaic into the Early Woodland Period (Oliver 1981). The association of small, and increasingly diminutive, stemmed points with Middle Woodland ceramics (see, for example, Trinkley et al. 1993:103-104) may indicate that the point has a considerably longer association.

Other Bifaces

One other biface was recovered during excavations at Old House Creek. This specimen was manufactured from heat treated Coastal Plain chert and appears to have broken near the center during manufacture. No clear attempts were made to rework the item into a new tool.

Lithic Debitage

Raw materials from Old House Creek are primarily Coastal Plain fossiliferous cherts. However, there are four specimens of metavolcanic materials. Probably the most important aspect to consider when examining the raw material associated with a lithic assemblage is the proximity of exploitable raw material sources to the site. Lithic raw materials were often constrained by natural or social limitations. Anderson et al. (1979) have provided a map showing the locations of various lithic sources. This map shows that there is no significant quarry in the region of the site. However, there are isolated outcrops of fossiliferous cherts along the South Carolina coast (Blanton et al. 1985). Clearly, most of the lithic raw material was gathered locally from these isolated outcrops. However, the four specimens of metavolcanic materials (representing 40% of the lithic debitage) came from the fall line area over 100 miles inland. It should be noted that these four metavolcanic specimens were all from the same provenience, which may suggest an isolated possession of the material. Table 7 provides a summary of the debitage analysis.

After dividing the debitage into primary, secondary, and non-cortical examples, the lithic debitage was analyzed using the following categories:

- bifacial thinning flakes are curved and exhibit no cortex. They normally have a single or multiple dorsal ridge with two or more flake scars (Oliver et al. 1986:196);

- pressure flakes are very small with small thin platforms and bulbs of percussion. Many pressure flakes are short and wide with distal ends which are as wide or wider than the midsection of the flake (Oliver et al. 1986:196);

- unspecialized flakes are relatively thick, early stage flakes which are very curved in cross-section. The platforms have no lip and are normally large and simple. The bulb of percussion is pronounced (Blanton et al. 1986:103);

- bipolar flakes are usually difficult to identify. The are recognized by the absence of a bulb of percussion, which is sheared, and by the absence of an actual platform. An impact point is identifiable. They are usually linear and exhibit cortex (Blanton et al. 1986:103);

- flake fragments are non-diagnostic medial and distal portions of flakes (Blanton et al. 1986:103);

- blade flakes are linear flakes with sub-parallel sides and dorsal ridges. They are usually produced from prepared cores (Blanton et al. 1986:104); and

- shatter is angular, blocky debitage with no evidence of platforms or bulbs of percussion (Blanton et al. 1986:104).

Sizing has been found to be useful in understanding reduction and curation of stone tools. As well, examining the stage of reduction of lithic debitage indicates the availability of the materials near the site. Quarrying behavior is likely to produce larger flakes reflecting initial reduction of stone tools, while at the other end of the spectrum, exotic materials are likely to be found as small flakes reflecting the reworking of existing tools. Flakes averaged 20 mm (size 5) with a median size between 5 and 6.[1] Comparing the size of Coastal Plain cherts to metavolcanics indicates that Coastal Plain cherts were easier to obtain, which is logical since they would have had to have ranged into the Fall Line region over 100 miles away to get metavolcanics. The average size of the metavolcanic is 4.5 (or 12.5 mm) and Coastal Plain cherts have an average size of 7.5 (or 35 mm). Although Coastal Plain cherts were locally available, the assemblage indicates that tools were highly curated. The categories of the specimens indicate that the majority of lithic working activities took place off site, probably at the source.

Another analytical method to examine tool curation and manufacture is determining platform preparation. This can provide information about tool use. As stated by Oliver et al. (1983:197), "curated tools used at the site leave debitage as their only evidence of use and resharpening activities." However, curated tools are sometimes discarded in exhausted forms at sties. As a result, the platforms may show evidence of polishing, grinding, or damage. Unfortunately, the platform edge is often difficult to examine because of weathering, different lithic materials, etc. The categories provided below are a combination of morphological and technological attributes:

- cortical platforms are covered with cortex and indicate that it was an initial flake. As a result, these platforms provide insights into procurement and production of flaked stone tool manufacture (Oliver et al. 1986:197);

- single facet platforms have one flat surface which is the portion of the core of biface that was struck to form the flake (Oliver et al. 1986:197);

- bifacial platforms have a number of previous flake scars on both faces of the platform. They

[1] Sizes were measured in 5mm increments ranging from 3 (10mm) to 11 (50mm) in size.

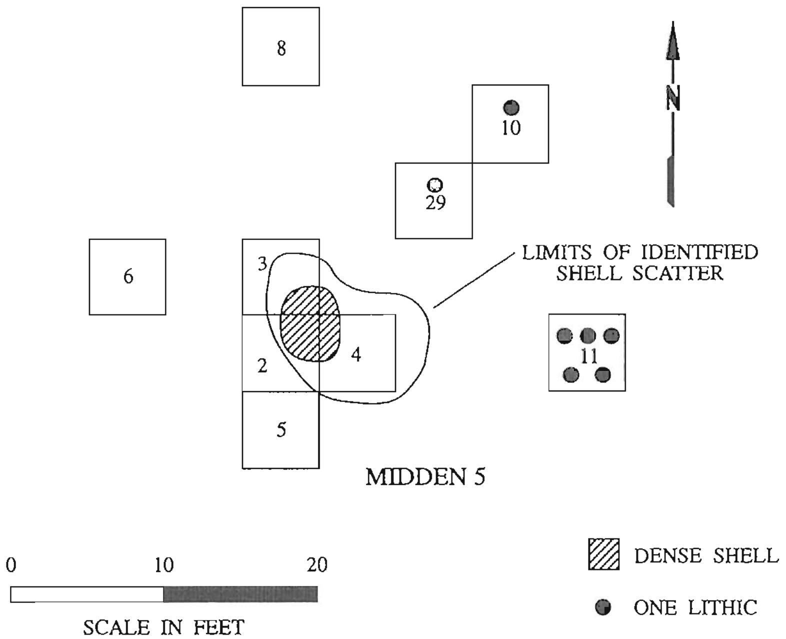

Figure 34. Spatial distribution of lithics around Midden 6 at Old House Creek.

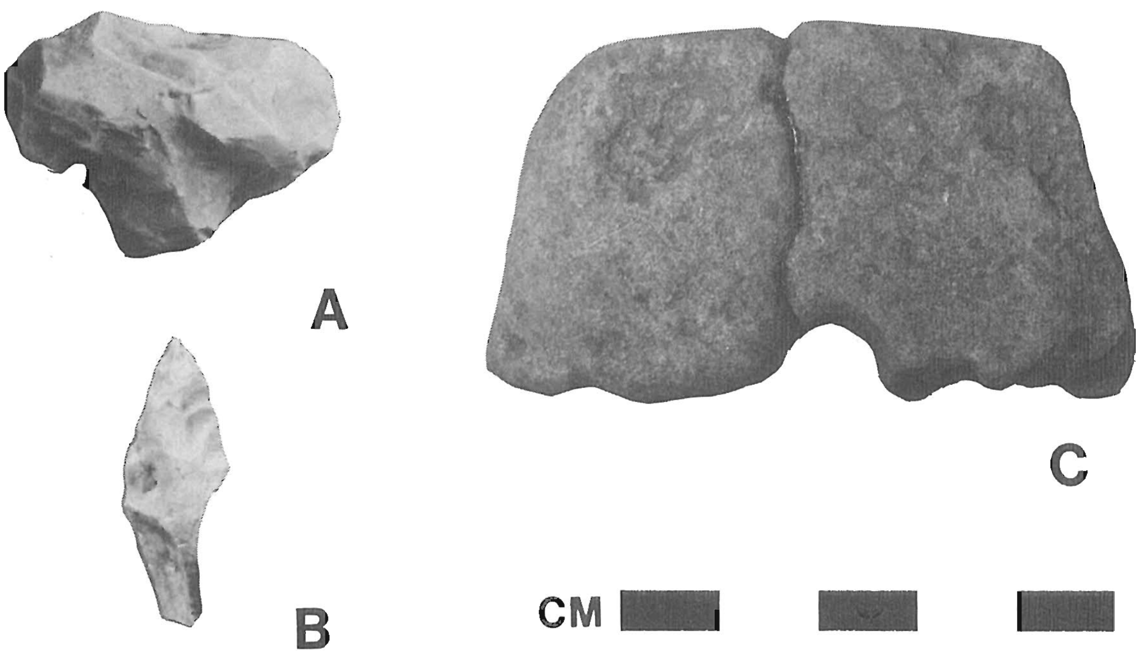

Figure 35. Examples of lithics recovered from Old House Creek. A, basal fragment of Small Savannah River Stemmed projectile point; B, chert biface; C, perforated soapstone slab.

are indicative of bifacial edge (from a biface). It should be noted that some cores can be facially reduced producing the same effect. However, by examining the platform angle one can discriminate between the two. Examination of the dorsal surface and flake cross section can aid in determining from which type of core flakes were removed (Oliver et al. 1986:197);

▪ crushed or collapsed platforms usually have only a small remnant platform, if any platform is left. This results when a problem with the percussor develops and most of the platform is destroyed (Oliver et al. 1986:199);

▪ triangular platforms have more than one facet with the dominant feature being a triangular ridge. This occurs when the knapper uses a dorsal ridge as a guide for the force from the percussor (which is usually what occurs with complete bifacial reduction) (Callahan 1979:53);

▪ alternate platforms occur when one flake is struck from one face and the blank is turned over and another flake is struck from the second face using the previous flake scar as a platform (Oliver et al. 1986:199);

▪ concave platforms are crescent shaped and occur when the knapper attempts to strike a second flake from a single platform. Many times these flakes are not removed because the platforms collapse (Oliver et al. 1986:199); and

▪ prepared platforms exhibit some form of preparation that was not readily distinguished (Oliver et al. 1986:199).

Only three specimens could be examined for platform type.[2] They included one single platform and two bifacial platforms. It is most likely that all three flake were struck from a biface given the classification of the flake types. This conclusion corresponds with the belief that primary reduction activities took place off site at the source of material.

Soapstone

Ten fragments of a perforated soapstone slab were recovered in one five foot unit located in Area 3. Two of the larger fragments were mendable and provided half of the slab. At its widest points, the slab measures 65.45 mm by approximately 68 mm and forms a hexagonal shape. The slab is 12.07 mm thick and the central hole has a diameter of 8.78 mm.

Soapstone is rarely found in Coastal Plain context because quarries are located too far away for it to have been easily procured. The Spartanburg area is most notable for its abundant quarries, and York and Edgefield counties are also known to have had quarries although the quarrying sites have not been documented (Sassaman and Anderson 1994:113). The occurrence of soapstone as well as the metavolcanic lithic materials at Old House Creek clearly indicates that either the site occupants were involved in trading or had actually visited these areas.[3]

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[2] Although the discussed platform typology may seem extraneous since only two platform types were identified in the collection, the description of types not present can point out what kinds of tools use likely did *not* occur at the site. Although we are well aware of the danger of using negative evidence, certainly this avenue is worthy of at least some consideration.

[3] While soapstone slabs are often found in Thom's Creek contexts (see, for example, Sassaman 1993) and, alternatively, are rarely associated with Middle Woodland assemblages, only 2.5% of the Old House Creek collection consists of Late Archaic/Early Woodland ceramics. Consequently, although we cannot rule out deposition of the slab during the Late Archaic/Early Woodland, curated use or even acquisition during the Middle Woodland seems probable.

Horizontal Patterning of Lithics

Because of the sparsity of lithic remains at Old House Creek, only a few statements can be made about horizontal patterning at the site. As previously discussed, the middens consisted of several relatively small middens (Middens 3, 4, 6, 7, and 9) and three much larger middens (Middens 1, 2, and 8). In the larger middens, no clear patterning in lithic location was visible. In the smaller middens, lithics occur more often in non-midden contexts. In fact, at Area 5 there is clearly a lithic working station located about 10 feet to the east of several shell pits and an adjacent structure and about 30 to 40 feet away from a small midden (Midden 6; see Figure 34). Although the sample size is very small, this may suggest that lithic working stations are located in non-midden areas. The presence of lithic debitage in the larger middens may be the result of site reoccupation.

Conclusions

The lithic artifacts from 38BU861 consisted of a sparse assemblage of locally available Coastal Plain cherts as well as metavolcanic materials and soapstone that would require travelling over 100 miles to procure. Alternatively, they may have traded with other groups whose seasonal rounds overlapped with theirs as well as with areas where these materials could be obtained.

The size and type of flakes at Old House indicates that no major lithic reduction took place on site. The presence of a relatively large (size 11 or 50mm) Coastal Plain Chert secondary flake does indicate that chert outcrops may have been located within a short travel. The one hafted projectile point had been heavily resharpened and, after breaking, was reworked into another bifacial tool. Clearly, lithic material was limited requiring the site occupants to make the most of what they had on hand.

Based on limited information, lithic work areas appear to occur in non-midden areas. When lithics occur in midden contexts, they were normally found in the larger middens which may be the result of site reoccupation.

Other Tools

Absent from the collection are a broad range of tools, such as worked whelks (see Espenshade et al. 1994: 116, 199 for a discussion), bone awls, and sherd abraders (see Thomas and Larsen 1979:44-46 for a detailed discussion of this tool type). The one additional artifact class found was a single sherd hone, exhibiting a single groove, likely associated with the shaping of a bone awl or pin. The groove measures about 9 mm in width, 4 mm in depth, and 50 mm in length. The hone was made on the exterior of a Deptford Cord Marked sherd measuring about 110 mm by 85 mm.

X-RAY FLUORESCENCE STUDY OF A ST. CATHERINE'S POTTERY SAMPLE

Introduction

X-ray fluorescence analysis was performed on a sample of the St. Catherine's pottery from 38BU861 with one primary goal in mind — to determine if the method was worth using in future studies of pottery associated with shell middens. In this particular example the analysis was oriented toward determining whether the paste and the temper consisted of the same or different clays by providing information on the chemical composition of the two components.

In X-ray fluorescence analysis, a pottery specimen is irradiated with primary X-rays from an X-ray tube or from radioactive sources. The X-rays displace electrons from the inner orbits of the constituent atoms, and these energy levels are filled by electrons from the outer levels. The energy released in this process is emitted as secondary or fluorescent X-rays with wavelengths ranging from 0.1 to 50Å. The secondary X rays are analyzed either through diffraction by a crystal, after passing through a collimator, or with a semiconductor detector and multichannel analyzer. The result in either case is graph showing the intensity of the X-rays (i.e., peaks) as a function of energy or wavelength. Each individual element has a series of wavelengths at which it emits secondary X-rays and hence has multiple peaks in its spectrum. The constituent elements of an unknown compound are thus identified by their wavelengths, while quantitative determinations are based on the X-ray intensities, using a series of calibrations or corrections (Rice 1987:394).

Procedure

The sherd selected for study was manually "disassembled" with the pieces of temper being removed from the paste. Four samples of paste were taken from different portions of the sherd and four samples of individual pieces of temper were examined. According to Mr. Randy Culp, the research consultant at the Center for Applied Isotope Studies at the University of Georgia, they needed at least 4 g of material for each sample. This was possible for the paste samples, but not for the temper samples since the largest temper fragment weighed only 0.33 g. As a result, we provided them with the four largest temper pieces as well as all the remaining temper. All samples were ground with an agate mortar and pestle to a fine powder.

The four paste samples were pressed into powder pellets for examination. Since the samples of the temper were so small, it was decided that they would be individually examined by placing the powder on mylar film. After this was done, the four temper samples were combined along with the remaining temper and pressed into one powder pellet, providing a composite analysis.

These five pellets (four paste and one temper) were analyzed along with a standard reference material (NBS2704) for 10 elements. These elements consisted of magnesium (Mg), aluminum (Al), silicon (Si), phosphorus (P), potassium (K), calcium (Ca), titanium (Ti), chromium (Cr), manganese (Mn), and iron (Fe). According to Rice (1987:390), major elements are those present in amounts of 2% or more. Minor constituents are present in amounts between 0.1% and 2%. Trace elements are present in very small quantities of less than 0.1% and are usually measured in parts per million (ppm) or parts per billion (ppb). In this study, major elements in the samples included Al, Si, Ca, and Fe. Minor elements were Mg, P, K, and Ti, while trace elements included Cr and Mn. Rice (1987:390) states that since the kinds and amounts of trace elements are so uniquely characteristic of individual clays and clay products, they, along with the minor elements, have formed the basis for

	Table 8. Temper Samples on Mylar Film			
	Sample 1	Sample 2	Sample 3	Sample 4
% Al	9.21	1.16	0.59	8.03
% Si	23.99	24.02	21.40	20.99
% P	0.16	0.15	0.17	0.17
% K	1.21	1.39	1.00	1.06
% Ca	2.90	3.56	5.48	3.12
% Ti	0.44	0.59	0.47	0.54
ppm Cr	112.62	31.13	56.61	111.94
ppm Mn	131.25	130.43	62.87	183.05
% Fe	2.30	2.80	2.59	2.56

most provenience analyses of pottery.

Data Analysis

The results of the temper samples on mylar film varied greatly between samples (Table 8). This wide variation was not expected since we entered into the problem with the preconceived notion that the temper would have been gathered from the same source. According to Culp (personal communication 1995), the use of mylar films can be problematic since they often provide inaccurate readings resulting from the dispersion of the powder across the film, whereas powder pellets are more concentrated and more accurately reveal percentage of weight. Given this potential problem, the mylar film samples were not further interpreted.[1]

The results of the powder pellet analysis is provided in Table 9. Although clearly the samplesize is small and the temper fragments were combined, bivariate plot charts using log transforms of the elements in parts per million (ppm) values revealed that the temper sample is different from the paste samples (Figures 36, 37, and 38).

The results were treated as lognormal distribution rather than a normal distribution because past studies (see Glascock 1992:16) have shown that the data are more normally distributed when treated as logarithms of the measured concentrations. Another reason is that transformation of concentration data into logarithms compensates for the differences in the magnitudes between the major elements and the trace elements.

Table 9.
Pellet Analysis

	Temper		Paste 1		Paste 2		Paste 3		Paste 4	
Element	%	$\log^{10}$	%	$\log^{10}$	%	$\log^{10}$	%	$\log^{10}$	%	$\log^{10}$
% Mg	0.29	3.46	0.21	3.32	0.25	3.40	0.20	3.30	0.32	3.50
% Al	6.36	4.80	5.79	4.76	5.72	4.76	5.63	4.75	6.03	4.78
% Si	19.45	5.29	16.88	5.23	17.17	5.23	16.86	5.23	17.63	5.25
% P	0.18	3.25	0.14	3.15	0.19	3.28	0.17	3.23	0.22	3.34
% K	1.34	4.13	1.01	4.00	0.98	3.99	0.95	3.98	1.02	4.01
% Ca	2.45	4.39	1.59	4.20	1.61	4.21	1.61	4.21	1.67	4.22
% Ti	0.58	3.76	0.59	3.77	0.59	3.77	0.57	3.75	0.55	3.74
% Cr	0.0085	1.93	0.0065	1.81	0.0084	1.92	0.0082	1.91	0.0079	1.90
% Mn	0.0169	2.23	0.0140	2.15	0.0155	2.19	0.0204	2.31	0.0124	2.09
% Fe	3.22	4.51	2.70	3.43	2.59	4.41	2.60	4.41	2.61	4.42

Elements which were found to be good discriminators in this case were K, Ca, and Fe. In addition, a bivariate plot of the two major

[1] The conclusion from this is that while combining the temper may yield an averaged result, this is likely to cause less error than the use of mylar films, *for the purposes outlined.*

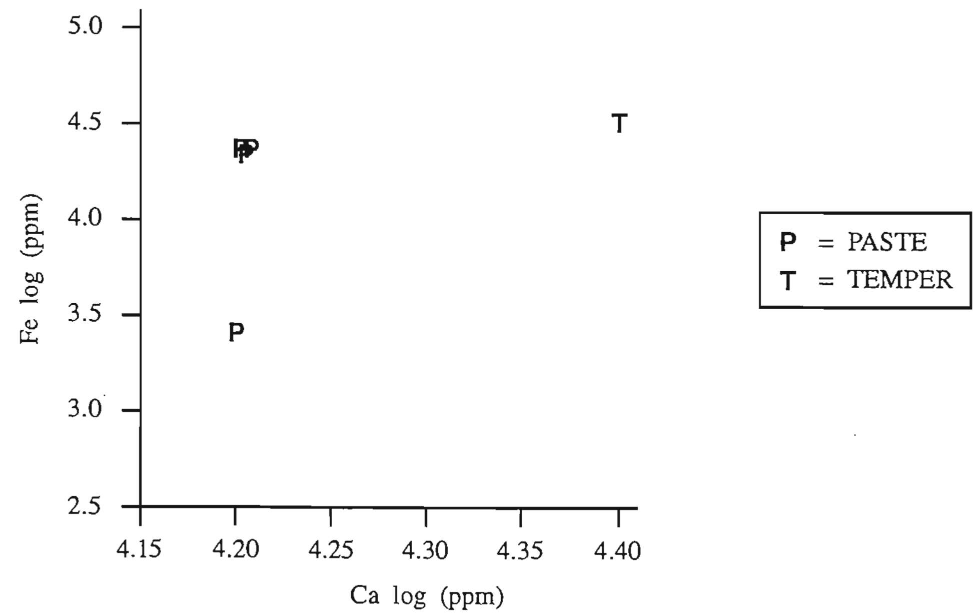

Figure 36. Plot of iron and calcium in ppm and log[10] ppm values.

