Abstract

The Chesapeake Watershed Archaeological Research Foundation conducted limited archaeological testing at site 44NH440 and limited pedological-geological evaluations of the Mockhorn Island area in Northampton County, Virginia. These investigations were conducted from July 1, 2002 through June 31, 2003. These evaluations were conducted in accordance with an agreement with the Virginia Department of Historic Resources.

Multiple shoreline surface collections were conducted at 44NH440. A shoreline redeposition experiment was performed within the "swash & berm" zone adjacent to 44NH440 and five 1-x-1-m test units were excavated. The results indicate that multiple re-examinations of eroding shoreline sites are needed to effectively assess the prehistoric cultural chronologies evident at individual archaeological sites. The results suggest that redepositional processes (i.e., "swash & berm" activity and littoral & current movement) which impact eroded cultural material can be effectively monitored via experimental methods. The results also suggest that 44NH440 represents a stratified archaeological site along the Atlantic coast with Paleo-Indian through Middle Woodland era occupations. The site is located on a former linear ridge that slowly dips to the northeast. The ridge also has marked topographic relief east to west. The soils work conducted at the site also confirms the presence of distinctly stratified deposits. The consequences of this research effort clearly indicate the value of integrating pedology, geology, paleoclimatology, and archaeology in areas heavily impacted by Late Pleistocene through Holocene marine transgression processes, as well as Late Pleistocene through Holocene terrestrial paleoclimatic events.

With respect to archaeological investigations in the Atlantic coastal zone, the work at 44NH440 has provided data relative to the intact nature of inundated archaeological deposits impacted by Pleistocene and Holocene marine transgression. Undisturbed paleosols, intact cultural features and buried cultural deposits were located during the investigations at 44NH440. Importantly in the lower topographic sections west of the ridge crest at 44NH440, the Middle Woodland era organic midden is completely intact and buried below 60 to 70 centimeters of Late Holocene tidal marsh accretion deposits. Given the slow rates of sea level rise over the past 2,000 years, the archaeological record at 44NH440 has survived virtually intact. In the past when sea levels were rising at a rapid rate, cultural deposits should have survived quite well along the coastline. In comparison, the fetch-related erosion processes are destroying archaeological sites along the Chesapeake Bay side of the Delmarva Peninsula (Lowery 2001) during periods with minimal or stabilized sea level rise. Comparable archaeological data from the Atlantic seashore side of the Delmarva Peninsula would indicate massive levels of sediment accretion and sub-aqueous burial processes that are preserving similar age prehistoric cultural sites on relatively intact old upland landscapes. Aside from the bioturbation of cultural deposits in stable coastal settings, the work at 44NH440 would suggest that inundated prehistoric sites should be relatively intact in settings located off of the coast on the Middle Atlantic continental shelf. The rapid rates

of sea level rise during the Late Pleistocene and Early Holocene should be viewed as an archaeological benefit rather than an archaeological detriment.

The outcome of this study also indicates that the investigated portion of eastern Mockhorn Island has a high archaeological potential, as do the other unexplored hummocks located within the interior non-eroded portion of the island's landmass and adjacent to the modern shoreline. Like 44NH440, these interior and coastal hummocks represent former upland settings. Unfortunately for the archaeologist, a mantle of tidal marsh, sub-tidal reworked coastal sediments, and barrier island lagoons or bays have largely buried the former riverine settings, floodplain areas, active springheads, and freshwater seeps associated with the ancient Mockhorn Island landscape. As such, 44NH440 only provides a limited glimpse into the use of this ancient landscape by prehistoric peoples.

It is recommended that additional work at 44NH440 be conducted to further assess the site's archaeological record and the site formation processes. Even so, the current work conducted at 44NH440 clearly indicates that the site is presently eligible for nomination to the National Register of Historic Places. The work at 44NH440 provides a future case study for dealing with inundated prehistoric sites along the Atlantic seashore. Suggestions for underwater archaeological research are presented. Future research efforts could include archaeological investigations at the other documented sites on Mockhorn Island, as well as, the uninvestigated interior hummocks included within the island's landmass. Also, consideration should be given to paleoenvironmental reconstruction through analysis and dating of organics included within the tidal marsh peat deposits, and within the buried landscapes or paleosols located beneath the aeolian sediments that blanket the island.

1: Project Background

Introduction

The Chesapeake Bay Watershed Archaeological Research Foundation (C-WAR) conducted a limited archaeological evaluation of 44NH440 on Mockhorn Island off the Atlantic coast in Northampton County, Virginia from July 1, 2002 through June 31, 2003 (Figure 1). The archaeological evaluation was conducted in accordance with a "Threatened Sites Program" proposal and agreement between C-WAR and the Virginia Department of Historic Resources (VDHR).