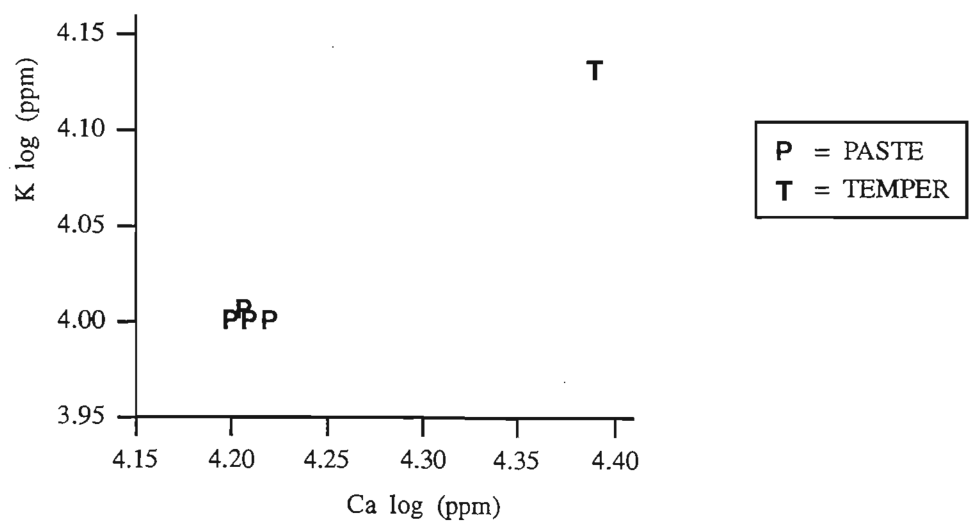

Figure 37. Plot of potassium and calcium in ppm and log[10] ppm values.

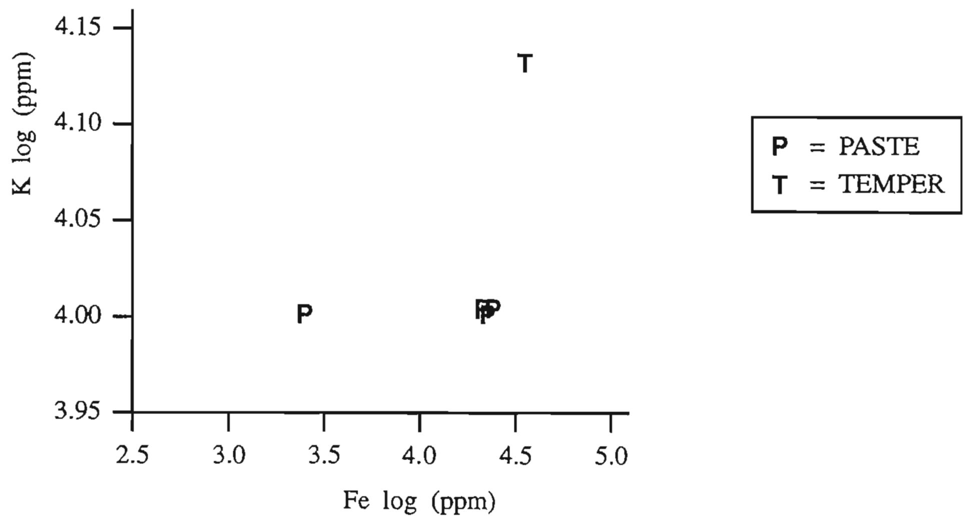

Figure 38. Plot of potassium and iron in ppm and $\log^{10}$ ppm values.

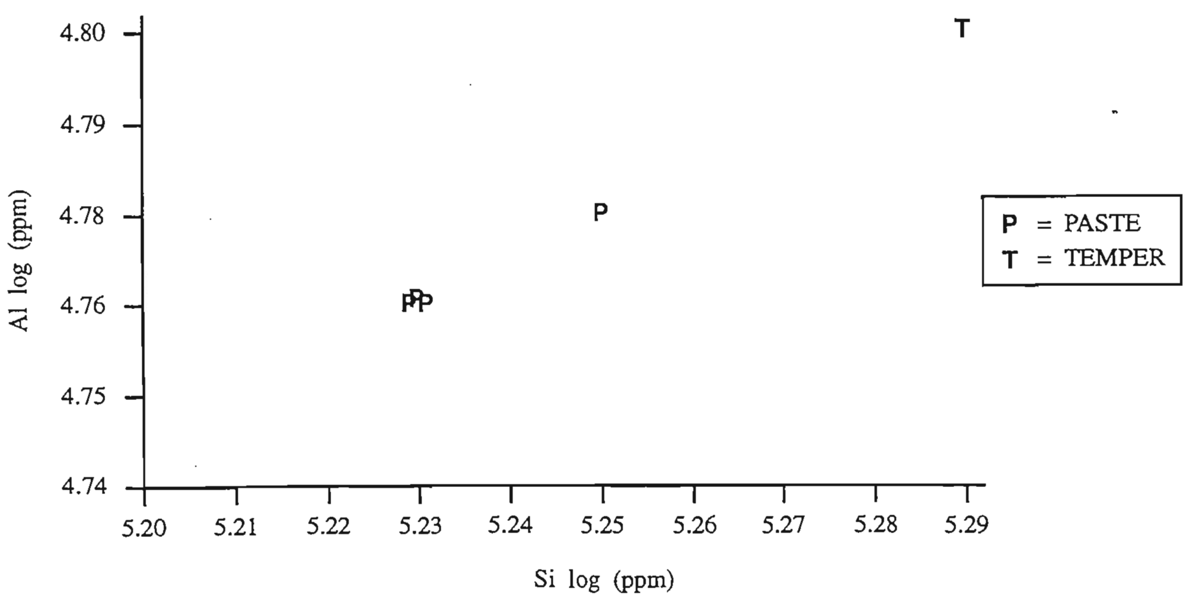

Figure 39. Plot of aluminum and silica in ppm and $\log^{10}$ ppm values.

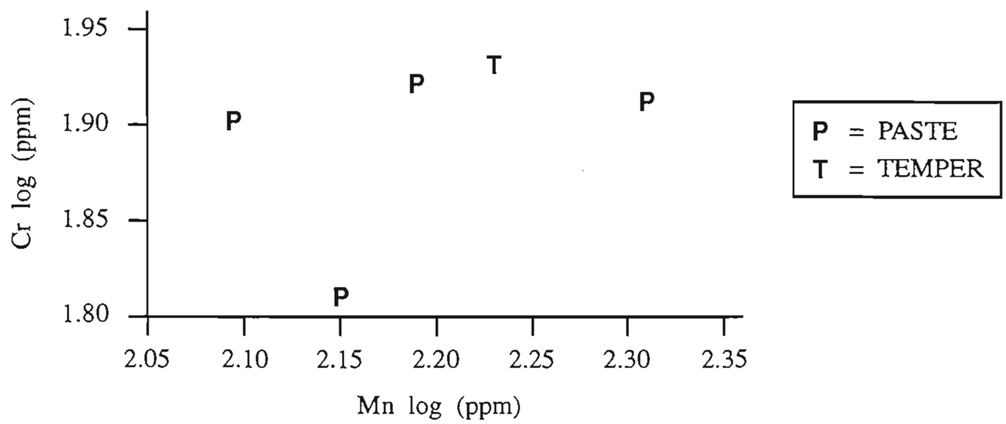

Figure 40. Plot of chromium and manganese in ppm and log10 ppm values.

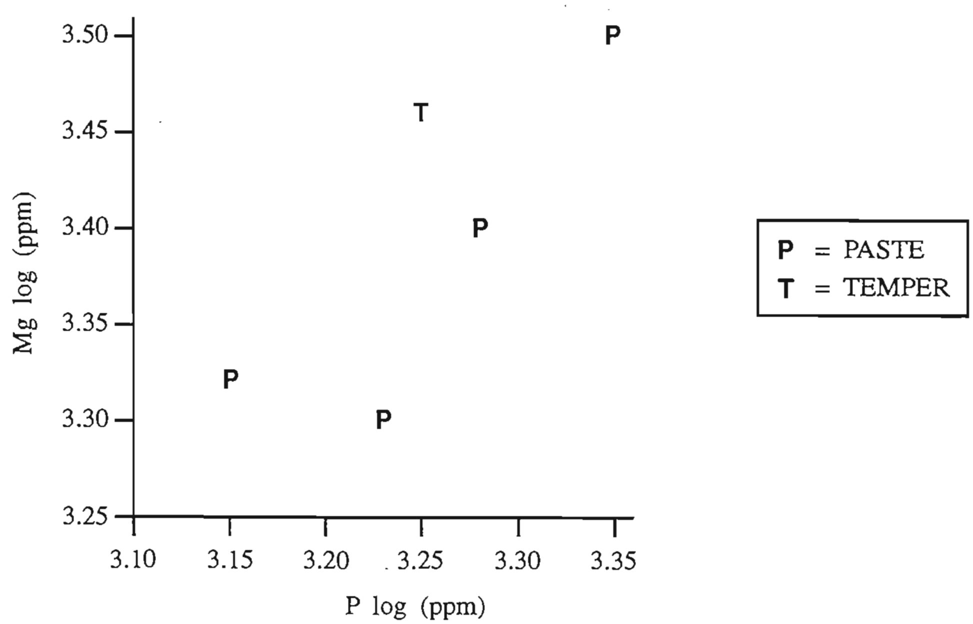

Figure 41. Plot of potassium and magnesium in ppm and log10 ppm values.

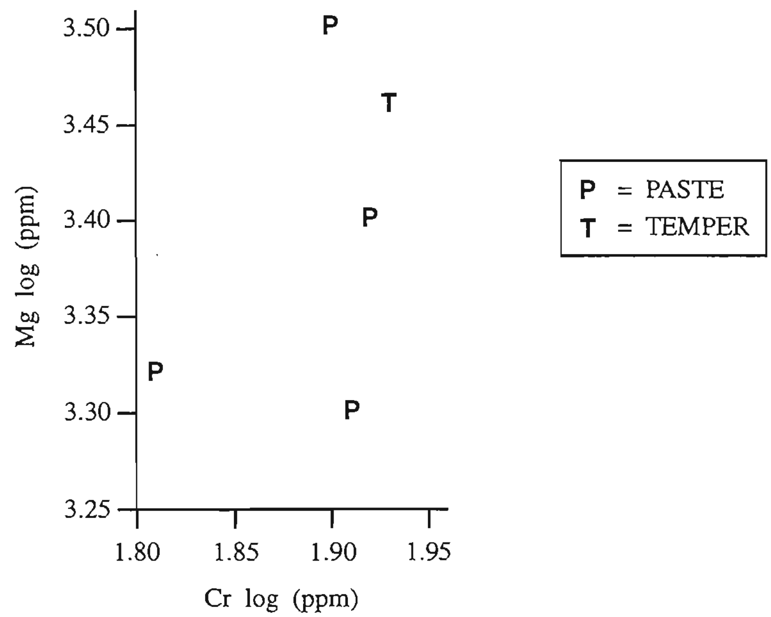

Figure 42. Plot of chromium and magnesium in ppm and $\log^{10}$ ppm values.

constituents (Al and Si) revealed differences (Figure 39). While the differences may be fortuitous, the presence of at least three good discriminators out of 10 elements strongly suggests significant differences in the two pottery components. Several other bivariate plots are presented (Figures 40, 41, and 42) showing that there are not other types of clustering. In every example of clustering, the temper always stands alone.

If we assume that the temper and paste were fired together as raw clay, and therefore, at the same temperature, it can be assumed that significant differences in the elemental make-up mean they are from different clay sources. Unfortunately, without knowing the clay sources and elemental reactions to firing temperatures for that specific clay it may be difficult to move beyond this level of interpretation in this study. Since firing temperature was probably quite variable from vessel to vessel, pots from the same site made from the same clay may produce different elemental profiles. A case study of elemental concentrations using ICP Mass Spectrometry of an acid solution for raw clay and for clay fired at 400°C, 600°C, and 800°C for Clay 51, Wilson Creek clay near Vosberg Mesa (Burton and Simon 1993:50) show relatively little variation in $\log^{10}$ values. For instance, aluminum varied from 4.20 to 4.51, iron from 4.51 to 4.53, and magnesium from 3.9 to 4.1. The only element that varied greatly was titanium which ranged from 2.4 to 3.4. As will be discussed later, the acid digestion method is more sensitive to firing temperatures. The key may be that one needs to look for "robust solutions" or very strong difference between pottery components or types.

Conclusion

The conclusion drawn from this study is that there appears to be significant differences between the temper and the paste of the one St. Catherine's pottery sherd. Three elements (K, Ca and Fe) were shown to be good discriminators between the two pottery components. As discussed previously, it is unknown how strongly differing firing temperatures will affect elemental abundance. A case study of Wilson Creek clay, as well as other case studies, provided in Burton and Simon (1993:50) suggests that the range of elemental concentrations is not very wide. As a result, if consistently there are relatively great differences of an element between two potteries or pottery components, it is likely that it is because they were manufactured from different clays.

It is possible that a different sampling method and a larger sample size will provide better information on the usefulness of X-ray fluorescence for archaeological pottery. However, this takes money that is often not available. While not outrageously expensive, each sample in the current study cost $75. To provide a statistically sound data base, particularly at the intra-site level, a large sample is needed. The use of ICP Mass Spectrometry is much less expensive and may prove to be useful in differentiating between pastes. However, it should be remembered that while X-ray fluorescence provides data on the paste and its mineralogical components, ICP Mass Spectrometry using acid digestion looks only at the paste with very little contribution of the mineralogical components. The drawback is that acid digestion is more sensitive to technological parameters such as firing temperature, and probably to postdepositional alteration, than are methods such as X-ray fluorescence that measure total elemental abundances (Burton and Simon 1993:46).

FAUNAL ANALYSIS

Michael Trinkley
and
Jack H. Wilson, Jr.

Introduction

The vertebrate faunal collection from the Old House Creek site was analyzed for this study. The faunal collection consists of 95 bone elements and fragments that weight 205.52 gms. Material was recovered by dry-screening unit soil through ¼-inch mesh or water-screening feature soil through ⅛-inch mesh screen.

This section of the Old House Creek study provides a description of the animal species represented in the faunal collection, the results of the zooarchaeological analysis of the remains, and a comparison of the data obtained from the site with that for other sites along the coast of the Carolina Province.

Analytical Techniques

The faunal collection from Old House Creek was studied by the authors using standard zooarchaeological procedures and the Chicora Foundation comparative faunal collection. The bone material was sorted to class, suborder or species, and individual bone elements were identified. The bones of all taxa and other analytical categories were also weighed and counted. The Minimum Number of Individuals (MNI) for each animal category was computed using paired bone elements and age (mature/immature) as criteria. A minimum distinction method (Grayson 1973:438) was used to determine the MNI for each of the four specific midden areas yielding vertebrate faunal remains. This method provides a conservative MNI estimate based on the total faunal assemblage from each cultural/spatial component present in the study.

As a measure of zooarchaeological quantification, MNI has a number of problems (Grayson 1973:438; 1984:28-92; Klein and Cruz-Uribe 1984:26-32). How one aggregates the MNI will affect the number of individuals calculated. If MNI is calculated based on the entire site, the number will be smaller than if it is calculated for each excavation unit and totaled for the site. Use of MNI emphasizes small species over large ones. For example, a collection may have only a few large mammals, such as deer, and scores of fish. Yet, the amount of meat contributed by one deer may be many times greater than that contributed by a score or two of fish.

Given the problems associated with MNI as a zooarchaeological measure, an estimate of biomass contributed by each taxon to the total available for use by the inhabitants of the site is also calculated. The method used here to determine biomass is based on allometry, or the biological relationship between soft tissue and bone mass. Biomass is determined using the least-squares analysis of logarithmic data in which bone weight is used to predict the amount of soft tissue that might have been supported by the bone (Casteel 1978; Reitz 1982, 1985; Reitz and Cordier 1983; Reitz and Scarry 1985; Reitz et al. 1987; Wing and Brown 1979). The relationship between body weight and skeletal weight is expressed by the allometric equation $Y = aX^b$, which can also be written as $\log Y = \log a + b(\log X)$ (Simpson et al. 1960:397). In this equation, Y is the biomass in kilograms, X is the bone weight in kilograms, a, is the Y-intercept for a log-log plot using the method of least-squares regression and the best fit line, and b is the constant of allometry, or the slope of the line defined by the least-squares regression and the best fit line. Table 10 details the constants for a and b used to solve the allometric formula for a given bone weight X for each taxon identified in the archaeological record. In using allometric calculations to predict proportional biomass from bone weight it is important to note that the weight of bone used in the calculation obviously influences the results. There a number of factors, such as differential preservation or discard practices, that may affect the weight of the bone recovered from an archaeological site. Thus, this technique of analysis may not give the precise results that the final numbers would appear to indicate.

In order to investigate questions concerning the variety and degree of specialization exhibited by the vertebrate faunal assemblages, measures of diversity and equitability are often calculated for both MNI and biomass based on the identified species present. Typically, however, a minimum count of 500 bone elements is required. In this case, even combining all of the units yields less than 100 bone elements. While diversity and equitability are discussed, they must be very cautiously interpreted with such a small sample size. The diversity of a sample indicates the variety that is present and gives some indication of the richness of the sample. The equitability measures evenness and richness of the sample. Diversity is measured here using the Shannon-Weaver formula and the equitability is measured using the Sheldon formula.

Table 10.
List of Allometric Values Utilized in this Study to Determine Biomass in Kilograms (kg) Based on Bone Weight Expressed in Kilograms.

Faunal Category	log a	b	r^2
Mammal	1.12	0.90	0.94
Perciformes (sea bass, bluefish)	0.93	0.83	0.76
Callinectes (crab)	0.99	0.82	0.58

Derived from Table 4 in Reitz (1985:44) and Table 2.3 in Quitmyer (1985b:440).

The Shannon-Weaver (1949:49) formula used to determine the diversity of a sample is:

$$H = - \sum p_i(\ln p_i)$$

where H is the measure of diversity, and p_i is, in this case the biomass of each species/taxon "i" divided by the total biomass as appropriate for the sample. Thus, for each identified species/taxon that has a biomass calculation, p_i is calculated by dividing the biomass for that species by the total biomass from the sample. The diversity measure H is the sum of all the p_i multiplied by the natural log (ln) of each p_i. Diversity measured by the Shannon-Weaver formula has a scale that runs from 0 to 4.99, with 4.99 indicating high diversity and 0 indicating no diversity.

The Sheldon formula (Pielou 1966; Sheldon 1969) used to determine the equitability of a sample is:

$$H' = H/(\ln N)$$

where H' is the measure of equitability, H is the Shannon-Weaver diversity measure calculated for the sample, and N is the total number of cases, observations, or, in this situation, species/taxon for which biomass was calculated in the sample. Equitability is simply the diversity measure divided by the natural log (ln) of N, the number of species/taxon for which biomass calculations was made. Equitability is measured on a scale that goes from 0 to 1.0. A low equitability value near 0 indicates that one taxa is considerably more abundant than all other taxa. A value near 1 on the scale indicates an even distribution of taxa. A value in the vicinity of the midrange of the scale, 0.5, indicates a more normal distribution of taxa. A normal distribution in this case indicates that there are a few abundant taxa, a moderate number of common taxa, and many rare taxa.

Identified Fauna

Before considering the results of the zooarchaeological study of the faunal remains recovered from site, the general use and habitat preference for each identified species will be considered. Table 11 lists the various animal species identified in the archaeological collections recovered from the excavations within the identified shell middens and features.

Wild Mammals

The most numerous of the wild mammals is the white-tailed deer (*Odocoileus virginianus*). A variety of uses exist for the different parts of this animal, so that almost all of a deer was utilized in some manner prehistorically by the Indians (Runquist 1979:169; Swanton 1946:249). Deer metatarsals were used as beamers and split to make needles; ulnae were used as awls; and antlers were made into flakers, projectile points and fish hooks (Swanton 1946:249; see also Trinkley 1980). Rattles, flutes, bracelets, and beads were also made from deer bone (Swanton 1946:249). Sinew and entrails were manufactured into bow strings, rawhide, throngs, and "thread" (Swanton 1946:249). Deer brains were combined with green corn to tan leather (Lawson 1967:217). The skins, hooves, and antlers were rendered into glue. Heads, skins, and antlers were used as decoys in hunting and as status/clan indicators. Hides were sewn into clothing, and used as coverings for houses/doors (Swanton 1946:249). In general, the deer's preferred habitat is the edge of deciduous forests and open forests, although they will move to mudflats around marshes to feed on the grasses found there.

Male deer tend to grow antlers beginning in May, with full development of hardened antler occurring in September. Antlers are usually dropped between the middle of January and the beginning of February. Females and their young form small family groups from the spring through the summer. These small family groups tend to become larger during the rutting season in September, October and November, with mature males moving amongst the females of small deer bands. Once the males have dropped their antler they stay with the small bands of females and

Table 11.
Minimum Number of Individuals (MNI), Number of Bones, Weight, and Estimated Meat Yield by Species for the various middens at Old House Creek.

Species by Midden	MNI #	MNI %	Number of Bones	Weight gms	Biomass kg	Biomass %
Midden 1						
White-tailed Deer, *Odocoileus virginianus*	1	33.3	11	47.72	0.850	91.3
Raccoon, *Procyon lotor*	1	33.3	1	1.27	0.030	3.2
Unidentified Mammal	-	-	10	2.18	0.050	5.4
Silver perch, *Bairdiella chrysura*	1	33.3	1	0.02	0.001	0.1
Midden 2						
White-tailed Deer, *Odocoileus virginianus*	1	50.0	1	12.70	0.260	99.8
Silver perch, *Bairdiella chrysura*	1	50.0	1	0.01	0.001	0.2
Midden 3						
White-tailed Deer, *Odocoileus virginianus*	1	33.3	14	71.69	1.230	71.5
Raccoon, *Procyon lotor*	2	66.7	13	18.31	0.360	20.9
Unidentified Mammal	-	-	16	5.95	0.130	7.6
Midden 5						
White-tailed Deer, *Odocoileus virginianus*	1	50.0	22	40.16	0.730	84.9
Raccoon, *Procyon lotor*	1	50.0	1	2.16	0.050	5.8
Unidentified Mammal	-	-	4	3.35	0.080	9.3
TOTAL	8	-	95	205.52	3.772	-

young deer through the winter months. Just prior to the spring fawning period these bands break-up into small family units, with the males departing and becoming part of all-male groups, which are usually small in number (Smith 1975:18-19).

Raccoon (*Procyon lotor*) bones are present in small numbers in the prehistoric collections. Raccoons served as a food resource for the Indians, the furry skin was used for clothing, and claws were utilized as ornaments (Swanton 1946:250). This mammal is able to adapt to a variety of habitats, although they prefer wooded areas near water.

Pisces

Remains of fish appear to be only an incidental part of the prehistoric Deptford-St. Catherines faunal assemblage analyzed for this study. The single species present is the silver perch (*Bairdiella chrysura*), also known as the yellowtail or sand perch. This species is found in salt and brackish waters on mud, sandy, shell, and mixed bottoms in sea grass. Adults migrate offshore during the winter, but young fish remain inshore year-round. The best fishing period is September and October. The silver perch typically ranges in size from ¼- to ⅓-pound (Freeman and Walford 1976).

Analysis and Interpretation of the Faunal Remains

The prehistoric vertebrate faunal remains analyzed for this study total 95 bone elements and fragments that weigh 205.52 grams. Table 11 summarizes the MNI and biomass calculations by faunal category for each of the four middens. Only three identified species are present: deer, raccoon, and silver perch. Deer and raccoon each account for four MNI, while two MNI were identified of the silver perch. When biomass is considered, however, the deer contributed a total of 3.07 kg of meat, compared to 0.44 kg contributed by the raccoons, or the 0.002 kg contributed by silver perch. Combined, wild animals account for 80% of the MNI and 99.9% of the biomass -- illustrating that fish were a very inconsequential food source at Old House Creek.

It is intuitively obvious that the site exhibits very low diversity. The only two wild animals present are deer and raccoon. No opossum, rabbit, fox, or squirrel were recovered, although all would have been relatively abundant in the project area. No wild birds were present in collection, in spite of the prevalence of turkey in the oak uplands and migratory waterfowl such as duck in the marshes. Turtles, an almost ubiquitous species at other prehistoric sites, are totally absent at Old House Creek. Fish, extraordinarily common in the nearby creeks and impoundments, are nearly absent. Even commensal species, commonly found nearly human occupations, are absent from these collections.

Diversity and equitability indices were calculated for the biomass totals of the three species/taxa present at the site (Table 11). It is again appropriate to remind the reader that the sample sizes are very small. It is highly likely that they are, in fact, so small that the diversity and equitability results are statistically unreliable. Nevertheless, they are offered as *suggestive*. The diversity measure for biomass (0.16) is very low (on a scale that goes from 0 to 4.9), while the equability measure is moderately low (0.33 on a scale that goes from low, 0, to high, 1). For MNI, the diversity figure (0.45) is still at the very low end of the scale, although the equitability (0.94) is high, that is above 0.50. These figures, especially the diversity indicae for biomass, are interpreted to mean that a small number of species/taxa supply the bulk of the food that could have been obtained from animal resources. Deer is the primary and by far the most important meat resource of the wild mammal group that dominates the collection. The other species/taxa and faunal categories pale in comparison. Still, the high equitability for MNI indicates that a number of faunal species/taxa were being exploited from all three of the major habitats (maritime forest, marshland, and estuaries). Although deer is obviously the most important meat resource for the inhabitants of the site, other wild animals were also used for food.

Comparison of the Old House Creek Faunal Assemblage with other Faunal Collections

The faunal assemblage from Old House Creek represents a relatively small, although carefully examined collection. Extreme care must be used in interpreting this collection, much less

Table 12.
Comparison of the Faunal Category Patterns from Selected Prehistoric Sites
by MNI and Biomass Percentages.

	38BU861		38BU805[1]		38CH124[2]		38BU1214[3]		38BU464[3]		9CAM171[4]		38BU2[5]	
Faunal Category	MNI	Biomass	MNI	Biomass	MNI	Biomass	MNI	Biomass	MNI	Biomass	MNI	Biomass	MNI	Biomass
Wild Mammals	80.0	99.9	29.4	66.5	32.8	94.1	50.0	62.9	19.4	49.7	1.9	33.6	27.0	80.5
Wild Birds	0.0	0.0	17.7	4.5	10.3	1.9	0.0	5.8	4.2	3.0	0.8	0.2	4.0	0.3
Reptiles	0.0	0.0	17.7	14.9	15.5	2.0	25.0	9.7	5.6	6.8	3.8	8.9	16.0	5.0
Fish	20.0	0.1	17.7	13.2	32.8	1.9	25.0	21.5	61.1	37.9	88.7	56.3	53.0	14.2
Commensals	0.0	0.0	17.7	0.9	8.6	0.1	0.0	0.0	9.7	2.5	4.7	0.8	0.0	0.0
Total Percent	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Total MNI	10		17		58		12		72		257		55	
Total Biomass	3.51 kg		2.89 kg		103.18 kg		2.79 kg		7.56 kg		6.27 kg		16.24 kg	

[1] Wilson and Wilson 1986:Table 31 (Stallings Island Component).
[2] Wilson 1993:Table 26.
[3] Wilson 1991 (38BU1214-Deptford Component; 38BU464-Savannah Component).
[4] Smith et al. 1983:Table 3 (Savannah Component).
[5] Espenshade et al. 1994:Table 31 (Deptford Component).

making comparisons to other (often equally small) assemblages. Regardless, there are several other sites in the coastal areas of the Atlantic seaboard in South Carolina and Georgia possessing prehistoric period faunal remains with which Old House Creek can be compared (Table 12). These include much earlier Stallings and Thom's Creek sites (38BU805 and 38CH124) on Hilton Head Island, and Kiawah Island, S.C. (Wilson and Wilson 1986; Wilson 1993); a slightly earlier Deptford site (38BU1214) from Spring Island, S.C. (Wilson 1991); a Deptford site (38BU2) from Spring Island, S.C. (Espenshade et al. 1994); and two collections that date only slightly later, a Savannah faunal assemblages from 38BU464 on Callawassie Island, S.C. (Wilson 1991) and a shell midden site (9CAM171) in King's Bay, Georgia (Smith et al. 1981 in Reitz and Cordier 1983).

Comparing the biomass profile for the faunal collection from Old House Creek (38BU861) with the selected sites, it obviously differs greatly from the others. The wild mammal biomass percentage at Old House Creek exceeds that for mammals in all of the other collections -- only the Thom's Creek assemblage at 38CH124 comes close to the dominance of wild mammals found at this site. Fish, while found at all of the sites, provide the least biomass contribution at Old House Creek. The site also lacks any species of wild birds, reptiles, or commensals -- consistently found at the other sampled sites. While it is possible that differences in season, activities scheduling, and environment available for exploitation contributes to these differences, the diversity and equitability information also suggests that the differences may be attributable to intentional selection of a very focused subsistence quest.

Summary

The Old House Creek collection possesses 10 identified individuals and 95 identifiable bone elements or fragments. This is not more than the threshold minimum of 200 MNI or 1400 bone elements required to document that a representative sample is being studied (see Grayson 1979; Wing and Brown 1979). Consequently, this information (especially as it related to diversity and equitability) should be very carefully interpreted.

While the presence of deer antler and pedicals in the faunal collection typically reflects a fall/early winter habitation, their absence (as in the case of Old House Creek) cannot be taken as meaning the opposite is true. The presence of silver perch is only very weakly suggestive of a fall occupation, since the smaller fish can be found in the coastal waters year-round. In sum, the Old House Creek collection fails to provide any convincing seasonality data.

Burning is the only modification to the bone associated with this site, and only the deer bone exhibits either blackening or calcification. In Midden 3, 0.56 gm of the deer bone (or 0.8%) was burned, while 10.25 gm (25.5%) of the deer bone in Midden 5 was burned. Although burning is often taken as an indication of consumption, there remains the possibility of burning after discard. No bone was recovered with identifiable rodent or carnivore gnaw marks. This suggests that the bone was not left exposed for any significant length of time, but was quickly buried in pits or under sheet midden. This conclusion seems to be consistent with the absence of lensing or micro-stratigraphy in the middens themselves. None of the bone recovered from Old House Creek exhibited any intentional working or modification.

Examination of element distribution for such a small sample is not likely to yield particularly conclusive results. Although some portions with relatively little meat, such as the feet, jaw, and ribs are present, deer is represented primarily by hindquarter and forequarter sections. While some deer was apparently processed at the site, there is also the possibility that other animals were butchered at the kill site, with only prime portions returned to Old House Creek. The raccoon remains, while less numerous, seem to be represented by a greater variety of body parts, perhaps suggesting that they were trapped at or near the site, with on-site processing of the entire carcass.

ETHNOBOTANICAL REMAINS

Introduction

Ethnobotanical remains were recovered from a large number of excavation proveniences associated with the Old House Creek site, including handpicked samples from ¼-inch dry screening of midden soil, ⅛-inch water screening of midden soil samples, and ⅛-inch water screening of feature samples, as well as water-floated samples from Features 1-4 and Feature 6. All of the collected samples were incorporated into this analysis to ensure that a broad range of materials associated with the Middle Woodland occupation at the site were examined.

Flotation samples, offering the potential to recover very small seeds and other food remains, are expected to provide the most reliable and sensitive subsistence information. Samples of 10 to 20 grams of processed fill or carbonized material are usually considered adequate, if no bias was introduced in the field. Popper (1988) explores the "cumulative stages" of patterning, or potential bias, in ethnobotanical data. She notes that the first potential source of bias includes the world view and patterned behavior of the site occupants -- how were the plants used, processed, and discarded, for example. Added to this are the preservation potentials of both the plant itself and the site's depositional history. Of the materials used and actually preserved, additional potential biases are introduced in the collection and processing of the samples. For example, there may be differences between deposits sampled and not sampled, between the materials recovered through flotation and those lost or broken, and even between those that are considered identifiable and those that are not.

In the case of Old House Creek the soil samples were each 5 gallons in volume (representing soil prescreened to remove the large shell) and were water floated (using a machine assisted system) after the excavations at Chicora's Columbia laboratories.

Handpicked, or even waterscreened samples, may produce little information on subsistence since they often represent primarily wood charcoal large enough to be readily collected during either excavation or screening. Such handpicked samples are perhaps most useful for providing ecological information through examination of the wood species present. Such studies assume that charcoal from different species tends to burn, fragment, and be preserved similarly so that no species naturally produce smaller, or less common, pieces of charcoal and is less likely than others to be represented -- an assumption that is dangerous at best. Such studies also assume that the charcoal was being collected in the same proportions by the site occupants as found in the archaeological record -- likely, but very difficult to examine in any detail. And finally, an examination of wood species may also assume that the species present represent woods intentionally selected by the Native Americans for use as fuel -- probably the easiest assumption to accept if due care is used to exclude the results of nature fires. While this method probably gives a fair indication of the trees in the site area at the time of occupation, there are several factors which may bias any environmental reconstruction based solely on charcoal evidence, including selective gathering by site occupants (perhaps selecting better burning woods, while excluding others) and differential self-pruning of the trees (providing greater availability of some species other others). Smart and Hoffman (1988) provide an excellent review of environment interpretation using charcoal which should be consulted by those particularly interested in this aspect of the study.

Recently Espenshade et al. (1994:122, 131) have recommended the use of flotation samples from a "control block" not associated with any cultural deposits in order to evaluate the potential for charcoal found in the excavations to be naturally occurring. Samples from Spring Island's 38BU2 measuring 50 cm square by 10 cm in depth produced from 5.3 gm to 1.0 gm of charcoal, with the quantity of charcoal diminishing from level 2 to level 6. While they maintain that the control was "very beneficial" it is uncertain exactly how the information was used to moderate the findings of flotation studies from cultural units. Regardless, there can be no dispute that some of the charcoal, even from heavily occupied sites, is naturally occurring. Attempting to quantify the amount, and more specifically, the species, are more difficult questions. Smart and Hoffman (1988:170) seem to dismiss these issues, noting that even naturally occurring charcoal can likely provide vegetative information, even if it is not necessarily contemporaneous with the site occupation. In addition, they note that archaeologists should be able to identify, and discount, *major* contributors to the naturally occurring charcoal, such as "burrows and root holes."

Procedures and Results

The five flotation samples were prepared in a manner similar to that described by Yarnell (1974:113-114) and were examined under low magnification (7 to 30x) to identify carbonized plant foods and food remains. Remains were identified on the basis of gross morphological features and seed identification relied on Schopmeyer (1974), United States Department of Agriculture (1971), Martin and Barkley (1961), and Montgomery (1977). All float samples consisted of the charcoal obtained from 5 gallons of soil (by volume). The entire sample from this floated amount was examined. The results of this analysis are provided in Table 13.

In all but one sample (Feature 6) the uncarbonized materials (rootlets and similar trash) comprise the majority of the remains. Shell, including land snails, bits of marine shell such as oyster, and odostomes, is also very common in Features 3 and 4. Ignoring these remains, the samples are composed largely of wood charcoal (which clearly dominates Features 2 and 6). Hickory nutshell is found in three samples -- Features 1, 2, and 6, contributing between 0.2 and 8.5% by weight. Carbonized seeds are exceedingly rare, with only one fragmentary example of a viburnum seed (*Viburnum* sp.) recovered from Feature 3.

There are four hickories common to the Beaufort area -- bitternut (*Carya cordiformis*), water (*C. aquatica*), mockernut (*C. ovalis*), and pignut (*C. glabra*). These species occur on a variety of soil types, from dry woods to rich or low woods to swamp lands. In South Carolina they fruit in October, although seeds are dispersed from October through December (Bonner and Maisenhelder 1974:269; Radford et al. 1968:363-366). Good crops of all species are produced at intervals of up to three years when up to about 16,000 nuts may be produced per tree (Bonner and Maisenhelder 1974:271). Complicating this simple seasonality is the ability of the nuts to be stored for up to six months.

The presence and diversity of hickories is significant given their suspected contribution to the prehistoric diet. The occurrence of hickory nutshell at Stallings-Thom's Creek sites has been previously noted (see Harris and Sheldon 1982; Trinkley 1976, 1986) and is perhaps most significant because of its high protein and fat content, providing a caloric value equal to that of many meats (Asch and Ford 1971; Hutchinson 1928:261). They have likewise been found at a variety of Deptford and Middle Woodland sites (Espenshade et al. 1994:132; Trinkley 1991; Trinkley et al. 1993:131)

In addition to the probable use of hickory nuts, the flotation samples indicate the presence of only a single seed, that of viburnum (*Viburnum* sp.). There are a number of species found in South Carolina, typically occurring as deciduous shrubs or small trees, but the most likely species in the Old House Creek area is *V. rufidulum*, also known as blue haw. It is found in relatively xeric pine-oak and oak-hickory forests, fruiting from September through October, although the fruit can be found on the plant throughout the winter (Radford et al. 1968:537-541; Schopmeyer 1974:844-845).

The handpicked samples were also examined under low magnification with a sample of the wood charcoal identified, where possible, to the genus level, using comparative samples, Panshin and de Zeeuw (1970), and Koehler (1917). Wood charcoal samples were selected on the basis

Table 13.
Flotation sample components, weight in grams

Provenience	Wood wt	Wood %	Uncarb. Organic wt	Uncarb. Organic %	Shell wt	Shell %	Bone wt	Bone %	Hickory Nutshell wt	Hickory Nutshell %	Seeds wt	Seeds %	Total	Seeds
Feature 1	5.10	45.7	5.83	52.2			0.21	1.9	0.02	0.2			11.16	
Feature 2	6.06	50.6	4.89	40.9					1.02	8.5			11.97	
Feature 3	7.12	24.2	14.12	47.9	8.21	27.9					0.01	t	29.46	1 *Viburnum* sp.
Feature 4	3.75	18.5	13.36	65.8	3.18	15.7							20.29	
Feature 6	10.31	68.8	3.16	21.1	0.69	4.6	0.09	0.5	0.83	5.5			15.08	

of sufficient size to allow the fragment to be broken in half, exposing a fresh transverse surface. A range of different sizes were examined in order to minimize bias resulting from differential preservation. The results of this analysis are shown in Table 14 as percentages.

Wood charcoal, as previously mentioned, is abundant in all of the Old House Creek proveniences. This study found that it consists almost entirely of pine (*Pinus* sp), which is found in 20 of the 22 proveniences. Other species include hickory (*Carya* sp.), found in five of the 22 proveniences; maple (*Acer* sp., probably *A. rubrum*, red maple), found in only one sample; oak (*Quercus* sp.), found in five of the 22 proveniences; walnut (*Juglans* sp.) and dogwood (*Cornus florida*), found in only one provenience each; magnolia (*Magnolia* sp.) and ash (*Fraxinus* sp., probably *F. caroliniana*, the water ash), each found in two proveniences; and hackberry (*Celtis* sp.), sweetgum (*Liquidambar styraciflua*.), and cedar (*Juniperus* sp., probably *J. silicicola*, southern red cedar), all found in only one provenience each.

Hickory nutshell is found in seven samples, comprising over a quarter or more of the collected charcoal in four. One sample, from Unit 21 associated with Midden 1, yielded nutshells sufficiently intact to determine that at least some of the specimens were pignut hickory (*Carya glabra*). This species is found in a wide variety of conditions, including drier sandy ridges as well as lower, more fertile depressions. In South Carolina the fruit is typically dropped in October, although dispersion can last for several months (Fowells 1965:124-126; Radford et al. 1968:368).

Two of the samples, Unit 1 and Unit 7, both associated with Midden 3, produced single carbonized examples of palmetto seed (*Sabal* sp.) The palmetto seeds may represent either the *Sabal palmetto*, which has a tree form, or the *S. minor*, which is a low palm. The cabbage palm is very common and while it has few commercial uses, it is extensively used by the rural residents -- the bud provides food and the leaves are used in weaving. While there is no evidence that the fruits were used by the Native Americans, they are eaten by animals and birds (Schopmeyer 1974:744). The fruits ripen in the late fall or winter. Recent research on the Calusa in Florida has revealed that this coastal group ate the berries of the saw palmetto (*Serenoa repens*, *Sabal* and *Serenoa* are the only two genera of the Arecaceae family). While not typically considered "tasty," they are very nutritious, containing 1.6% protein, 4.4% fat, 36.4% carbohydrates, and 55.0% moisture (William Marquardt, personal communication 1994).

Discussion

Both the flotation and waterscreened samples are dominated by wood charcoal, primarily pine, and a single plant food remain -- hickory nutshell. The study perhaps contributes to a better understanding of the site environs, as well as the activities of the Deptford/St. Catherines people who lived around Old House Creek.

The charcoal represents woods which could reasonably be associated with a maritime forest, such as hickory, oak, southern red cedar, and magnolia. The sweetgum may be found with oaks and hickories in mesic mixed hardwoods.

Table 14.
Analysis of wood species from the waterscreened samples, by percent

Provenience	pine	hickory	maple	oak	walnut	dogwood	magnolia	ash	hackberry	sweetgum	cedar	hickory nutshell	palmetto seed	UID
Midden 1														
Unit 17	61	6										33		
Unit 21	13	2										85		
Unit 21. ph 1	100													
Midden 2														
Unit 25	60		20											20
Unit 26					20	80								
Midden 3														
Unit 1	67	11					5	5					1	11
Unit 7	80			10								10		
Unit 18	71												14	14
Unit 19*	100													
Unit 20	50			16			17					17		
Unit 22*	100													
Feature 3	100													
Feature 5	75													25
Midden 5														
Unit 3	50													50
Unit 8	28			43								29		
Unit 10, ph 1									100					
Unit 10, ph 2	25	25										25		25
Unit 11	100													
Unit 29	66			34										
Feature 1	60							20				20		
Midden 6														
Unit 9	66			34										
Midden 7														
Unit 13	25									25	25			25
Unit 13, ph 1	34	33												33
Unit 14	100													

* samples containing a large proportion of uncarbonized remains which are likely naturally occurring

Trees such as the water ash and red maple are likely found in wetland areas or low rich woods. Pine, while suggestive of a disturbed habitat, is present naturally in the more sheltered areas of maritime forests (Barry 1980:179). The dominance of pine, however, suggests a fire sub-climax pine forest with minor components of oak and hickory. The choice of reconstruction is therefore determined by the weight given to the pine -- does it represent the species' occurrence prehistorically, or does it represent intentional cultural selection (perhaps as fuel)? It may be more important that the site exhibits the diversity it does, since that suggests foraging activities which incorporated relatively dry upland soils, more mesic soils, and even some wetland areas bordering on swamps.