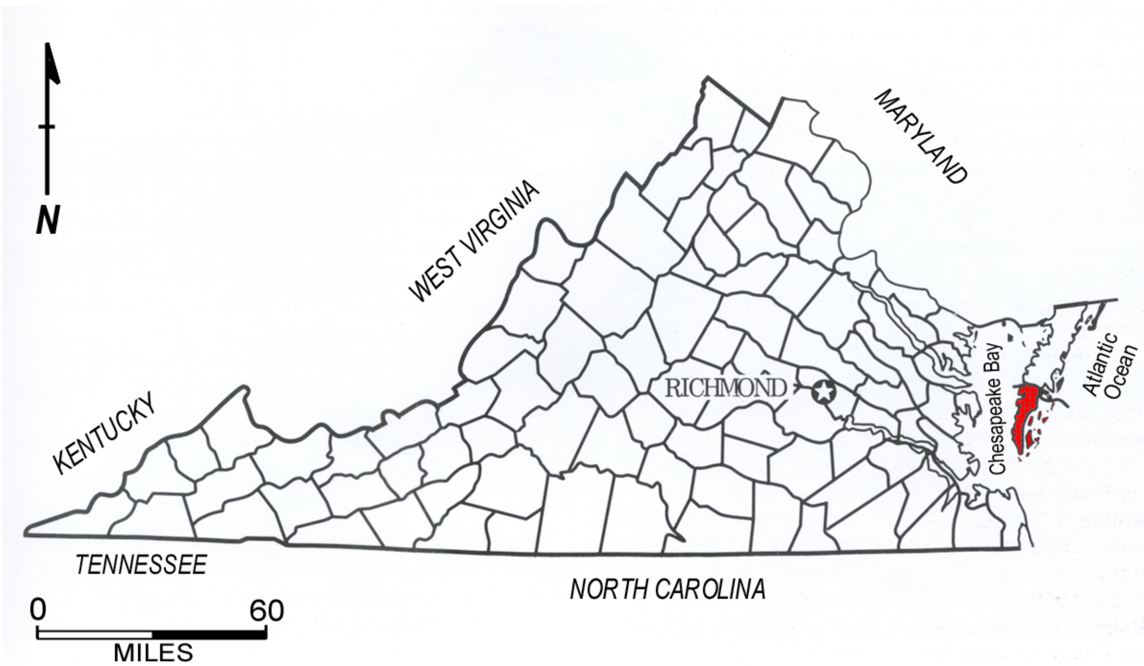


Figure 1. County Area and Location.

The purpose of this project was to evaluate the shoreline and coastal processes impacting 44NH440, assess the archaeological integrity associated with the site, understand the site formation processes associated with the region, and use the combined data to better understand the broader archaeological record along Delmarva's Atlantic seashore. Because the Commonwealth of Virginia owns Mockhorn Island, the project was geared towards assessing the region so that the appropriate agencies could properly evaluate and better manage the archaeological resources located on the island. 44NH440 represents only one of many documented and undocumented archaeological sites included within the island landmass. The site was recorded in 2002 as the result of a survey of the Atlantic seashore of Northampton and Accomack Counties (Lowery 2003a). The site's location was predicted prior to the fieldwork associated with the survey (Ibid) and the initial evaluation of the shoreline area at 44NH440 revealed an amazing prehistoric assemblage, which spanned 13,000 years of human occupation. The approach combined strategic archaeological testing with geoarchaeological study of the site and the associated regional sediments. An additional component of the archaeological investigation was to assess the offshore processes relative to the archaeological remains at 44NH440 to better understand the marine transgression impacts to potential inundated prehistoric archaeological sites situated east of Mockhorn Island on the continental shelf.

Darrin Lowery, Executive Director of C-WAR, carried out the archaeological field evaluation, interpretive graphics, and the preparation of the final report. Soils analysis at the site involved Dr. John Wah of the University of Maryland. Mr. Norman K. Brady and Mr. David R. Thompson, who are members of the Board of Directors of C-WAR, provided assistance in the field. Dr. Ralph Eshelman, a vertebrate paleontologist, also provided field assistance and critical evaluation of the vertebrate remains found at the site. Dr. George Oertel of Old Dominion University provided valuable geological assistance relative to the formation of Mockhorn Island. Field assistance was also gleaned from the help and efforts of Mr. Michael Owens. Additional help was provided by Dr. Dennis Stanford of the Smithsonian Institution and Dr. Michael Waters of Texas A&M University. The boat, trailer, and field equipment were supplied by charitable donations made to the Chesapeake Watershed Archaeological Research Foundation, which is an IRS recognized 501(c)(3) public non-profit organization. Even though numerous people contributed to the Mockhorn Island investigation, the accuracy and interpretations presented in this report are the sole responsibility of the author.