The most conservative, and hence safest, approach is simply to note that these taxa were present in the Old House Creek area about A.D. 1000 when the site was occupied. If, however, the ethnobotanical record from other Woodland sites in the coastal region is examined, pine seems to consistently dominate the collections. While this suggests that we are observing a consistent pattern, it still cannot tell us whether the pattern is cultural (i.e., the Woodland people selected for pine) or whether the pattern accurately represents the taxa present for use (i.e., pine was simply the most common tree in the site area). There are good arguments on both sides. Autecology reveals that a fire sub-climax is possible in the project area and ethnohistoric accounts are replete with examples of Native Americans affecting their natural environment through the use of fire. Likewise, pine is an excellent self-pruner, provides hot fires, and is easy to ignite -- all qualities which would support intentional selection. Feature 5, interpreted to represent an abandoned firing pit for pottery, contained only pine, strongly suggestive of intentional selection -- at least in this one case.

It is impossible for the Old House Creek data to provide a clear answer to this question. Future research at other Middle to Late Woodland sites, combined with extensive pollen studies, will be necessary for anything approaching a definitive explanation. The pollen study of Old House Creek (see Cohen, this volume) reveals that pine also dominates the pollen record, with pollen from species such as oak, hickory, and sweetgum being found in about the same proportion as charcoal. If in fact pine was as common as suspected, then the dominance of hickory nutshells becomes that much more significant. In the midst of oak-pine forests, presumably maintained through fire, sites like Old House Creek may represent "islands" where hickory resources were especially prevalent. Even today on Hilton Head Island, hickories tend to be found in small, localized areas. Being intolerant of salt, they also avoid maritime forests and near marsh areas.

The hickory nuts suggest a fall or winter occupation of the site, although they can be collected and stored for future use, perhaps as late as March or April. The palmetto seeds are dispersed from September through November. The viburnum fruits in late fall, although the plants often retain the fruits throughout the winter. Theses ethnobotanical remains suggest that at least some activities took place in the fall or early winter months. Occupation during other seasons, of course, cannot be ruled out based on this evidence.

The absence of "weedy" taxa, often found at coastal sites and suggestive of disturbed habitats, cannot easily be explained, especially since there is some indication of such genera in the pollen record (see Cohen, this volume). The absence of "weedy" plant seeds may be due to their small size and fragility. However, since most grasses produce seeds during the summer or early fall, their absence may indicate that the site was not occupied during this part of the year.

POLLEN ANALYSIS

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Sub-midden Samples

Two samples characterized by the researchers as "sub-midden" were submitted for analysis. One was collected from Feature 1, underlying Midden 5, thought to represent a shellfish steaming pit. The other came from Feature 3, underlying Midden 3, and was also interpreted to be a shellfish steaming pit. The only significant difference between the two is that Feature 3 was possibly reused, while Feature 1 appears to be a single episode pit. Each sample consisted of soil preserved within the body whorl of a whelk, a collection process recommended to maximize available soil and minimize potential for contamination by modern pollen. These samples were thought by the researchers to potentially reflect the paleoecology of the site during its earliest occupation.

Feature 1

Samples were macerated for pollen and ten slides were scanned to identify pollen types and percentages. Not enough pollen were found to construct a valid pollen diagram nor to reconstruct the paleoecologic setting. However, the following types were identified:

Types Identified	No. Counted/10 slides
Arboreal	
Cedar/Juniper Type	1
Nonarboreal	
Sphagnum	1

This sample consisted almost entirely of amorphous substances, such as resinous and tanniniferous globs and cell fillings. An occasional, nearly amorphous, gelified, tissue fragment also occurred. It is likely that these remains represent substances hydrothermally leached and/or thermally exuded from the wood being burned in the pit which were then redeposited in the sample zone.

Feature 3

Samples were macerated for pollen and ten slides were scanned to identify pollen types and percentages. Sufficient well-preserved pollen were obtained to construct a pollen diagram. However, given the small numbers of nonarboreal pollen present, it was decided to construct a single pollen diagram on the basis of the total number of palynomorphs, rather than to separate the arboreal and nonarboreal types. The following types were identified:

Types Identified	No. Counted/10 slides
Arboreal	
Pinus (pines)	112
Quercus (oaks)	26
Carya (hickories)	23
Myrica (wax myrtle)	28
Liquidambar (sweetgum)	12
Poss. *Corylus* (hazel nut)	2
Nonarboreal	
Polypodiaceae (ferns)	6
Gramineae (grasses)	2
Compositae	1
Unidentified	4

While there was no charcoal in this sample, almost all of the tissue fragments present were unnaturally darkened and gelified, as would result from a hydrothermal alteration process. Except for a few ferns, grasses, and composites, the sub-midden palynomorphs in this sample consist almost entirely of windblown arboreal types, pine, oak, hickory, wax myrtle, and sweetgum. These types represent typical vegetation of sandy, dry, well-drained portions of the Coastal Plain, such as the project area. No marsh or swamp plants were encountered. The pollen in this sample also tended to be well preserved.

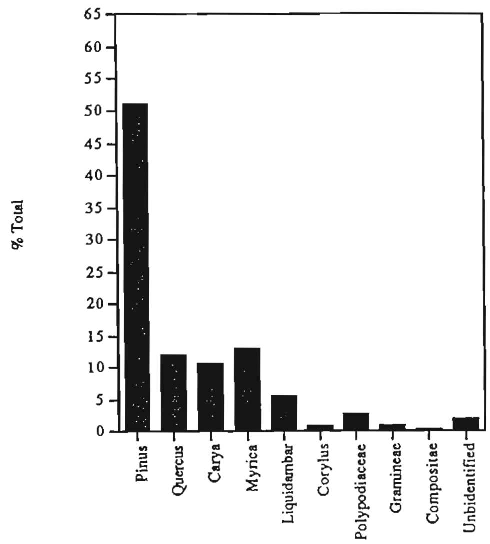

Figure 43. Pollen graph for Feature 3.

Midden Samples

Three samples were submitted from the shell midden zones of a single excavation unit, Test Pit 21, comprising a portion of Midden 1. They were collected in a manner identical to the sub-midden samples. These pollen samples were hoped to reflect ecological changes in the site environment caused by intensive occupation. In addition, three samples from a single 10-foot excavation unit (collected from the SW quad, NE quad, and SW corner) were examined to evaluate the potential range of pollen preservation.

Unit 21, SW Quad Sample

Samples were macerated for pollen and ten slides were scanned to identify pollen types and percentages. Not enough pollen were found to construct a valid pollen diagram nor to reconstruct the paleoecologic setting. The pollen that did occur were highly corroded and fragmented. However, the following types were identified, along with various unidentified plant fragments:

Types Identified	No. Counted/10 slides
Arboreal	
Pinus (pines)	5
Nonarboreal	
Chenopodiaceae	3

Unit 21, NE Quad

Samples were macerated for pollen and ten slides were scanned to identify pollen types and percentages. No pollen were found.

Unit 21, SW Corner

Samples were macerated for pollen and ten slides were scanned to identify pollen types and percentages. Sufficient well-preserved pollen were obtained to construct a pollen diagram. However, given the small numbers of nonarboreal pollen present, it was decided to construct a single pollen diagram on the basis of the total number of palynomorphs, rather than to separate the arboreal and nonarboreal types. The following types were identified:

Types Identified	No. Counted/10 slides
Arboreal	
Pinus (pines)	201
Quercus (oaks)	46
Carya (hickories)	40
Myrica (wax myrtle)	3
Ilex (holly)	2
Smilax (cat briar - vine)	2
Nonarboreal	
Polypodiaceae (ferns)	5
Osmunda (ferns)	1
Gramineae (grasses)	3
Polygonaceae	2
Compositae (var flowering plants)	1
Unidentified	6

The palynomorph assemblage of this midden sample is dominated by pines, oaks, and hickories. In this respect, its dominant forms are very similar to those of the pre-midden samples.

However, its assemblage differs somewhat from the pre-midden sample in that it contains no sweetgum pollen and has a much smaller percentage of wax myrtle. This sample also contains a somewhat greater diversity of plant types (e.g., in addition to the categories shown above, several different composites and several different types of pine were encountered). Furthermore, the variety of tissue fragments occurring in this sample is greater than that of the sub-midden sample. Such things as vascular tissues, cuticles, and resinous globs are common. This sample also contains significant quantities of charcoal.

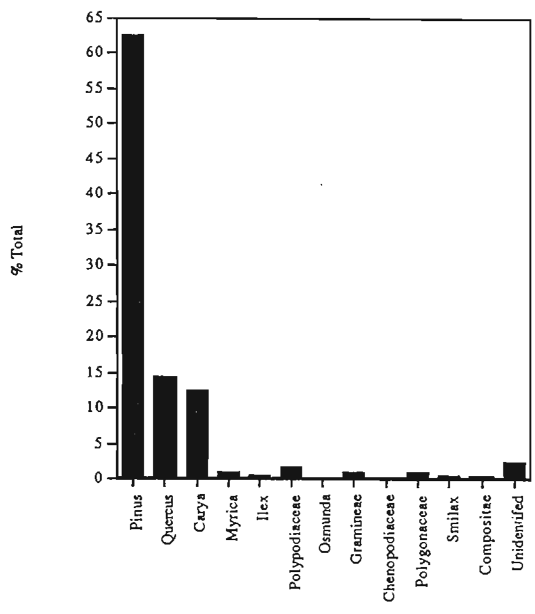

Figure 44. Pollen graph for Unit 21, SW corner.

Although palynomorph recovery was reasonably good, both the palynomorphs and tissue fragments were often highly corroded, with this corrosion being typical of intense microbiological decay. The amount of this corrosion was much higher than that observed in the sub-midden sample.

Conclusions

Of the five samples provided, only two (one from the sub-midden level of Feature 3 and one from the midden sample of Unit 21) showed reasonably good preservation. While it is clear from these samples that pollen analysis of archaeological shell midden sites along the South Carolina coast can contribute significant data, preservation continues to be an unresolved issue. Even within one unit, under seemingly identical conditions, preservation can vary dramatically (such as seen in Unit 21). The best solution may be to collect larger numbers of samples, maximizing the potential for recovery of palynomorphs.

The data from this site, however, suggests that there may have been some ecological change resulting from the occupation. As previously mentioned, not only do the sub-midden and midden samples vary in specific species, but the midden sample exhibits greater variation in species, perhaps the result of the forest being opened up or disturbed by human occupation. Additional studies, using much larger samples, are necessary.

ANALYSIS OF OYSTERS

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Introduction

Archaeological oysters from data recovery excavations at the Middle Woodland period site 38BU861, near Old House Creek on Hilton Head Island, Beaufort County, South Carolina, were supplied to the author by Chicora Foundation of Columbia, South Carolina. Accompanying the samples was a request for input concerning the environment(s) being utilized, uses of the oysters by site inhabitants, season(s) of gathering, and other behavioral aspects of the aboriginal peoples which might be deciphered via analysis of the oyster shells. A summary of these findings in included in this section.

The author chose to utilize these samples for examination of other aspects of shell midden archaeology. Among the oysters, the size, and means of gathering, of samples necessary to extract meaningful information were explored using various subsets of samples from the Test Pit 1 data at Midden 3. Among non-oyster components of the midden, samples from 38BU861 were employed to develop techniques for using the oyster-parasitic pyramidellid snail, *Boonea impressa* (Say) as an indicator of season of site occupation. Original phases of this latter work were undertaken with the generous support of the State Historic Preservation Office of the South Carolina Department of Archives and History. With their continuing generosity, the results of this snail endeavor are summarized herein. Criteria used in making oyster-based reconstructions are outlined in Lawrence (1988), with a more recent modification of working methods presented in Lawrence (1991).

The Shellfish

Results from the emphasized Test Pit 1 area are presented here in approximate chronological sequence: lowermost Feature 3, then the shell pocket from the SE quadrant, followed by the general SE quadrant sample and the column samples from the NE corner of Test Pit 1.

Unit 1, Feature 3; hand-picked sample

Materials consist of 14 larger (height greater than 7.5 cm, which is the minimum marketable size for oysters in the State of South Carolina[1]) left valves. At least 11 of the 14 are intertidal cluster oysters. Attachment areas are overall of but moderate size, suggesting that these oysters came from clusters within tidal flats, and not from creekbank-lining clusters. Individuals display quite large sizes for the American Oyster, with valve heights ranging to over 180 mm. Oyster shell epi/endobionts, with a single exception, are striking in their absence, suggesting that these oysters came from higher reaches of the intertidal zone. Original (purple) shell pigmentation is preserved on a minority of the valves; botryoidal overgrowths occur on 5 of the 14 left valves of the sample. Beige discolorations are also present on a majority of the valves, and are deepest in color near the point of greatest convexity on valve exteriors. Several striking stabbing notches are preserved; these plus exfoliate dorsal valve margins indicate that the original shells had their two valves forcibly separated and that the oysters were indeed used as foodstuffs. Sample size is too small to yield meaningful data on season or seasons of gathering.

Valve discolorations, their hues and distributions, are compatible with the

[1] One reviewer noted that there is no minimum legal size for oysters in South Carolina. "Marketable" in the context of this study simply means the minimum size that the consumer will knowingly purchase at retail.

interpretation of Feature 3 as an oyster steaming pit. If the hand-picked sample is at all representative of the entire oyster population from Feature 3, during this early phase of site occupation large cluster oysters were readily available from nearby intertidal flats, which most likely were present within major creek or river drainages. The oysters were indeed utilized for food.

Unit 1, Shell Pocket above Feature 3;
hand-picked sample

About 40% of the 50+ left valves in this hand-picked sample are cluster oysters which are basically indistinguishable from the underlying Feature 3 materials. Although the maximum valve height is somewhat less (160 mm) than those of the feature, this subset of the sample does still include oysters of rather large size. About 60% are scatter oysters, one-sixth of which contain the galleries and perforations of clionid sponges. Polydorid bristleworms are present but are not at all striking in their abundance even in the scatter oysters. This latter observation strongly suggests that bottom sediments in the collecting areas were sandy, and not composed primarily of fine-grained or "fluffy" muds (see Lunz 1941). Again, well-preserved stabbing notches and ventral exfoliation indicate forceful valve separation and point toward food use of these oysters. Botryoidal overgrowths occur but are less common on the scatter oysters.

Unit 1, SE Quadrant, general; hand-picked

This sample includes 24 larger left valves, all but 2 or 3 of which are scatter oysters. Maximum valve height continues to decrease; the few cluster oysters in this lot range to only 125 mm in height. Although several valves display light polydorid bristleworm infestations, none of the 24 has a significant level of shell epibionts or endobionts. These oysters most likely came primarily from lower intertidal to subtidal regions, in areas of somewhat reduced salinities and with sandy, not mud-rich, bottoms. Beige to gray valve discolorations are common and these discolorations are striking, and confined to regions of maximum valve convexity, on several specimens. Calcitic overgrowths appear on 4 of the 24 larger valves. Exfoliation of the ventral margin and stabbing notches appear on the larger valves; the oysters were, again, used as foodstuffs. One double notch records a twice-unsuccessful attempt to shuck the oyster using a pointed or bladed instrument. Of the 46 smaller left valves provided, all may be interpreted as scatter oysters; seven of these display the galleries of clionid sponges in the valves. The lack of an appropriate ligament geometry model for South Carolinian low intertidal to subtidal oysters, and a small sample size, make impossible a meaningful analysis of seasonality in collecting these shellfish.

Unit 1, NE Corner column, Bag 1;
bulk sample

The biota from Bag 1 included angular fragments of quahogs and 2 unabraded whelk columellas. The presence of juvenile oysters in this bulk lot indicates that the oysters were originally gathered as grab samples, i.e., they were not sorted and separated by size at the collecting site. The bag included 35 larger left valves and 14 larger right valves. At least eighty percent (29) of the 35 larger left valves are scatter oysters. Epi/endobionts are prominent on none of the larger valves, although minor polydorid bristleworm infestations were noted on two specimens and an impressed barnacle "ghost," on another single valve. Discolorations, ranging from beige to gray, are relatively common on the larger valves. Marginal disturbances range from small, confined stabbing notches to broad ventral exfoliations on the larger left valves; one larger right valve displays rather striking evidence of valve cracking; food use of the oysters is again confirmed. Calcitic overgrowths are prominent on only one of the larger left valves. The statement made above, concerning seasonality analysis, also applies to both bags of this bulk sample.

Unit 1, NE Corner column, Bag 2;
bulk sample

The Bag 2 materials include a rather significant number of juvenile oysters, especially juvenile right valves, indicating that size sorting, if done at all, did not take place at the collecting site. The sample includes 43 larger left valves and 23 larger right valves. For both valves, cluster and scatter oysters occur in subequal numbers. Two of the scatter oysters were collected dead, as evidenced by penetration of valve interiors by clionid sponges. The cluster oysters display no striking shell epi/endobionts; nearly 25% of the scatter oyster larger left valves contain the perforations and internal galleries of clionid sponges. Slight and beige discolorations appear on a majority of all larger valves; several display more striking and deeper brown or gray discolorations. Exfoliate valve margins and broad stabbing notches can be recognized on the larger scatter oysters; on one larger cluster oyster, stabs occur between the left valve ribs. As has been stated elsewhere, this latter observation suggests that the oyster was shucked in hand, with left valve down, and forceful entry achieved by prying at the complementary high-standing areas of the right valve.

Seasonality by Odostome Growth Analysis

As stated in the introduction, samples from data recovery work at 38BU861 were used for the development of techniques which utilize the growth of the oyster-parasitic pyramidellid snail, *Boonea impressa*, as indicators of season of oyster collection. These techniques have been reported in detail elsewhere (Lawrence 1994), but a summary of the findings is included here for the sake of completeness.

The basic technique, measuring size at death of these snails, was established by Russo (1991) and is founded upon observations that: (1) primary recruitment of new generations of these snails takes place in the springtime or early summer, (2) the average lifetime of *B. impressa* is about one year, and (3) during its lifetime this impressed odostome undergoes regular and measurable accretionary growth. Russo (1991) wisely used modal size classes as the basis for interpretations and combined sizes into broad, seasonal categories; only 6 seasonal groupings (Spring, Summer, Autumn, Late Autumn, Winter, Late Winter) were recognized. Data grouping is basically achieved by rounding sizes upward, to the next higher 0.5 mm.

Multiple, nested, and size-graded standard sieves were used in the sorting of sediments; of the sieve sizes readily available to the writer, those with openings of 2.00, 1.18, 0.85, and 0.50 mm were chosen. This size range included a finer mesh opening than that recommended by Russo as a minimum sieve size. Approximately 10 liters of sediment were sieve-processed during the initial testing phase of work.

The intact and entire (or nearly entire) snails were affixed to cardboard, partitioned mounts using gum tragacanth, and valve heights were next measured with a micrometer ocular, which had been calibrated with regard to the microscope being used.

The grouped data for valve heights of the impressed odostomes from 38BU861, Unit 1, rounded up to the nearest 0.5 mm, yield a unimodal distribution which is presented in Table 15. The use of Russo's seasonal interpretations generates a late fall primary season of gathering for the oysters and their parasites. The breadth of the single mode suggests that collecting could have taken place over a longer period, ranging from fall through winter (or the months of September through January).

Table 15.
Odostome Heights (in mm) from
Unit 1, Midden 3

Odostome Height	N	%
2.1 - 2.5	5	4.4
2.6 - 3.0	10	8.8
3.1 - 3.5	14	12.4
3.6 - 4.0	21	18.6
4.1 - 4.5	31	27.4
4.6 - 5.0	23	20.4
5.1 - 5.5	9	8.0
Total	113	100.0

During preparation of the present report, considerable time was spent trying to duplicate these odostome measures, as a test of within-site consistency in seasonal use. Materials from Test Pit 26 (from Midden 2) were utilized in this latter, and not completely successful, work. A similar (10 liters) volume of sediment was again processed, using this time an extended range of sieve sizes (openings down to 0.4 mm). Concentrations of odostomes were less in this second sample and the quality of preservation of the snails also decreased, so that only 37 usable measures could be obtained from this second sample. This number does not compare favorably with the larger samples of odostomes used for seasonal reconstructions by Russo (1991). Grouped data for the Unit 26 materials are, however, presented in Table 16, using the same presentation format as for the Test Pit 1 sample of *Boonea* (Table 15). Thus the seasonal reconstruction from the Unit 21 data (late fall) may be open to question. When the detailed North Carolina data of Wells (1959) are added to the provincial picture of odostome growth developed by Russo (1991), additional factors which may complicate interpretations of the odostomes appear. To cite but one example, the relative concentration of individuals larger than or smaller than the modal class may become an important consideration in interpreting season of death from growth data for these snails.

Table 16.
Odostome Heights (in mm) from Unit 26, Midden 2

Odostome Height	N	%
1.6 - 2.0	2	5.4
2.1 - 2.5	5	13.5
2.6 - 3.0	6	16.2
3.1 - 3.5	6	16.2
3.6 - 4.0	4	10.8
4.1 - 4.5	8	21.6
4.6 - 5.0	4	10.8
5.1 - 5.5	2	5.4
Total	37	100.0

Summary of Interpretations

This summary is based on the supposition that the hand-picked samples, provided to the writer by Chicora Foundation, are acceptable representations of the sample universe of larger oysters from the appropriate proveniences.

The oysters from 38BU861 were consciously gathered by inhabitants of the site for use as food. The oysters were gathered from nearby flats where substrata were not thick or "fluffy" muds. Both middle to high intertidal clusters of oysters, and more scattered individuals from lower in the intertidal gradient, were actively collected. The waters covering these flats, at high tides, were of somewhat reduced salinities (not fully, open marine in salt content).

Inhabitants initially gathered quite large cluster oysters for steaming (Feature 3; arguments can be made for the heating or steaming of all of the examined oysters from this site). This is contrary to the seeming preference of aboriginal peoples for the more ovate, scattered oysters, a preference which has been noted in many coastal regions of the State, but would represent an energy-efficient use of human collectors, with the ease of gathering of the clusters. As large cluster oysters became less readily available, still large but scattered oysters grew in proportion within the samples gathered (Shell Pocket sample); as cluster oysters became depleted, scattered individuals came to make up the distinct majority of the oysters gathered, at least in the Unit 1 area of this site (general midden and column samples), while maximum sizes of the gathered oysters decreased. These continuing changes are evidenced in the two subsets (bags) which, collectively, represent the column sample from Unit 1. To combine material from these two bags, to create a single, larger, presumably more comprehensive sample, or to use one bag but not the other in the name of time constraints, would both result in the loss of valuable information about the history of this site.

Season of occupation at the site, based upon growth analysis of oyster-parasitic snails from a single provenience, was during the fall of the year. Attempts to provide internal control for this reconstruction of seasonality were unsuccessful, given the time and other constraints of the present report.

SEASONALITY OF CLAM SHELLS

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The quantity of quahog shells (*Mercenaria mercenaria*) was adequate for growth line work only from one shellfish steaming pit, Feature 3, encountered at the base of the shell midden in Unit 1, under Midden 3. There was a minimum of 37 individuals represented in the feature, 33 of which proved readable. The shells were in excellent condition, only one having a rind obscuring the growth increments. Twenty-one left valves and 15 right valves were whole; 5 lefts and 5 rights lacked umbones, and 5 rights were fractured transversely.

A marginal piece of the 37 individuals was ground to a high luster (the valves were broken when whole) and examined under low magnification or macroscopically for color at the margin -- white/brown or gray. Relative amount (width) of that color band compared to the width of the same color in the previous year of life was recorded as well using three categories: one third as wide, two-thirds as wide, three-thirds as wide. The color was then *interpreted* as to whether the animal was in an annual cycle of fast growth (white or brown shell) or slow growth (gray shell), known as the fast/slow technique. The amount of growth was also recorded as opaque (fast) 1, 2, or 3 (O1, O2, O3) or translucent (slow) 1, 2, or 3 (T1, T2, T3), known as the opaque/translucent technique.

Growth controls are essential for the second stage of interpretation, that of when in the 12 month calendar year the shells were harvested. The controls used by this author were built on a set of 1846 quahogs collected from Bird Shoals, North Carolina from July 1980 through September 1988 (Table 17). There are large samples from at least six months for six years. These controls emphasize a biological axiom -- that there is a great deal of variation in the way individuals respond to stimuli. It is incumbent upon the researcher to capture variation at the level of the population, not the individual.

To interpret death time of a single shell would be meaningless. If it died in fast growth, in most years that could be any one of ten months. If it died in slow growth, in could have been harvested in any one of twelve months. If one measures the amount of growth, one can find that in every month there will be individuals less than 10% grown and individuals more than 60% grown. Counting daily lines evidences the same amount of variability in any calendar month. There is no absolute measure or guide by which a researcher can match an individual shell and an individual month.

Since it is necessary to interpret a population of shellfish, it is necessary to investigate a population of archaeological shellfish, or a single death assemblage. There are two ways that confidence can be gained that a single death assemblage is being sampled -- by considering only shells from a single sealed pit, or, less reliably, by taking the shells from a very small volume of matrix, such as a column sample level. The shells from 38BU861 were assembled from a single shellfish steaming pit and should represent a single death assemblage.

Through extensive research and blind testing, this author has found that calendar months are best typified by the fast/slow and opaque/translucent percents of populations of quahogs. Tables 18 and 19 present this information for the Bird Shoals, North Carolina control used to interpret the set of quahogs in Feature 3 at 38BU861. Table 20 records the raw data for the 37 shells examined. The control data require a sample size of at least 22 shells, a requirement met by the archaeological sample submitted from 38BU861.

The set of 33 readable shells contained 31 (94%) shells in fast growth and 2 (6%) in slow growth. That ratio brackets the months of December

Table 17.
North Carolina *Mercenaria* Control Statistics
Collected at Bird Shoals

Month	Number Received	Cut	Measured	Color
July 1980	25	25	15	25
February 1981	14	14	10	14
April 1981	20	20	14	19
June 1981	12	12	9	11
August 1981	11	11	3	10
October 1981	8	8	2	8
December 1981	9	9	5	8
February 1982	12	12	7	9
January 1984	38	36	34	34
February 1984	31	27	25	25
March 1984	27	24	19	23
April 1984	41	40	39	40
May 1984	40	36	33	36
June 1984	40	39	32	39
September 1985	50	50	38	50
October 1985	52	52	50	52
November 1985	47	47	44	47
December 1985	35	35	34	34
January 1986	44	43	41	43
February 1986	33	33	31	33
March 1986	38	37	34	37
April 1986	34	34	32	33
May 1986	50	50	46	50
June 1986	50	48	48	48
July 1986	50	50	42	50
August 1986	52	52	44	52
September 1986	52	52	52	52
October 1986	31	31	28	30
November 1986	43	39	39	40
December 1986	32	32	27	31
January 1987	36	36	34	36
February 1987	33	33	24	30
March 1987	30	29	21	29
April 1987	36	36	31	35
May 1987	42	42	30	42
June 1987	45	45	38	45
July 1987	46	45	39	45
August 1987	48	48	44	48
September 1987	47	47	39	47
October 1987	44	44	39	44

through April. Stage O1 was dominant which also brackets the months of December through April. Stage O3 was the death time for 6% of the shells which narrows the possible harvest to February-April. That 3% of the shells died during T1 seems to bracket the months March-April (Table 19).

Quahogs from numerous sites in the Carolinas consistently show a winter-spring harvest (Claassen 1986), yet are usually inadequate for addressing the issue of when shellfishing was scheduled by the human predators. We can say no more than that the shells uncovered in this St. Catherine's period (A.D. 1150) pit were harvested in the spring. To address quahog harvesting practices at this site, or shellfish harvesting practices at this site, would require very large samples from single death assemblages from multiple places in the site.

Table 18.
Mercenaria Dying in Fast Growth in the Bird Shoals Control
percent of all animals / percent of measurable animals

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980							0/0					
1981		93/90		95/93		18/22		0/0		0/0		87/80
1982		89/86										
1984	100/100	100/100	100/100	98/97	86/85	8/6						
1985									10/13	55/58	77/81	88/88
1986	100/100	97/97	97/100	100/100	52/52	6/6	0/0	4/2	31/31	33/32	90/92	97/100
1987	94/94	93/96	90/95	100/100	57/50	7/3	0/0	0/0	9/10	48/46	77/76	58/52
1988	100/100	94/97	100/100	94/100	90/89	34/36	0/0	0/0	27/20			
Range												
Max	100/100	100/100	100/100	100/100	90/89	34/36	0/0	4/2	31/31	55/58	90/92	97/100
Min	94/94	89/86	90/95	94/93	52/50	6/3	0/0	0/0	9/10	0/0	77/76	58/52
n	150/145	144/126	127/109	161/147	170/146	190/172	173/145	151/132	200/169	134/119	122/116	104/138

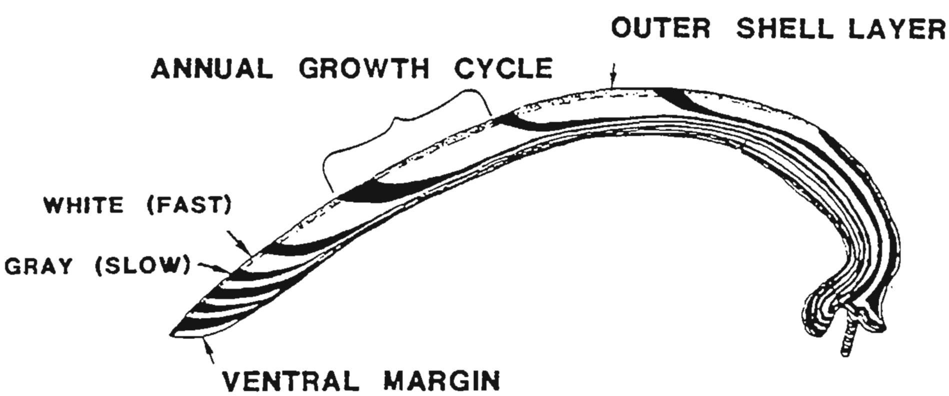

Figure 45. Typical cross-section of clam shell showing light and dark growth lines.

Table 19.
Opaque/Translucent Percents for the North Carolina Control
with the Dominant Growth Phase Indicated in Bold

	O?	O1	O2	O3	T1	T2	T3	T?
January 1984	3	**97**	0	0	0	0	0	0
1986	0	**100**	0	0	0	0	0	0
1987	3	**56**	36	0	3	0	3	36
1988	0	**95**	5	0	0	0	0	0
Total	2	**87**	10	0	1	0	1	0
February 1981	7	**86**	0	0	0	7	0	0
1982	22	**44**	22	0	0	0	11	0
1984	0	**88**	12	0	0	0	0	0
1986	0	**91**	0	0	0	0	3	0
1987	7	30	**40**	20	0	0	3	0
1988	0	**79**	12	3	0	0	3	3
Total	6	**77**	15	4	0	1	3	1
March 1984	9	**74**	17	0	0	0	0	0
1986	0	**97**	0	0	3	0	0	0
1987	10	**38**	34	10	0	0	4	0
1988	8	**66**	24	3	0	0	0	0
Total	7	**69**	19	3	1	0	1	1
April 1981	0	**79**	16	0	0	5	0	0
1984	5	**63**	28	3	0	0	0	3
1986	0	**81**	15	3	0	0	0	0
1987	3	23	**37**	**37**	0	0	0	0
1988	6	35	**47**	6	3	0	0	3
Total	3	**56**	29	10	1	1	0	1
May 1984	3	28	**44**	11	14	0	0	0
1986	0	26	22	4	**42**	6	0	0
1987	5	0	17	36	**43**	0	0	0
1988	12	12	**50**	17	10	0	0	0
Total	5	17	**33**	17	27	2	0	0
June 1981	0	9	9	0	**73**	9	0	0
1984	0	5	0	3	**74**	13	0	5
1986	2	2	0	2	**81**	10	2	0
1988	0	2	19	13	**62**	0	0	4
Total	1	4	6	4	**75**	7	1	1
July 1980	0	0	0	0	**60**	32	0	8
1986	0	0	0	0	36	**38**	18	8
1987	0	0	0	0	**49**	36	11	4
1988	0	0	0	0	**92**	2	2	4
Total	0	0	0	0	**59**	27	8	6
August 1981	0	0	0	0	10	30	**40**	20
1986	0	4	0	0	19	33	**42**	20
1987	0	0	0	0	19	35	**42**	4
1988	0	0	0	0	**59**	24	17	0
Total	0	1	0	0	27	31	**35**	6
September 85	0	10	0	0	20	32	**38**	0
1986	2	**29**	0	0	10	31	27	2
1987	0	9	0	0	23	**34**	32	2
1988	0	27	0	0	25	**31**	16	0
Total	1	19	0	0	20	**32**	28	1
October 1981	0	0	0	0	0	**50**	25	25
1985	0	**56**	0	0	13	10	19	2
1986	3	27	3	0	3	17	**43**	3
1987	0	**48**	0	0	7	25	20	0
Total	1	**33**	1	0	6	26	27	7
November 1985	0	**77**	0	0	2	9	13	0
1986	0	**82**	8	0	0	3	5	3
1987	3	**74**	0	0	3	14	6	0
Total	1	**78**	3	0	2	9	8	1
December 1981	0	**88**	0	0	12	0	0	0
1985	0	**88**	0	0	0	9	0	3
1986	6	**58**	32	0	0	0	3	0
1987	0	**58**	0	0	0	19	16	6
Total	1	**73**	8	0	3	7	5	2

Table 20,
Opaque/Translucent
Percents for Feature 3

	N	%
Fast Death	31	94
O1	22	66
O2	7	21
O3	2	6
Slow Death	2	6
T1	1	3
T2	0	0
T3	1	3

OTHER SHELLFISH

Preceding sections of this study have explored the ability of oysters (*Crassostrea virginica*) to offer environmental and seasonality dating and clams (*Mercenaria mercenaria*) to provide an indication of seasonality. There are, however, other shellfish present at Old House Creek and an examination of these species may help us to better understand not only the dietary choices present, but also the environmental variability of the site area. In particular, small quantities of Atlantic ribbed mussel (*Geukensia* [formerly *Modiolus*] *demissa*), common cockle (*Trachycardium muricatum*), stout tagelus (*Tagelus plebeius*), knobbed whelk (*Busycon carica*), and periwinkle (*Littorina littorea*) were found either in individual features or in the general midden excavations. While not a shellfish, the blue crab (*Callinectes sapidus*) was also recognized as a minor constituent of the midden through the recovery of pinchers.

Atlantic Ribbed Mussel

This is the third most common shellfish, following oyster and clam, being found in Middens 1-3 at percentages ranging from 1.8% to 0.2% by weight. It was likewise found in all of the features, ranging from a high of 16.7% by weight in Feature 6 to a low of 2.0% by weight in Feature 3. This high level of ubiquity suggests the ribbed mussel was a common species, perhaps exploited opportunistically.

It is common in the salt marshes and brackish estuaries, usually buried in the mud among the roots of the marsh cordgrass *Spartina* or fastened to objects at the surface of the mud. Typically about an inch of its wide end sticks above the mud. At high tide it opens and feeds by siphoning water; at low tide the shell is closed tight. This shellfish is able to move, albeit very slowly. Even today ribbed mussels may be found interspersed in oyster beds. Although Larson (1969:126) notes that ribbed mussels can form single-species beds, a study in the Port Royal Sound area by Vernberg and Sansbury (1972) found them as single individuals in sandy muds or attached to oyster shells in clumps. Their density ranged from about 0.3 to 2 individuals per square meter in study plots (Vernberg and Sansbury 1972:274). Quitmyer (1985a:30) notes that they are often found localized in the high marsh grasses and mudflats -- areas easily traveled and open to simple collection techniques.

Ribbed mussels, as suggested by their presence in the middens at Old House Creek, are edible, having what is often described as a chewier and fuller-flavor than oysters when steamed (Amos and Amos 1985:408; Meyer 1991:54).

Stout Tagelus

The species is found in the general excavation of only Midden 3, and even there as only a barely noticeable trace. It was found only in Feature 3, also associated with Midden 3, there accounting for only 1.0% of the sample by weight. This very low density of occurrence suggests that tagelus may have been accidently collected.

It is typically found in similar ecological settings as the ribbed mussel, preferring sand-mud intertidal areas where it burrows into the bottom. Collecting the species requires that they be dug out and Larson (1969:125) questions the ease with which they could be obtained. Nevertheless, he notes that they contribute noticeable, if small, concentrations to Georgia middens, suggesting at least occasionally they were intentionally collected, perhaps in the process of also collecting burrowing clams. Quitmyer (1985a:31) indicates that the collection process is rather involved, indirectly suggesting that occasional collection with other species is more likely than direct exploitation. This linkage with clams is reasonable and suggests that at best the tagelus were obtained incidental to the primary goal of clam collection.

Common Cockle

The cockle is found only in Unit 21 of Midden 1, where it accounts for only 0.1% of the sample by weight. The very rare presence of this species suggests accidental inclusion, likely in the process of gathering of other shellfish. The cockle is typically found very shallowly (under a half inch) buried in sand or mud below the mean low water in depths ranging from 1 to 30 feet (Amos and Amos 1985:398). Its preference is for sandy bottoms along beach and tidal areas.

Periwinkle

While common at Late Archaic sites, the periwinkle at this site was limited to occurrence in Features 1 and 2, both associated with Midden 5. In each feature the periwinkle accounts for only 0.3% of the sample by weight.

The periwinkle's only habitat is the salt marsh, since the snail is totally dependent upon brackish water. It feeds on algae found growing on marsh grass, shells, debris, and even the marsh surface. They are relatively easy to collect since they tend to move up and down *Spartina* in rhythm with the tides. Vernberg and Sansbury (1972:274) found a periwinkle density of up to 120 individuals per square meter of marsh during the summer. During the cold winter months, however, periwinkles tend to be conspicuously absent from the marsh (Meyer 1991:51).

They may be prepared by steaming them for about 10 minutes and then picking the meat out with a small bit of wood. The snails may also be boiled to produce a broth, with the shells sinking to the bottom of the stew pot.

Knobbed Whelk

Whelk was found only in Feature 3 associated with Midden 3, where it represents 1.0% of the feature's shell content by weight -- making it a very uncommon species.

Whelks are typically found on sandy bottoms in shallow waters, although they may also be found buried in sand flats exposed by the low tide and even in oyster beds, where they are a major predator of the oyster. In fact Larson noted that "these few large and edible snails would . . . have been picked up when found among the oysters" (Larson 1969:128). Quitmyer (1985a:32) observes that the whelk is a migratory species, with peak densities in fall and spring. During the winter and summer they typically move into deeper waters or the beach zones -- areas less likely to have been visited by the occupants of Old House Creek.

Blue Crabs

Blue crabs are typically found in shallows and brackish waters from the low tide line to considerable depths. Its adaptability, however, is amazing and crabs are able to survive even in fresh water. The male blue crab spends its adult life in the brackish water of sounds and estuaries. The female resides there until her eggs are ready to hatch, when she travels into the open ocean and releases her eggs. The crab hatchlings are swept back into the estuaries where they reach one or two inches by their first winter. While at least some crabs will found in South Carolina marshes year round, the greatest numbers occur between April and November (Freeman and Walford 1976:11; Moore et al. 1980:16).

Larson (1969:135) notes that there are an average of three to four crabs to the pound of live weight, but of this only 10% to 15% is edible meat -- making the crab a rather poor (or at least expensive) dietary choice. This, in fact, may account for its very rare presence in the Old House Creek assemblage.

Shellfish Identified at Old House Creek

Tables 1 and 4, in the previous section entitled **The Excavations**, have detailed the proveniences and percentage (by weight) of the various shellfish found during these investigations. This data is graphically presented in Figure 46. In each of the three best explored middens, oysters dominate the collections, consistently comprising more than 95% of the midden by weight. Clam accounts for between 1.5% and 3.2%. Mussel comprises only 0.2% of Midden 3 by weight, although they contribute between 1.2% and 1.8% of the weight of Middens 1 and 2.