Description of the Project Area and Environmental Setting

Mockhorn Island is located in the Coastal Plain on Virginia's Eastern Shore in Northampton County within the Atlantic Ocean watershed (Figure 2). Virginia's Eastern Shore represents the southernmost part of the Delmarva Peninsula, bounded on the west by the Chesapeake Bay and on the east by the Atlantic Ocean. Mockhorn Island is located approximately 2 miles east of the mainland. The island is separated from the mainland by Magothy Bay, to the south, and Mockhorn Bay, on the north. Several coastal barrier islands are located east of Mockhorn that are separated from the island landmass via South Bay, Main Ship Shoal Channel, and Smith Island Bay. Numerous tidal creeks intersect Mockhorn Island, as well as, the areas surrounding the island landmass. Sand Shoal Inlet, New Inlet, Ship Shoal Inlet, Little Inlet, and Smith Island Inlet provide direct water access between Mockhorn Island and the Atlantic Ocean. These inlets also provide the tidal ebb and flood pathways, which influence the shallow lagoons, basins, and creeks that surround Mockhorn Island. The water that surrounds the island is a true Euhaline system with a mean annual salinity above 30 parts per thousand. As such, the Mockhorn Island area would be classified as having a marine ecosystem.

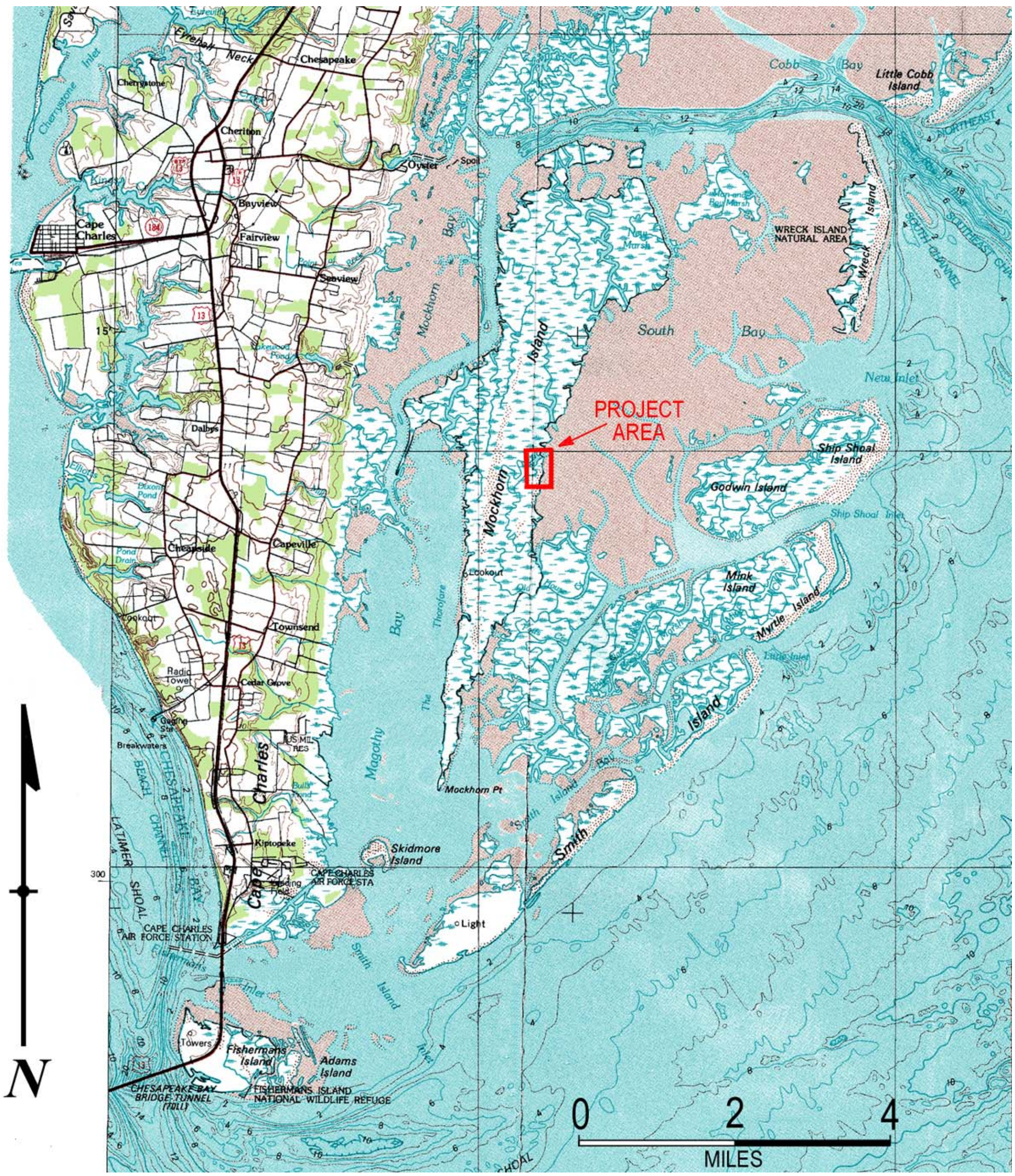


Figure 2. Project Area and Setting.