While neither clam or mussel is especially numerous in the Old House Creek middens,

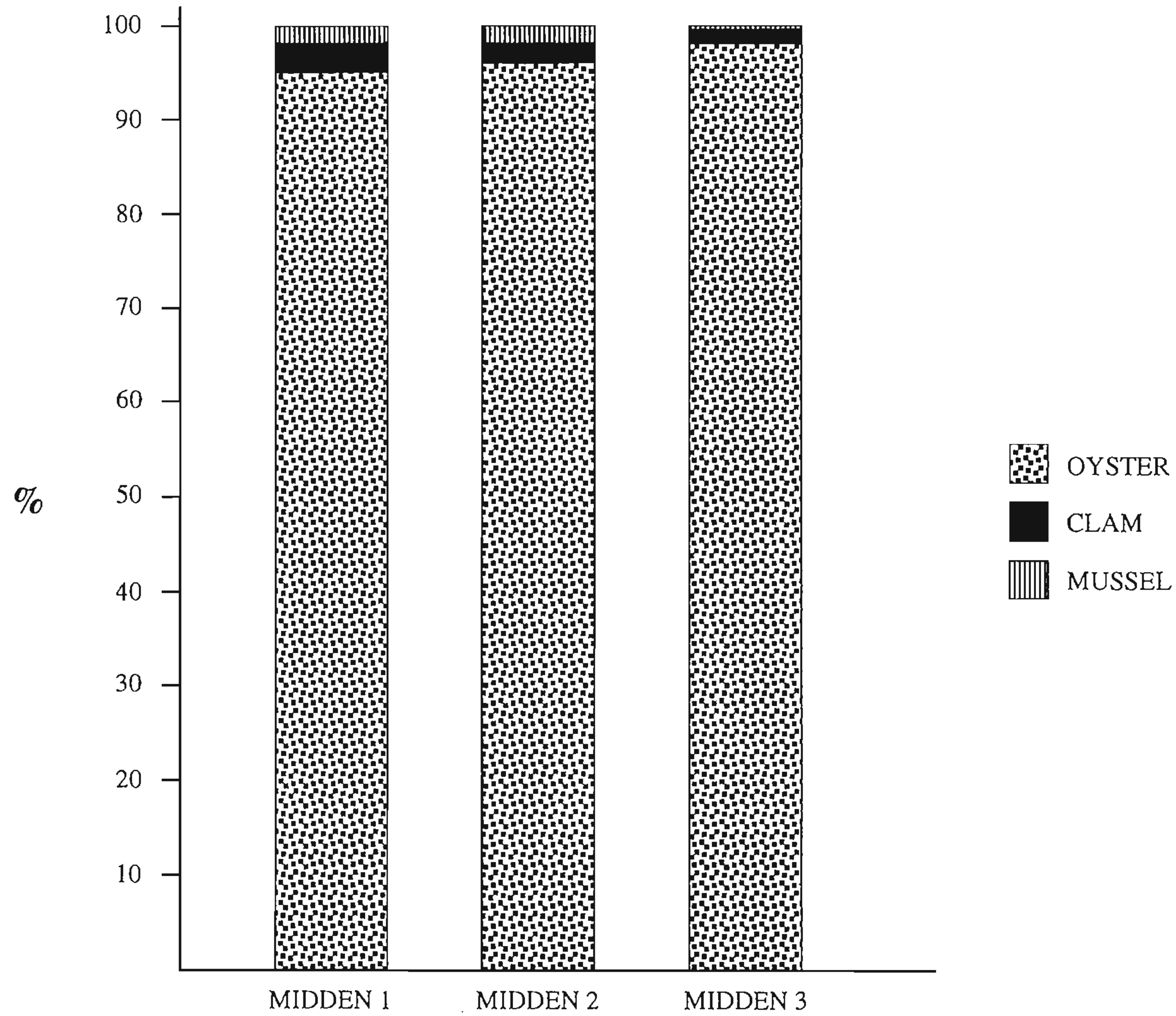

Figure 46. Shellfish found in midden excavations and features at Old House Creek.

Espenshade et al. (1994:170) have previously suggested that quantities as low as 0.8% may indicate intentional collection. If this is so then both clam and mussel may represent sought after species, rather than shellfish opportunistically collected.

Just as allometric formula are useful for understanding the biomass contribution of different vertebrate remains, they may also be used in the analysis of shellfish. Allometry, as previously discussed, is the biological relationship between soft tissue and bone mass. Biomass is determined using the least squares analysis of logarithmic data in which bone weight is used to predict the amount of soft tissue that might have been contained in the shell. The relationship between body weight and shell weight is expressed by the allometric equation $Y = aX^b$, which can also be written as $\log Y = \log a + b(\log X)$. In this equation, Y is the biomass in kilograms, X is the shell weight in kilograms, a is the Y-intercept for a log-log plot using the method of-least squares regression and the best fit line, and b is the constant of allometry, or the slope of the line defined by the least squares regression and the best fit line. Table 21 details the constants for a and b used to solve the allometric formula for a given shell weight X for each taxon identified in the archaeological record. In using allometric calculations to predict proportional biomass from shell weight it is important to note that the weight of shell used in the calculation obviously influences the results. There are a number of factors, such as differential preservation or discard practices, that may affect the weight of the shell recovered from an archaeological site. Thus, this technique of analysis may not give the precise results that the final numbers would appear to indicate.[1]

Table 21.
Allometric Values Used to Determine Biomass in Kilograms Based on Shell Weight Expressed in Kilograms.

Shellfish	log a	b
Oyster	- 0.77	0.97
Clam	- 0.50	0.94
Mussel	- 0.22	0.80

Derived from Quitmyer 1985b:40.

Table 22 provides the biomass data for the shellfish recovered from Middens 1 - 3. As expected, oyster dominates the biomass calculations, although the data further supports an interpretation that clam and mussel were intentionally sought out and collected. The biomass of minor species, such as periwinkles, whelk, and stout tagulus, was so inconsequential that it is not included in this analysis. These species may represent true opportunitistic collection, with their remains found in isolated features or midden pockets.

Table 22.
Estimated Meat Yield for Shellfish at Old House Creek

	Midden 1		Midden 2		Midden 3	
Shellfish	kg	%	kg	%	kg	%
Oyster	139.5	95.2	95.4	95.7	71.9	97.4
Clam	6.0	4.1	2.9	2.9	1.7	2.3
Mussel	1.0	0.7	1.4	1.4	0.2	0.3

Shellfish, when compared to most mammals, supplies relatively little protein. For example, 100 gms of oyster provides approximately 66 calories and 8 gms of protein, compared to 100 gms of deer meat which provides 126 calories and

[1] Kennedy and Espenshade (1992:85), using the allometric formula, comment that "to compensate for non-meat supporting shell, 82.62 percent of the total shell weight [is] utilized in the meat weight formula (Adams 1985:37)." In actuality, this adjustment was recommended by Quitmyer (1985b:37) to compensate for the dead oysters typically included in clumps. There does not seem to be any indication that he intended it to be a generalized corrective factor applied to all shellfish remains. Nor does there seem to be any particular reason to apply this factor unless there is clear and convincing evidence that the site occupants were collecting substantial amounts of dead shells. In the current study we have not used this factor, although it can certainly be applied by others using our data, if they wish.

21 gms of protein. A shellfish diet, supplemented with fish, hickory nuts, and deer meat, however, is not particularly wanting, as Table 23 reveals. In fact, shellfish as a dietary core is likely better in many ways than corn as the dietary core, since corn provides (per 100 gms) only 63 calories and 3 gms of protein.

It is not our intention to procede further with this analysis. The reconstruction of prehistoric foodways or the estimation of dietary composition is frought with difficulties. The errors of any reconstruction are magnified and compounded with every additional equation or assumption. We hope only to suggest here that many shellfish species -- such as those found at Old House Creek -- may comprise either a small, or large, portion of the diet based on our current data and level of understanding.

Table 23.
Composition of Sample Foods and Nutritional Reguirements

	Protein gms	Calcium mg	Phosphorus mg	Iron mg	A IU	B1 mg	B2 mg	Niacin mg	C mg	Calories
Daily requirements of active male	54	800	800	10	5000	1.5	1.8	20	45	3000
Clams, 100 gms	12.8	96	139	7	110	0.10	0.18	1.6	t	92
Oysters, 100 gsm	8.4	94	143	5.5	310	0.14	0.18	2.5	t	66
Mussel, 100 gms	14.4	88	236	3.4		0.16	0.21			95
Corn, 100gms	2.7	5	52	0.6	390	0.11	0.10	1.4	8	63
Deer, 100 gms	21.0	10	249	7.8		0.23	0.48	6.3		126
Hickory nut, 100 gms	13.7		360	2.4						673

Compiled from Church and Church 1966; Sebrell and Haggerty 1967; Watt and Merrill 1963

Summary

Several of the minor species found at Old House Creek are considered weak seasonal indicators. Periwinkles, for example, tend to be more common during all seasons except the winter. The blue crabs tend to be most common from late spring through late fall. The knobbed whelk would have been most readily available in the fall and spring. To this data can be added the information supplied by Claassen and Lawrence elsewhere in this study: at least one feature produced clams likely collected between March and April and odostome research suggests that least some of the oysters were collected during the fall.

The problem, of course, is that these data suggest potential occupation during all seasons except the winter. Since many of these species are uncommon to rare at the site, this scarceness may only be an indication of collection during a season of relatively low density, such as the winter (with the clam and odostome data extending occupation to the early spring and late fall).

The data are more helpful when we consider exploitation of distinct habitats. Ribbed mussel, knobbed whelk, and even periwinkles and crabs were likely collected incidental to the gathering of oysters. All three were likely found on the intertidal mud flats. During the molting process crabs seek shelter and places to cling to, both of which are offered in the shallow tidal channels. They are much easier to collect here than in the more open, deeper waters, where they are much less restricted in their movements. Ribbed mussels will be found throughout this area, especially in the high marsh at the base of *Spartina* grass and even mingle with the oysters themselves. Stout tagelus were similarly found in the process of collecting clams, frequently at the low water mark. Only the cockle represent an unusual species, perhaps reflecting exploitation, or at visitation, of a different habitat. Cockle, however, are so uncommon that not much can be made of their occurrence. In sum, the occupants of Old House Creek limited their visits to two distinct habitats -- areas suitable for collection of oysters (the primary activity) and areas suitable for digging clams (a secondary activity). In this respect they appear to be very focused, with relatively little apparent interest in diversifying their activities.

These comments must be tempered with the understanding that marshes are very complex and can exhibit tremendous diversity in relatively small areas. For example, intertidal estuarine flats commonly occur in the irregularly flooded high marsh areas. In these areas intertidal oysters are nearly ubiquitous, forming clusters or "rocks." Clams can be abundant in the lower intertidal zone of the same estuarine flats, perhaps only a few hundred feet away (Sandifer et al. 1980:263).

An 1890-1891 survey of many of the tidal creeks in the site vicinity offers one view of these habitats. Battle (1892) describes many of the creeks as "winding channels, " often surrounded by islands and mud flats, covering many acres, densely packed with oysters. He also notes the frequent occurrence of "ledges," bordering the creeks themselves, which support intertidal oysters. Consequently, while there is good evidence that several different areas of the marsh were used by the occupants of Old House Creek, it does not necessarily follow that the use of the these areas resulted in, or was the result of, particularly complex cultural decisions.

RADIOCARBON DETERMINATIONS

Beta Analytic, Inc.
Miami, Florida
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Sample Preparation

A series of five samples was submitted to Beta Analytic for radiocarbon determinations, each with the request to obtain $^{13}C/^{12}C$ ratios for ^{13}C adjusted ages. All of the samples consisted of charred material, further described in a following section. The samples were submitted on April 29, 1994 and the results were provided by Beta Analytic on May 25.

The samples were each gently fractured, bathed in de-ionized water and examined for rootlets. They were then given serial acid and alkali washes to remove carbonates and secondary organic acids, followed by a final acid rinse. After drying and final inspection, the sample carbon within each was synthesized to benzine, measured for ^{14}C content, and calculated for radiocarbon age. Two of the samples (Beta-72293 and Beta-72296) contained less than 1 gram of carbon after processing and were given extended counting to increase precision. The other samples contained sufficient carbon to allow normal counting procedures.

The dates are reported as RCYBP (radiocarbon years before present, A.D. 1950). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature. Stable carbon ratios are measured on request (as in this case), and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

Calibration of Radiocarbon Dating Results

Calibration of radiocarbon age determinations are applied to convert B.P. (before present) results to calendar years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to 7,200 B.P. The parameters for older samples up to 22,000 B.P. (not included in this study), as well as for all marine samples, have been inferred from other evidence, but have not been conclusively verified.

The Pretoria Calibration Procedure program has been chosen for these dendrocalibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. On the calibration curves accompnying this study, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). There are separate calibration data for the Northern and Southern hemispheres.

The calibrations assume that the material dated was living for exactly 20 years like, for example, a collection of individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature data. For other materials, the maximum and minimum calibrated age ranges given by the computer program could be in error. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of some younger material in the total sample. Since the vast majority of samples dated probably will not fulfill the 20-year-criterium and, in addition, an old wood effect or young carbon inclusion might not be excludable, these dendrocalibration results should be used only for illustrative purposes.

While archaeologists seem to prefer the precision implied (incorrectly) in one-sigma dates, Beta Analytic recommends that two-sigma dates, with 95% probability, be used for interpretation and discussion of the samples. The radiocarbon age, with its one-sigma standard deviation, should be listed in a table for the use of future researchers. This recommendation has been followed in this study.

Sample Proveniences and Results

Feature 2

Handpicked wood charcoal was submitted from the general excavations of the south half of this steaming pit. As previously discussed there is an indication that this pit was reused, so the charcoal may represent mixing of several episodes, although since the pit evidences no indication of sand lensing, it was likely not open or used over a long period of time. Artifacts associated with the pit include four Deptford Cord Marked sherds (catalog number ARCH-3436).

The sample yielded a date of 1800 ± 60 B.P. (Beta-72293; δ = -26.7‰) or a calibrated age of 1780 ± 60 B.P. The two-sigma calibrated range for this sample is A.D. 110 to 410, which covers the span of DePratter's (1979) Deptford I and Deptford II phases. With less precision, using a one-sigma deviation, the sample appears to date from the later portion of the Deptford I phase. Regardless, the dates are consistent for the recovered material and indicate a relatively early date for the site area in the vicinity of Units 2 and 5.

Feature 3

Handpicked wood charcoal was submitted from the excavation of Feature 3, a shellfish steaming pit. While there is some evidence that the pit may have been reused, the submitted material came exclusively from the lower levels and is thought to represent a single episode of use. Unfortunately, no ceramics were recovered from the feature. It does, however, pre-date the accumulation of the overlying Midden 3, which is dominated by Deptford (56%) and St. Catherines (34%) pottery.

The sample yielded a date of 830 ± 70 B.P. (Beta-72294; δ = -26.4‰) or a calibrated age of 800 ± 70 B.P. The two-sigma calibrated range for this sample is A.D. 1050 to 1300, which covers the span of DePratter's (1979) St. Catherines and Savannah Periods. With less precision, using a one-sigma deviation, the sample appears to date from the late portion of the Savannah Period. These dates, if accepted as accurate, dramatically increase the period during which St. Catherines pottery was being used by coastal South Carolina groups. A similar conclusion has been previously reached on the basis of radiocarbon dates obtained for the Pinckney Island research:

> The traditional chronology of the Middle and Late Woodland seems to break down on a regional basis. The Savannah and Irene phases that Caldwell (1970) and DePratter (1979) report for the period from A.D. 1200 to 1500 do not occur in the Victoria Bluff and Pinckney Island area. The St. Catherines pottery, which previously was given a terminal

date of about A.D. 1150 by DePratter (1979:111), has been dated into the sixteenth century on Pinckney Island. The continuation of essentially a Middle Woodland lifestyle well into at least the fourteenth century suggests that the late Guale intrusion was relatively minor in many areas, or at least co-existed with the native inhabitants whose lives were generally unchanged (Trinkley 1981:92).

Midden 3 (Units 1 and 7, Zone 1A)

Neither of the two units placed in Midden 3, overlying Feature 3 discussed above, produced sufficient charcoal for a radiometric dating. Consequently, samples from both units were combined in order to achieve a large enough sample of carbon. To minimize the potential for non-cultural remains only hickory nut charcoal, thought to be associated with the subsistence activities characterizing the site, were used for the date. Midden 3, as previously mentioned, was dominted by Deptford pottery (accounting for 56% of the total), although St. Catherines wares (primarily St. Catherines Cord Marked) accounted for about 34% of the total. Using the traditionally accepted dating framework proposed by DePratter (1979), this assemblage would suggest a date range of perhaps 850 years, from A.D. 300 to 1150. In addition to providing information on this particular assemblage, we hoped that the date from Midden 3 would provide some indication of how long the midden was actually used. Recognizing the degree of imprecision represented by radiometric determinations we did not anticipate a clear quantifiable date range, but rather speculated that the dates would reflect contemporanity, suggestive of short-term occupation. The alternative, of course, would be two distinct dates, more suggestive of multiple episodes of occupation and use.

The sample yielded a date of 1030 ± 80 B.P. (Beta-72296; δ = -27.4‰) or a calibrated age of 990 ± 80 B.P. The two-sigma calibrated range for this sample is A.D. 890 to 1230, which covers the span of DePratter's (1979) Wilmington II, St. Catherines, and Savannah I phases. With less precision, using a one-sigma deviation, the date almost exactly corresponds to the St. Catherines phase, A.D. 1000 to 1150.

The samples from Feature 3 and Midden 3 exhibit an overlap in the two sigma range from A.D. 1050 to 1230. Complicating this analysis is the fact that the feature yielded a later, not earlier, conventional radiocarbon age (800 ± 70 B.P.) than the overlying midden (990 ± 80 B.P.). The most conservative interpretation is that the results are ambigious and offer little information on length or intensity of midden occupation.

Feature 6

Handpicked wood and hickory nut charcoal was submitted from the excavation of Feature 6, which may represent either a shellfish steaming pit or alternatively a low point in which general midden collected. Regardless, it appears that the feature predates the accumulation of the overlying Midden 1. Material identified from this feature includes one Deptford Plain sherd and one St. Catherines Cord Marked sherd. Like other assemblages found at 38BU861, this one would seem to date somewhere between DePratter's (1979) Deptford and St. Catherines Periods, or from perhaps A.D. 300 to 1150. Given the presence of the St. Catherines sherd, it seems reasonable that the feature would be later, rather than earlier, within this range.

The sample yielded a date of 2140 ± 80 B.P. (Beta-72295; δ = -27.8‰) or a calibrated age of 2100 ± 80 B.P. The two-sigma calibrated range for this sample is 370 B.C. to A.D. 80, which spans DePratter's (1979) Deptford I phase, a period typically dominated by Deptford Check Stamped and Linear Check Stamped pottery. With less precision, using a one-sigma deviation, the date range is 190 B.C. to 10 B.C., toward the end of the Deptford I phase. This sample suggests that at least this portion of the site saw ocupation far earlier than any of the other areas radiometrically sampled and that the basal portion of Midden 1 began accumulating at least by about A.D. 80.

Midden 1 (Unit 21, Zone 1a)

Handpicked charred hickory nutshell fragments were submitted from the northeast quadrant of Unit 21. Overlying Feature 6, this midden contained about equal proportions of Deptford (51.9% of the sample) and St. Catherines (48.1% of the sample) pottery. All of the St. Catherines pottery was cord marked, while the Deptford wares were dominated by plain examples (69.1% of the Deptford collection). Deptford Cord Marked sherds accounted for 26.2% of the Deptford wares and simple stamped was found on only 4.7% of the Deptford pottery. This assemblage suggests a Deptford II through St. Catherines phase, perhaps A.D. 300 through 1150 (DePratter 1979).

The sample yielded a date of 1350 ± 60 B.P. (Beta-72297; δ = -28.7‰) or a calibrated age of 1290 ± 60 B.P. The two-sigma calibrated range for this sample is A.D. 650 to 880, which spans DePratter's (1979) Wilmington II phase, lying between the Deptford II and St. Catherines phases, and characterized by a type of pottery not found in Midden 1 (and found at Old House Creek in only very small quantities).

This date may represent a mid-point in a continuum of Deptford and St. Catherines pottery or it may represent an artifical date resulting from the mixing of charcoal from two discrete assemblages. At the present time it is not possible to determine which explanation offers the best fit or explanation.

Summary

Most of the radiocarbon dates present for Old House Creek fall into a relatively long period representing the date range expected for Deptford and St. Catherines wares (see Table 24). Beyond the obvious, however, the radiometric dating failed to provide clear and consistent information on pre-midden and midden occupations. While we are confident that the $^{13}C/^{12}C$ ratios provided vastly more accurate ^{13}C adjusted ages, the study perhaps best illustrates two of the most serious failings.

First, the use of material from non-sealed or single-episode contexts (such as the combination of hand picked charcoal in general excavation levels) introduces a potentially fatal flaw into the methodology. Although the inherent problems were immediately recognized, we hoped that judicious selection of proveniences and materials would minimize the problem. It is now more apparent that the combination of charcoal found interspersed throughout the midden makes it impossible to determine whether the middens represent one group using both Deptford and St. Catherines wares, two successive groups using different wares, or the same group using a slowing evolving ware. Ideally only charcoal from sealed contexts clearly representing one episodal activity should be used for dating. This, however, would likely eliminate the use of coventional radiometric dating, leaving little in its place.[1] Perhaps a more fruitful approach is selecting charcoal from relatively thin horizontal lens of the middens and using extending counting techniques to increase precision.

Second, and related to the first issue, is the relatively small sample sizes being dated. Although five dates were obtained, each with $^{13}C/^{12}C$ ratios, this represented two different middens and three different site areas. At most each midden received only two dates -- one from the base of the midden and the other from within the midden. While in an ideal world this should be sufficient to indicate generalized midden

[1] This is not, of course, entirely true. A possible alternative is AMS analysis, or accelerator dating. It has been long recognized that the analysis of bulk organic carbon results in an "average" radiocarbon date based on multiple components — open to criticism or potential error. An AMS date, on the other hand, can be obtained on a component of unique age, perhaps a single fragment of charcoal or a single fragment of charred hickory nutshell. Dates with the same precision as found in standard techniques requiring 5 to 10 g of charcoal can be obtained through AMS with samples as small as 0.002 g. Subjectivity would be reduced to interpretation of the single component whose origin can perhaps be more easily traced and documented. AMS dates, however, costs approximately $550, even heavily subsidized by the use of government laboratory facilities, about twice that of standard radiometric dating. In addition, depending on the work load of the lab, AMS dating can require upwards of 90 days.

Table 22.
Radiocarbon Dates from Old House Creek

Lab Number	Provenience	^{14}C Age Years B.P. ± 1δ	$^{13}C/^{12}C$ ratio	^{13}C Adjusted Age
Beta-72293	Fea 2, S½	1800±60 B.P.	-26.7 ‰	1780±60 B.P.
Beta-72294	Fea 3	830±70 B.P.	-26.4 ‰	800±70 B.P.
Beta-72295	Fea 6	2140±80 B.P.	-27.8 ‰	2100±80 B.P.
Beta-72296	Unit 1/7, Zone 1a	1030±80 B.P.	-27.4 ‰	990±80 B.P.
Beta-72297	Unit 21, Zone 1a	1350±60 B.P.	-28.7 ‰	1290±60 B.P.

occupation spans, the real world is less tidy. Perhaps the approach is not viable. But it is also possible that the approach simply needs larger samples to smooth out irregularities, ensure better representativeness, and offer greater statistical precision.

As a result, we would propose that where individual middens are discernable, these two steps should be integrated: small samples from only narrowly defined horizontal levels should be taken and these samples should be maximized throughout the midden. Since it appears that two samples are inadequate, we would conservatively recommend doubling the number to four dates per midden and basal midden area -- even if this means that only one midden can be dated at a specific site. Since it will likely be impossible to know, in the field, which middens will produce the best samples of ceramics, or the greatest number of discrete carbon samples, all middens investigated must be equally well sampled to allow the greatest possible flexibility in the lab analysis.

While not conclusive, this study does compound the evidence pointing toward a continuum of Deptford and St. Catherines wares, as well as to a continuation of the St. Catherines Period into the thirteenth and fourteenth centuries. This view was previously proposed as a result of work on Pinckney Island (Trinkley 1981). If, as suggested by the current evidence, the Middle Woodland lifestyle continued into the Late Woodland Period, the resulting cultural conservativism may be reflected in many other areas. For example, this may help explain the presence of relatively few large Late Woodland villages and the apparent absence of corn agriculture until very late along the coast. The study may also suggest that rote application of even nearby sequences, such as that developed by DePratter for the northern coast of Georgia, may be inappropriate for the lower South Carolina coast.

Supporting data was obtained from excavations at 38BU1214, 38BU464, and 38BU19 on Callawassie Island in Beaufort County. Site 38BU1214 yielded an uncorrected date of A.D. 930 for a Deptford feature (Trinkley 1991:91), further suggesting a very late continuation of Deptford pottery into the Late Woodland. Meanwhile, two nearby sites on Callawassie Island produced uncorrected dates of A.D. 750 and A.D. 980 for St. Catherines contexts (Trinkley 1991:71, 82). A site on Hilton Head (38BU833) yielded an uncorrected date of A.D. 1130 for a St. Catherines and possibly Savannah component (Trinkley 1992:25).

Recently, Espenshade et al. (1994:64-79) have reported four dates from their investigation of Deptford and Wilmington middens at 38BU2. These dates, all $^{13}C/^{12}C$ corrected, range from 4 B.C. ± 49 to A.D. 685 ±77 (only two lab numbers are offered, UGA-6546 and UGA-6634, and 2δ dates are not provided). These dates, with the associated remains, suggest to Espenshade and his colleagues that the Wilmington wares were introduced early along the South Carolina coast, co-existing with the Deptford wares. If so, then it would appear that the Deptford continuum offers tremendous variability, incorporating both Wilmington and St. Catherines pottery.

These data are presented in Figure 47, which illustrates a number of radiocarbon dates on Deptford and St. Catherines sites in Beaufort County. With but a few exceptions, the range of

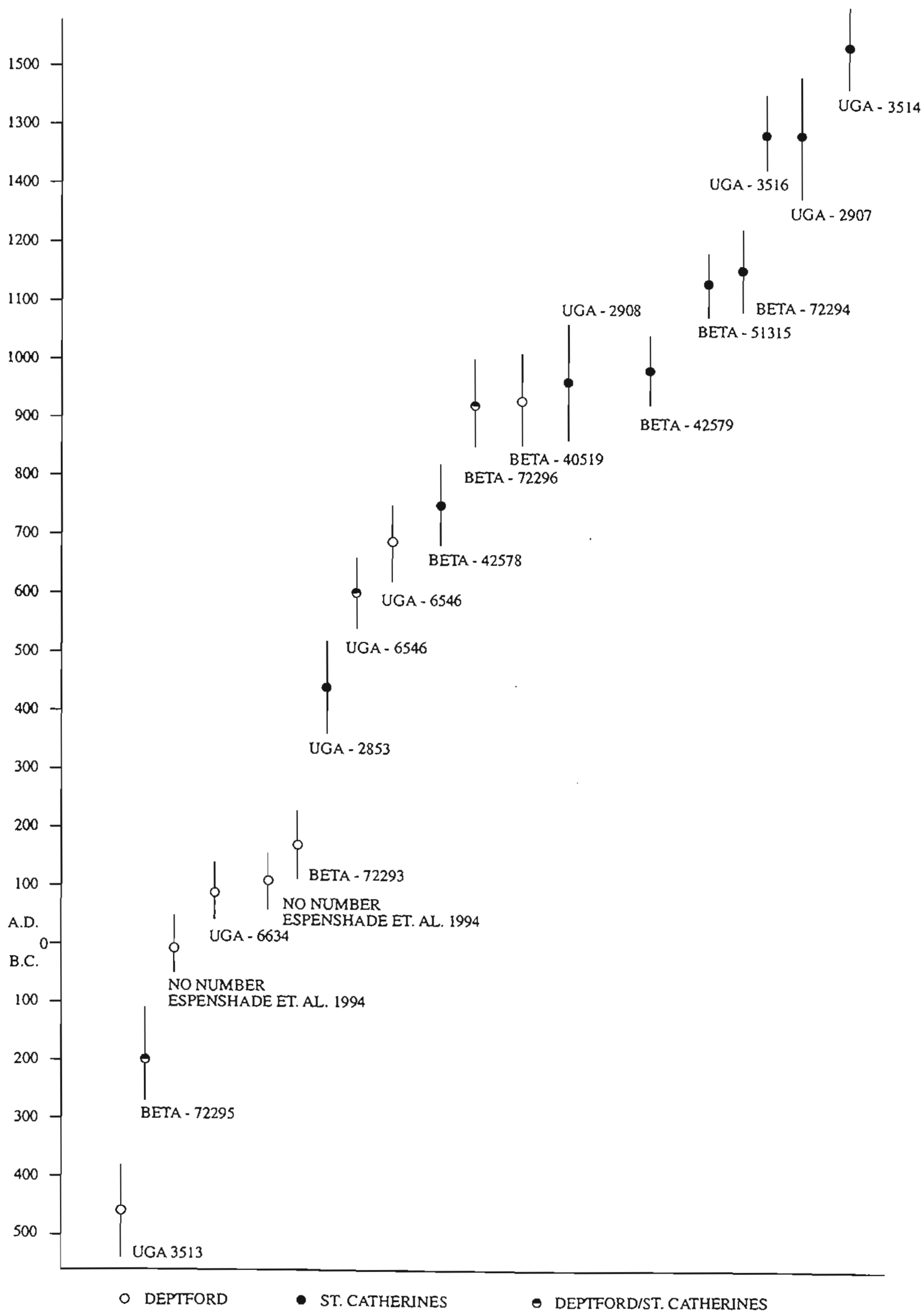

Figure 47. Chart illustrating the clustering of 19 radiocarbon dates available for the Deptford and St. Catherines sites in the Beaufort, South Carolina area.

dates reveals that most of the Deptford dates cluster between about A.D. 100 and A.D. 700, while most of the St. Catherines dates occur after A.D. 900. This, of course, tends to support DePratter's reconstruction and suggests that the dates may be less anomalous then at first thought.

Anderson (1994:367-368) briefly reviews some of the preliminary data suggesting a continuation of Late Woodland ceramics into the Mississippian. He notes that:

> the relationships between Woodland and Mississippian occupations in the lower and middle Savannah drainage, particularly the mechanisms bringing about the transition between these seemingly markedly dissimilar forms of social organization and subsistence adaption, will undoubtedly serve as a focus for much further research (Anderson 1994:368).

SUMMARY AND CONCLUSIONS

A wealth of data, sometimes conflicting, has been presented in these discussions. The investigations at Old House Creek opened a total of 700 square feet at five middens and 200 square feet at non-midden areas. The bulk of the excavations were screened, minimally, through ¼-inch mesh, although consistent samples of midden and features were water screened through ⅛-inch mesh. Each midden's size and orientation was plotted in the field and the site area was explored using primarily 20-foot auger testing. A topographic map was prepared using a 0.25-foot contour interval. Shell:soil ratios were obtained from each midden, using a standardized procedure. Pollen samples, examined by Dr. Arthur Cohen at the University of South Carolina, were collected from below and within middens. Carbonized floral materials were collected from feature flotation and from handpicking of water and dry screenings. Faunal samples were collected primarily from the ¼-inch screening, supplemented by the water screening, and were examined by Dr. Jack Wilson at the University of Vermont. Shellfish columns were collected from each midden, both for specialized examination of the oysters by Dr. David Lawrence at the University of South Carolina and for species tabulations (typically conducted by volunteers in the field). Five radiometric dates were ultimately obtained for two middens and processed by Beta Analytic. Clam shell seasonality was examined for one feature (the only feature yielding a sufficient number of clams) by Dr. Cheryl Claassen at Appalachian State University. Odostome research was conducted by Dr. David Lawrence using several proveniences and was evaluated for its future potential. The pottery recovered from the site was examined, with special attention paid to paste and fabric attributes. In addition, the University of Georgia performed X-ray fluorescence analysis of one sample, offering a tentative look at the paste and its inclusions. This section will help synthesize the presented data and explore their meaning.

Proposed Research Questions

Broadly speaking, the research at Old House Creek had three goals. Looking back, these were far more ambitious than our level of research allowed, but we believe that the studies have been exceptionally worthwhile.

First, we hoped to explore the typological validity of the St. Catherines pottery type. The initial testing results, which identified only St. Catherines pottery, was encouraging, since it suggested the site might represent a "pure" St. Catherines midden. We found, as more auger tests were screened and more units were opened, that the site included not only St. Catherines pottery, but also Deptford wares. Why the initial testing failed to reveal this diversity is not clear, but even a second examination of the ceramics recovered by the testing program reveals only St. Catherines pottery was recovered. This diversity resulted in our need to explore the validity of the St. Catherines type in relationship with the Deptford wares, introducing a variable which was difficult to control. Regardless, we believe that the study has made substantive contributions to our understanding of the St. Catherines "type," with the ultimate suggestion that it be subsumed within a type-variety system similar to that proposed by Dr. David Anderson (Anderson et al. 1982) as a result of the Mattassee Lake work.

Second, we hoped that careful attention to individual middens would help further our understanding of community patterning. While this interest is often subsumed under the category of "settlement system" research, Trigger (1968, 1978) points out that archaeologists typically study settlement systems "based on the assumption that the settlement pattern is a product of the simple interaction of two variables -- environment and technology" and that this approach usually investigates how the settlement system or pattern "reflects the adaptation of a society and its technology to its environment" (Trigger 1968:54). While Trigger does not reject this approach, he notes that archaeologists can also profitably explore settlements at a different level -- that of how individual buildings or structures (or middens) are arranged within single communities. Likewise, he does not reject the importance of environmental constraints:

> [ecological factors] will determine, for example, whether or not a community can complete its annual subsistence cycle at a single site, and whether a single site can be inhabited permanently. . . . When such sedentary life is not possible, a community may have to occupy a network of scattered settlements in the course of a year (Trigger 1968:61).

Under such circumstances the community might be forced to scatter into small family groups during at least certain seasons and the community, as socially defined, would be associated with more than one settlement or archaeological site. Trigger comments that our understanding of these dispersed settlement patterns will depend on understanding:

> whatever nuclei exist in the pattern and on estimations of the size of a community that could be associated with a particular mode of subsistence. Then, on the basis of complementary distributions, the pattern itself could be worked out, at least as a statistical possibility (Trigger 1968:61).

While the community size and even specific site locations are influenced by ecological factors, Trigger observes that the layout of the community itself will be more strongly influenced by family and kinship organization.

Finally, we intended to offer a more integrated environmental approach, emphasizing the dynamic interactions between the human group or groups at Old House Creek and the environment surrounding the site. At the grandest scale we hoped to focus on human ecosystems and integrate methodologies from at least biological and social sciences. Efforts to incorporate a physical science (i.e., geo-archaeological) approach was almost immediately unsuccessful because we were not able to locate the expertise necessary. While we doubted that one, especially brief, study could result in major changes, our goal was to develop an interest in productive interdisciplinary thinking. Environmental studies, of course, are one of the oldest interdisciplinary bridges in the field, although they are often taken for granted. We hoped to re-focus attention on understanding the interrelationships of the ecofacts present at the site -- which is, after all, the ultimate spirit of ecology.

Within these three broad areas of research interest, we developed a series of more easily definable questions. Some were purely methodological, while others approach (at least tentatively) understanding how the inhabitants of Old House Creek lived.

Our study of ***intrasite patterning*** focused on a variety of issues, including the adequacy of the sample size, the prospect of better than average results using auger tests at a 20-foot interval, possibly using auger tests to project cultural associations, and using a variety of techniques to identify and interpret midden distribution and orientation. The study of ***specific middens*** focused on evaluating the potential range of occupation through the use of radiometric dating, defining and exploring midden and non-midden areas, examining the distribution of artifacts across the site, investigating the use of both ¼- and ⅛-inch mesh for collection of data, and using pollen to evaluate changes in the site environs. ***Artifact research*** focused on what traditionally is the most common artifact type -- pottery. Within that category we were especially interested in paste and cordage. The paste, we hoped, would help define St. Catherines ware. The cordage, we hoped, would help define different kin groups within the community organization of the site. To this we added an interest in exploring the potential of x-ray fluorescence (XRF) to help us understand any potential differences in the paste and the posited temper of St. Catherines pottery. Our ***ecological research*** was generally stated as an effort to incorporate all of the different ecofact research into one environmental perspective. The results of each of these different areas will be briefly addressed.

Intrasite Patterning

As previously explained, the excavation of about 900 square feet accounts for an incredibly small percentage of the total square footage of 38BU861 (less than 0.02%). Viewed from a different perspective, the investigation of just under an acre of the Old House Creek midden area amounts to about a 10% sample of the site -- a seemingly more reasonable sample. Since the investigations incorporated study of areas not actually excavated (such as identification of middens through auger testing), the 0.8 acre study area (defined on the basis of the auger test grid), represents approximately 50% of the site area within the development tract (and hence available for study). Based on the recent study by O'Neil (1993), this seems to be a realistic sample, capable of addressing the variation typical at the site.

One reason the initial survey identified only St. Catherines wares may be the very small sample size of this early work -- auger testing 0.3 acre at 20 intervals and the excavation of four 5-foot units. O'Neil found that "clearly diagnostic artifacts from the earliest and the latest occupations of the site failed to show up" in excavations amounting to 23% or 38% of the site. It was only at about a 50% sampling fraction that the total complexity of the site was realized (O'Neil 1993:527).

Consequently, our findings concerning sample size seem to parallel those of O'Neil. Limited testing is likely to provide skewed results -- certainly a conclusion which will draw little debate. More significantly, it seems that a sample size of 50%, calculated at least on the basis of area investigated, if not on the basis of actual square footage excavated, is necessary to arrive at a reasonable level of representativeness.

Auger testing at a 20-foot interval seems to work, by which we mean that it seems to provide good detail concerning shell density (and hence likely midden areas), as revealed by our computer generated density maps (see Figure 21). When the data are examined using tests at 40-foot intervals, the information return is very thin, offering no real understanding of the site. Testing at 20-foot intervals also offers a range of artifacts. In this particular study it yielded 67 sherds, five bone fragments, and two flakes. Taken as a whole, the collection is adequate to correctly reconstruct the major temporal affiliation of the site and provide some information on the range of activities taking place (bone indicating some exploitation of mammals and the flakes indicating retouching of coastal plain chert artifacts).

The only real question is whether 10 foot auger testing intervals provide even better recognition of middens and recovery of artifacts. Although a portion of the site was examined using 10-foot interval testing, this question was not decisively answered by the Old House Creek study. We found that the area chosen for the more detailed 10-foot study incorporated a large area of Middens 1 and 8 -- both very large and dense. We found that the 10-foot intervals did not dramatically improve our understanding of these middens. In fact, the very close interval, in some ways, made our understanding more difficult -- being something like looking at an elephant through a magnifying glass. We suspect, however, that had the very close interval been in another area of the site -- one with less overwhelming middens -- it might have helped us understand individual midden boundaries better and it would have contributed a larger artifact sample. Consequently, our results here are qualified and additional research (incorporating an entire shell midden site at a 10-foot interval) is clearly worthy.[1]

The research was exceptionally successful at identifying the shell middens present within the study tract and also in helping us understand something of their organization. In the 260 by 140 foot study area nine individual middens were identified. Most were within 100 feet of the current marsh and all were above 10 feet AMSL (that is, above the wet, mucky soils typical of the lower elevations). The middens tended to get smaller

[1] We have explored this question in more detail at 38BU833, a Middle Woodland shell midden also situated on Hilton Head Island. While the results have yet to be interpreted, the research should be available within the next several months (see Adams 1994 for a brief review).

farther inland. There is also some indication of the middens being clustered. For example, within the study tract, there are four middens within an area of 120 by 90 feet (or 0.2 acres). In other words, nearly 45% of the middens were found on about 25% of the study tract. This clumping effect, perhaps indicating a nucleated settlement, has already been pointed out as needing additional research at other sites. Our effort to further explore this exciting phenomena, through a technique such as nearest neighbor analysis, proved impossible with the small sample sizes available.

The middens were found to cluster in size between 92 and 252 square feet, although there is clearly a great range in size. The larger middens, however, may represent similar amounts of shell as in the more modest middens, simply spread out over larger areas (based on our shell weight data). Again, further research is necessary, especially since our data here is biased by our inclination not to excavate in large dense middens, but rather to explore their periphery.[2] The available data also suggests an inverse relationship between the shell:soil ratio and the midden size in square feet, with the larger middens tending to have a lower shell:soil ration and the larger middens tending to exhibit fill dominated by soil. This also seems to support our idea that larger middens are simply small middens more spread out and trampled down.

Midden Research

It is clear that the intrasite patterning studies blend into the broad range of midden-related research topics. It is equally clear that our studies of midden and non-midden areas leave much room for additional work. A total of 575 square feet of Middens 1-3 was excavated, compared to 250 square feet of adjacent areas (using our initial definition of adjacent being within a 50-foot diameter of the midden). There does seem to be some indication that this admittedly arbitrary 50-foot mark may be too liberal. Artifact density declines dramatically more than about 10 feet away from the midden toe. Refuse -- shellfish, animal bones, and broken pottery -- seems to have been rather concentrated. While there are occupation areas, such as that found in Area 5, the sample is entirely too small to permit speculation. Curiously, this particular occupation area is associated with only a very small midden and it is nearly 200 feet from the marsh edge. Present at this site area, however, are the remains of what appears to a St. Catherines house -- a series of post holes suggesting a semi-circular to circular structure about 7 feet in diameter. This is reminiscent of a rustic -- and temporary -- shelter, perhaps designed to simply break the wind coming in off the marsh during the cool season.

The presence of large numbers of heavily crushed sherds (amounting to nearly 80% of the collection) suggests there was considerable pedestrian traffic on and around the middens. This is also suggested by the relatively few apparent cross-mends of pottery. We offer this interpretation cautiously, however, since cross-mends were not a direct goal of the analysis, but were only noted when obvious. Additional research, focusing on the prevalence of cross-mends and their locations, may help us to understand the formation of these middens.

The five radiocarbon dates obtained from Old House Creek are very useful in understanding the site, although not in the way intended by our initial research design. The corrected, one-sigma dates range from about 2100 B.P. to about 800 B.P. -- a seemingly exceptional range for a site producing primarily Deptford and St. Catherines pottery in firm contexts. Yet, with a little more inspection most of the dates fall into the range we might expect for these wares. Like at other sites there is once again a tantalizing hint that there may be a continuum of Deptford and St. Catherines wares, as well as a continuum of the St. Catherines phase into the perhaps the thirteenth or

[2] We have traditionally not wanted to attempt the interpretation of large and complex middens with limited time and resources for excavation -- resulting in rather tentative or even timid attempts to generate data by exploring the margins. In retrospect, this has been a poor decision and it seems important now to tackle these large middens. It may be here that micro-stratigraphy will become apparent, or alternatively, that it will be obvious that the middens have been spread out, perhaps by pedestrian activity. As previously discussed, one reviewer suggests that these large middens, if nothing else, be bisected without screening or soil processing, just to explore such issues.

fourteenth century A.D.[3] The extraordinary cultural conservativism expressed by the coastal tribes may have its roots in long-established Woodland Period traditions. If this is so, then it may have considerable impact on a broad range of additional questions -- the introduction of agriculture, the transhumant subsistence rounds proposed by Milanich (1971), and even the nature and purpose of Guale sites found in the Beaufort area.

We were not, however, successful at using radiometric evidence to evaluate the potential range of occupation at the middens. While this may have been a naive undertaking, we believe that its failure can be traced to the use of charcoal from non-sealed contexts (such as the combination of hand picked charcoal in general excavation levels) and the small sample sizes which allow little or no margin of error. These problems are real, but not insurmountable. Ideally, only charcoal from sealed contexts should be used,[4] but when this is impossible (as it likely will be for many occupations), it may be helpful to minimize the mixing of charcoal by using smaller samples coupled with extended counting times. We have previously discussed the option of using AMS dating for very small charcoal samples, such as a single fragment of hickory nutshell. This approach would avoid the averaging effect of larger bulk samples and almost certainly provide more secure dates. It will, however, be necessary to increase budgets to permit the use of technique and it will also be essential to ensure that projects budget the additional time necessary for AMS dating. Since charcoal tends to migrate more easily than intact shells, it may also be useful to begin comparing charcoal and shell dates to determine if the two are consistently in agreement. It may also be useful to date a larger number of individual samples from individual middens. Having four to six dates per midden may help to smooth out irregularities, ensure better representativeness, and offer greater statistical precision.

The pollen analysis, we believe, shows tremendous potential. While only two of the five samples revealed relatively good preservation, those two samples suggest ecological change occurring between the pre-midden and midden occupations. The midden sample revealed greater variation in species when compared to the pre-midden sample, perhaps as a result of the forest being opened up by human actions and disturbances. It seems clear that pollen analysis can contribute to our understanding of site ecology, but that a number of samples will be required for reliable results.

Finally, turning to a methodological issue, we found once again that the use of ⅛-inch mesh did provide evidence of fish remains at the site (a conclusion documented by a number of zooarchaeologists, but often ignored by field archaeologists). Without the use of this recovery technique the presence of the single fish species identified would have gone unrecorded. It could be argued that this single fish species is inconsequential -- both to the original site occupants and to our interpretation of past human behavior. This may be correct. It is certainly true that (as will be briefly discussed below) the biomass of the site is heavily weighted toward shellfish. Vertebrate remains contributed only a couple of percentage points at most, and fish comprised only a very small fraction of that contribution. On the other hand, the fish present are small and were probably caught in the upper reaches of the tidal creek. That so few are present suggests they may been collected from a tidal pool, likely while the Indians were collecting oysters. Consequently, the information from the ⅛-inch screen does offer us a better understanding of the site occupants. Of course, only a small sample (typically a quarter of the total soil volume) of each midden was waterscreened. It is likely that our recovery efforts would have been better had at

[3] We are sensitive to the fact that many colleagues will be hesitant to accept such long ranges. One of our reviewers adamantly rejects Deptford running as late as A.D. 930 and is only reluctantly willing to accept St. Catherines running to about A.D. 1500 on the South Carolina coast. Clearly the evidence for these ranges is tenuous, pointing out the need for additional work to either confirm, or reject, these suggestions.

[4] This view was also strongly expressed by one reviewer, who understandably noted that radiocarbon dates should be taken wherever possible from tightly sealed and unambiguous contexts such as pit bases or hearth bottoms. We agree with this recommendation, but point out that some shell middens have relatively few features; often these features produce little charcoal; and very often the features contain relatively few diagnostic artifacts.

least 50% of the soil been waterscreened. Was that additional information worth the effort, or put another way, was it cost-effective? We believe that it was, since much of the water-screening was done by volunteers.[5] The use of volunteers to collect this kind of information, that might not be cost-effective to collect otherwise, points out the importance of integrating the public into archaeological research. Is there a compelling reason to recommend that the quantity of waterscreened soil be increased to a 50% sample? This question is more difficult, especially since waterscreening can be logistically draining and volunteers are often an unknown commodity.

The use of 1/16-inch mesh is harder than ⅛-inch to justify. No additional information, during this study, came from the 1/16-inch screening. Whether this is representative of all middens we do not know. It seems reasonable to recommend the continued use of 1/16-inch mesh screening for the present time, although we acknowledge some skepticism that it will not be highly productive.

Artifact Research

Pottery was the most noticeable artifact at Old House Creek, although lithics and a single sherd hone (which implies the presence of bone or wood artifacts) were also identified.

While the ceramic analysis produced a broad spectrum of results, a few are worthy of special attention. Overall, the Deptford and St. Catherines wares were found to be very similar. Seventy-three percent of the Deptford wares evidenced a right or S twist of the cords, while 79% of the St. Catherines cord marked pottery also shows a right or S twist. This stands in contrast to most of the previous sites on which cordage analysis has been conducted, which suggested that left or Z twists were most common. About a third of the Deptford vessels suggest use over an open fire, perhaps in cooking. The number of St. Catherines vessels used this way may be as high as two-thirds. It seems clear that, unlike more interior Yadkin pottery, these vessels were primarily used for food processing.

The study suggests that the continuity between Deptford and St. Catherines is very strong. If the difference in temper is ignored, the two wares become virtually impossible to separate, at least at Old House Creek.

Our physical inspection of the St. Catherines temper failed to reveal any compelling evidence that sherds were being used. In fact, the temper can be removed from the surrounding paste with only a great deal of difficulty. We found considerable variability in the temper of St. Catherines sherds, both in size and frequency of inclusion. All of these factors suggest (but do not prove) that *the paste and temper are very similar.* A likely explanation is that the temper represents partially dried lumps of clay which have been incorporated back into the clay during the forming of vessels.

The chemical study of the St. Catherines sherd and associated temper reveals that the two are chemically distinct. One explanation is that dried paste (perhaps representing either left-over clay or even fragments adhering to mats or other items used in pottery manufacturing) from one episode of pot making was incorporated into the next episode. This would result in the paste and temper having different chemical signatures, but since the temper was only air or sun dried clay, it would be physically difficult to physically separate the two.

Comparison of the pottery between the middens reveals that the various types are found in consistent percentages. This may suggest that all three middens are generally contemporaneous or alternatively that there was considerable stability of the various types over time. In spite of this, there are some attributes which suggest that the wares in the individual middens are distinct from one another. While still tentative, we believe there is

[5] Our reviewers have mixed feelings regarding the use of volunteers, which we can appreciate. We, however, are convinced that their use is not only appropriate, but essential. As funding for archaeological research is threatened, it becomes increasingly important to find new and different ways of collecting important information. We believe that carefully instructed and supervised volunteers offer that potential. One reviewer pointed out that water screening should be conducted, regardless of the availability of volunteers. While we don't disagree, we are faced with a broad range of methodologies which "should" be incorporated, often in the face of limited funds. It is important for all of these issues to be considered in the development of research plans for archaeological sites.

sufficient evidence to suggest that the middens represent distinct family or kin-based refuse deposits with different potters contributing slightly different wares to each deposit.[6]

The lithic analysis revealed not only the presence of probable local materials, such as the coastal plain cherts, but also extra-local materials, such as the soapstone and metavolcanics. This suggests the presence of either a trade network with tentacles reaching into the South Carolina piedmont, or else rounds allowing these materials to be collected. While it seems reasonable to imagine seasonal rounds which incorporated chert outcrops in the Allendale area, it is less likely that the site occupants were collecting soapstone or even the metavolcanics. Sassaman (1993) has elsewhere provided a very cogent discussion of early soapstone use and production, tying it to social relations, trade, and the emerging ceramic technology. While he clearly shows a decline in soapstone use during the Late Archaic and Early Woodland (as ceramics take the place of "stone boiling"), there is little data on its use into the Late Woodland. Anderson (1994:201) briefly recounts the evidence suggesting that soapstone working and trade continued into the Mississippian Period, although by this time the raw material was being transformed into discoidals and pipes. Items such as that found at Old House Creek may represent a highly curated item, although it more likely suggests the gradual emergence of a new trade network. The assemblage also reveals that while extra-local materials were present, relatively little work beyond resharpening was taking place at Old House Creek. The lithics at the site were limited and they evidenced exceptional reworking, sharpening, and eventual discard.

Exploration of the lithics also revealed the presence of a possible lithic work station, removed from the middens, but closely associated with the posited St. Catherines structure. This occurrence of lithic work areas separated from the middens has been found at least at one other site (38BU1214 on Spring Island).

Turning to the subsistence remains, Old House Creek offers a relatively large assemblage. An examination of the faunal remains found that the collection exhibited a very low diversity, with a small number of taxa supplying the bulk of the biomass. The high equitability index for the MNI suggests that a number of taxa were being exploited, although there was a strong focus on wild mammals -- such as deer and raccoon -- which contributed 80% of the MNI and 99.9% of the biomass. There was relatively little seasonality evidence in the vertebrate faunal collection, although the presence of silver perch weakly suggests a fall occupation. Perhaps more importantly, the absence of rodent gnawing on the bone remains suggests that they were quickly buried, consistent with the absence of lensing or microstratigraphy at the site. This, in turn, may suggest that the site was intensively used during its period of occupation. That is, rather than the middens gradually forming over weeks or months, they may have formed within days or a few weeks.

The ethnobotanical remains found a wide variety of wood charcoal, suggesting that foraging activities incorporated a broad range of environments, including the dry uplands, the more mesic marsh edge, and even wetland areas. In spite of the variety, the dominance of pine (which also dominates the pollen record) suggests that the site area was characterized by a pine sub-climax forest. Stands of hickories may have existed as "islands" in the pine forest, focusing human occupation in relatively narrow areas along the marsh.

Other floral remains, such as charred hickory nuts, viburnum seeds, and palmetto seeds, are all suggestive of a fall or winter occupation. Even the failure to recover weed seeds (which should be present in a disturbed habitat) may make sense if the site had a cool weather orientation.

Shellfish was the most important food source present at Old House Creek. The three middens investigated contributed between 97.7% and 99.9% of the biomass present in each midden. Faunal remains, in comparison, contributed only 0.3% to 1.7%.

The shellfish at the site were dominated by oyster, comprising on average 96.8% of the

[6] One reviewer suggested that the on-going work by Keith Stephenson at Swift Creek middens in Georgia, as well as Ken Sassaman's work at Mim's Point in South Carolina may offer parallel evidence.

middens by weight. Examination of the specimens present suggest that middle to high intertidal clusters and scattered individuals from the lower intertidal areas were primarily used. There is also some evidence in one midden of the maximum oyster size decreasing through time. This finding is difficult to interpret, however, since we do not know the length of time represented by the midden. If the bulk of the evidence is correct and the midden represents a relatively short duration, then the decrease in oyster sizes may mean that the site occupants focused their attention on the marsh very close to the site, rapidly depleting the large oysters and turning to the smaller intertidal clusters. Although the oysters failed to offer seasonality data, the odostomes recovered from two samples are suggestive of a late fall occupation -- consistent with the floral remains.

There are other shellfish present at Old House Creek, although admittedly they are relatively uncommon. For example, clams account from 1.5% to 3.2% of the various middens by weight, while ribbed mussel ranges from 0.2% at Middle 3 to 1.2% to 1.8% at Middens 1 and 2. Both probably represent intentional, if opportunistic, collection. Periwinkles, whelk, and other remains suggests incidental inclusion, without any real effort at collection.

Examination of the clam shells from Feature 3 at the base of Midden 3 present a different view of the site's occupation. They suggest death from March to April -- during the spring. Only if a broader interpretation of the data is used do the results encompass the period from December through April. Admittedly, not too much can be made of this information as it reflects only one feature and Claassen warns that it cannot be taken as representative of the site as a whole.

The other shellfish are typically weakly suggestive of cool weather collection. For example, the knobbed whelk tends to be most common in the fall and spring. The near absence of periwinkles may be explained by their preference for warmer weather.

Ecofact Research

Karl Butzer has indicated that:

> the primary goal of environmental archaeology should be to define the characteristics and processes of the biophysical environment that provide a matrix for and interact with socioeconomic systems, as reflected, for example, in subsistence activities and settlement patterns. The secondary objective of this and of all the contributing methods is to understand the human ecosystem defined by that systemic intersection (Butzer 1982:6-7).

In a similar way, we hoped that our study at Old House Creek would re-focus attention on the biophysical environment as it affected and was affected by the culture of the occupants. Butzer also outlines five central themes in ecological studies: space, scale, complexity, interaction, and stability or equilibrium state.

The concept of space recognizes that rarely are cultural and ecological phenomena distributed evenly. A range of different factors, such as topography or climate, may affect human groups. At Old House Creek, we have found that occupation was perhaps drawn to this particular location because of its topographic setting (above 10 feet AMSL today) and its proximity to the appropriate marsh environment -- both rather broad parameters. It is likely that the presence of a fresh water spring just a few hundred yards from the site was a more significant feature, just as was the posited presence of hickory trees in a fire sub-climax forest dominated by pines.

Scale may be spatial or temporal. We may view our problem from the vantage point of a microscale or macroscale. Consequently, pollen analysis may explore the microscale of the immediate site area, represented by a small cluster of trees, or it may be viewed at a macroscale, indicative of the regional mosaic. Our understanding of scale is made more complex by adding a temporal or diachronic framework: seasonal rounds or even cyclical changes in the environmental conditions. The bulk of our work at Old House has focused on the micro, or at most mesoscale, while attempting (rightly or wrongly) to hold time constant.

In a similar vein, the theme of complexity illustrates that environments, like communities, are not homogenous. They change in relationship both to the scale of the study and to the temporal period being investigated. Many archaeological reports, including this one, incorporate environmental background studies that would seem to ignore the complexity of the study area. Recent sea level studies by Mark Brooks and his colleagues, as well as the paleoclimate analyses produced by the Tree Ring Laboratory at the Department of Geography, University of Arkansas (see Anderson 1994:277-283 for a summary) point out the complexity and the need to explore that complexity when developing cultural models. This is especially true along the coast of South Carolina where the biological diversity of the marsh, and its dense biomass, are unique.

Butzer notes that in a complex environment (such as that found at and around Old House Creek) with an uneven distribution of resources (again, such as we expect from the marsh and maritime environment with distinct areas of hickory nut resources or oysters banks), the human and nonhuman communities will interact internally, with each other, and with the broader environment. And they will interact at different scales and at different (or changing) rates. This is the characteristic of interaction. At Old House Creek we have only begun to understand this interaction through our study of the different environmental zones being used and how these zones may suggest the selection of some activities over others.

Finally, Butzer notes that the equilibrium state is typical of diverse communities where there is constant feedback from either internal processes or external actions. He notes that as a consequence, "readjustment, whether minor or major, short term or long term, is the rule rather than the exception" (Butzer 1982:8). Typically natural systems are characterized by negative-feedback systems, so that the environment is readjusted into a oscillating pattern or steady state. There are a variety of equilibrium types, but our understanding of the Old House Creek area is not adequate to fully integrate this theme into our study. At the microscale (coupled with synchronic view) it seems that the site evidences a steady-state equilibrium, with no net change in the equilibrium. Viewed from the perspective of a different scale (and incorporating a diachronic approach that focuses on the temporal processes) it is likely that our understanding of the equilibrium of these Middle to Late Woodland sites would change.

Admittedly, our goal here is to illustrate the diversity of approaches possible for the examination of sites such as Old House Creek, without embracing any one. We hope that our renewed emphasis on ecological questions will help direct future work at sites such as Old House Creek. For example, while use of the "site-catchment model" of Vita-Finzi and Higgs (1970), focused on a 10 km catchment reflective of the distance that can be walked in two hours, seems almost traditional in archaeological exploration of subsistence activities, it suffers from several significant problems. Too often there is an assumption that historic and prehistoric land-use categories are the same. Or it is assumed that prehistoric biotic distributions are the same as found today, or that they can be projected based on current evidence. This approach may also be criticized for its perhaps undue belief that technology guides the actual boundaries of the catchment circle, ignoring that to some degree technology is dependent on the resources.

At Old House Creek we have tried to integrate a wide range of subsistence studies to reveal a reliance, or focus, on the intertidal mud flats where oyster, ribbed mussel, knobbed whelk, periwinkle, and crabs will be typically found. The more sandy environs, suitable for clams and stout tagelus, seem less significant to the site occupants, although they were certainly visited.

The Future of Shell Midden Archaeology

Recently several different, and opposing, views on the future of shell midden archaeology have been offered (see Trinkley et al. 1992, Trinkley 1994, cf. Espenshade et al. 1994). It is tempting to dismiss these differences and focus on the future, but to do so would be a mistake since only with a resolution of these differences will it be possible to understand the direction in which shell midden research is (or will be) moving.

For example, Espenshade and his colleagues criticize calls for "new ways" of looking at old data. They claim that a variety of methodological approaches have been used in the past and they have resulted in little new information. They note that pollen studies have "made no significant contribution to Woodland archaeology" (Espenshade et al. 1994:181). They note that faunal and floral studies have only "demonstrated the lack of significant non-oyster remains" and that geomorphological study is unnecessary on simple sites, such as shell middens. In contrast, we take the position that all of these studies are worth pursuing with renewed, not reduced, vigor. That pollen studies seem to have offered inconsequential information may be our fault for not collecting and examining sufficient numbers of samples. Old House Creek suggests that perhaps as few as 20% of the samples will yield well preserved pollen. With this in mind, perhaps we should be sampling 20 or 30 areas within each midden, not 2 or 3? And certainly there is only so much which can be done with a faunal assemblage that contributes less than 2% of the biomass. But the work at Old House Creek, we believe, has shown how a detailed analysis of even small faunal assemblages can be pressed to provide additional information. We have also shown that it is difficult to find sites suitable for offering comparable material. Espenshade and his colleagues may be correct that shell middens are simple and that geomorphological studies are unnecessary, but this seems to be an opinion and not a scientifically based conclusion supported by the exploration of a number of sites.

Espenshade and his colleagues seem to suggest that efforts to find "new ways" of looking at old data is silly, if not outright ignorant. The is reminiscent of another colleague who quipped that asking questions reminded him of "Groucho Marx -- say the right word and a duck will drop from the ceiling" (Coe 1983:176). While good for a little controversy and a quick laugh at a colleague's expense, such attitudes do little to promote the growth of archaeology. It may be that Espenshade and his colleagues are correct -- it may be that shell middens are incapable of telling us any more about the past than we already know. It may be that we will only "see through a glass, darkly." If so, then to suggest exploring alternative ways of exploring shell middens and urging different approaches is, as Espenshade and his colleagues suggest, a horrible waste of the public's funds and resources.

But contemplate, if even for a brief moment, the alternative. Suppose that it is Espenshade and his colleagues who are wrong. Suppose that his explanations and rebuttals are off-mark and fail to take into consideration all of the variability and complexity of Middle and Late Woodland shell middens. What is the damage? Instead of wasting the public's money, we will have wasted the public's resources and who is to say that one is not as bad as the other? Might it not be responsible to explore shell middens as though each was our last opportunity?

As previously proposed, the study at Old House Creek suggests there is still information which can be wrung from shell middens. Larger numbers of pollen samples may yield greater information on site environs and their changes. Use of water screening may provide heretofore unavailable information on the diversity of faunal remains. Use of fabric and paste analysis may help us understand intrasite community patterning. The presence of small potsherds may help us to understand pedestrian traffic and the site formation process. While no ducks are likely to drop from the ceiling in response to the right question, better framing our questions and finding new ways of asking those questions may result in considerable data return.

Of course there is the potential for redundancy in data return and it seems that Espenshade and his colleagues are actually suggesting that we have reached that point in our studies. We can find common ground here and would agree -- there is certainly no reason to study the same issues over and over, each time coming to the same conclusion. We know that coastal groups collected, and presumably ate, shellfish. There is no big news here. However, Espenshade suggests that the sum total of our knowledge can be expressed something like Figure 13 (Espenshade et al. 1994:Table 49). We have already questioned how terms like relatively high or moderate, or low can be applied with any real meaning or precision. For example, how does Old House Creek "stack up"? We have the feeling that Espenshade and his colleagues would classify the site as an "oystering station."[7] Clearly the "oyster contribution" *is* "very high" and the contribution of "minority shellfish" *is* "very low," at least in relative terms. And so on down their list. But, when does the sherd density shift from low to moderate? And when are structural remains thought of as "present" or "occasional," rather than "very rare"? The lithic density at Old House Creek (or at 38BU1214, for that matter) is clearly greater than at sites with no lithic remains.

Of equal concern is that of the four site types proposed by Espenshade and his colleagues, only two at this point in time can be associated with St. Catherines phase sites -- the multi-family resident base at one end of the spectrum and oystering stations at the other end. Perhaps there are no sites in-between. Or perhaps we simply don't know enough to fill-in that gap. Perhaps Old House Creek is somewhere in the middle, representing a multi-family, kin-based oystering station using for several weeks during a seasonal round? Perhaps "oystering stations" are not as simple as Espenshade and his colleagues suggest. Their simplicity or complexity may, at least partially, relate to the depth of our investigations and our knowledge at any particular moment.

As we explained earlier, the model proposed by Espenshade and his colleagues is interesting and it offers an exceptional ***starting point*** for additional research and testing. To consider it, however, the culmination of our research and knowledge, we believe, would do archaeology, the model, and our colleagues a disservice. We endorse further investigation of these site types. In furtherance of that goal, it would be helpful for Espenshade and his colleagues to refine their "expectations" offering greater precision and thereby allowing others to explore the model with less chance of misinterpreting their intentions.

For our part, we have outlined areas which we believe may provide fruitful information at other Middle and Late Woodland shell middens. Ranging from additional radiometric dates to greater numbers of pollen samples, to exploration of entire middens, the suggestions may, or may not, stand the test of time. It would be tragic, however, if the discipline were unwilling to even consider the possibility that this research is not only warranted, but also required of us as guardians of the public trust.

[7] This assumption on our part is based on their placement of similar sites, such as 38BU1214, in this category, not on any explicit statement by them. In this sense, we admit to "putting words in their mouths," and apologize in advance if this our assumption is faulty.

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