Mockhorn Island is classified as a barrier island associated with Virginia's Atlantic coast (Badger and Kellam 1989). Generally, it is assumed that Delmarva's barrier islands are geologically young (Oertel and Kraft 1994). Geologic research associated with the Mockhorn Island and Magothy Bay area concluded that the island is geologically much older (Finkelstein and Kearney 1988). Finkelstein and Kearney (Ibid) wrongly concluded that the island mass represents a Late Pleistocene-age high sea stand barrier island. Given current sea level data and isostatic crustal adjustment data for the Delmarva area, the sub-surface geology that Finkelstein and Kearney (Ibid) investigated had to have been created during low sea stands associated with isotopic Stage 3 and 2 circa 35,000 to 20,000 years ago.

Hints about Mockhorn Island's geological formation compared to the formation processes associated with "classic" coastal barrier islands are evident in aerial photographs of the region. The soil maps for the area (see Cobb and Smith 1989: Sheets 17, 19, and 21) illustrate Mockhorn's unique landscape compared to the associated "classic" coastal barrier islands along the Atlantic coast. According to Oretel and Kraft (1994: Figure 6.8), barrier islands typically have curved dune ridges, curved swale areas, and multiple curved dune ridges and swales along the terminal ends of the island. The curved dune ridges and swales seen on coastal barrier islands were formed as a result of the interaction between tidal ebb-and-flood processes, storm-surge activity, littoral drift, coastal wind activity, and coastal cuspate patterns (Ibid). Cobb and Smith (1989: Sheets 19 and 21) illustrate the curved ridge and swale pattern for Smith Island, which is located southeast of Mockhorn Island. Meanwhile, the ridges or hummocks evident on Mockhorn Island are linear and not curved (Ibid: Sheets 17 and 19). The ancient geology of Mockhorn Island (Finkelstein and Kearney 1988; Foyle and Oertel 1992) suggests that the ridges and hummocks evident within the island landmass represent upland aeolian dunes, which resemble dunes formed in desert landscapes (see Werner 1995; Nickling and Neuman 1999).

The platform landmass that encompasses Mockhorn Island was created as a result of ancient coastal geological processes. Oertel and Foyle (1995) indicate that the lower portion of the Delmarva Peninsula was created as a result long-term littoral sediment infilling of a series of paleochannels. The infilling episodes are directly linked to ancient periodic high sea-stand events that occurred over the past 3 million years. Aside from the present, the most recent high sea-stand event occurred during isotopic Stage 5E or approximately 125,000 years ago. During this high sea-stand event, littoral sand movement along the ancient coastline filled a former low sea-stand paleochannel of the Susquehanna River creating the second Nassawaddox Spit (see Figure 3). When sea levels fell during the most recent glacial episode, the Susquehanna River carved a new channel south of this new spit creating the Cape Charles Drainway and joining forces with the York River watershed. Like the mainland associated with the second Nassawaddox spit, the foundation or platform landmass of Mockhorn Island was created over the past 125,000 years or so.

During the most recent glacial maximum when sea levels dropped markedly, the Atlantic coastline was scoured by new river and stream systems. These river and stream systems and the associated valleys have largely been drowned by our present high sea-stand. The valleys have also been filled by reworked coastal marine sand, mud, peat, and shell lag. With respect to the archaeology of Mockhorn Island, Oertel and Kraft (1994) mention that one of the major drowned river systems off of Virginia's Eastern Shore is the Chincoteague macro-watershed. The watershed's headwaters extended into Maryland near present-day Sinepuxent Neck. The tributary drainage divide pattern noted on the Delmarva Peninsula (Ibid: Figure 6.11) and the published geological information relative to ancient river channel deposits (Finkelstein and Kearney 1988: Figures 1 and 2; Foyle and Oertel 1992; Shideler et al. 1984) suggest that the Chincoteague macro-watershed valley emptied into the ancestral Susquehanna River between Mockhorn Island and the mainland. As such, Mockhorn Island is the only upland area east of this former river valley that has survived Holocene marine transgression (see Figure 4).

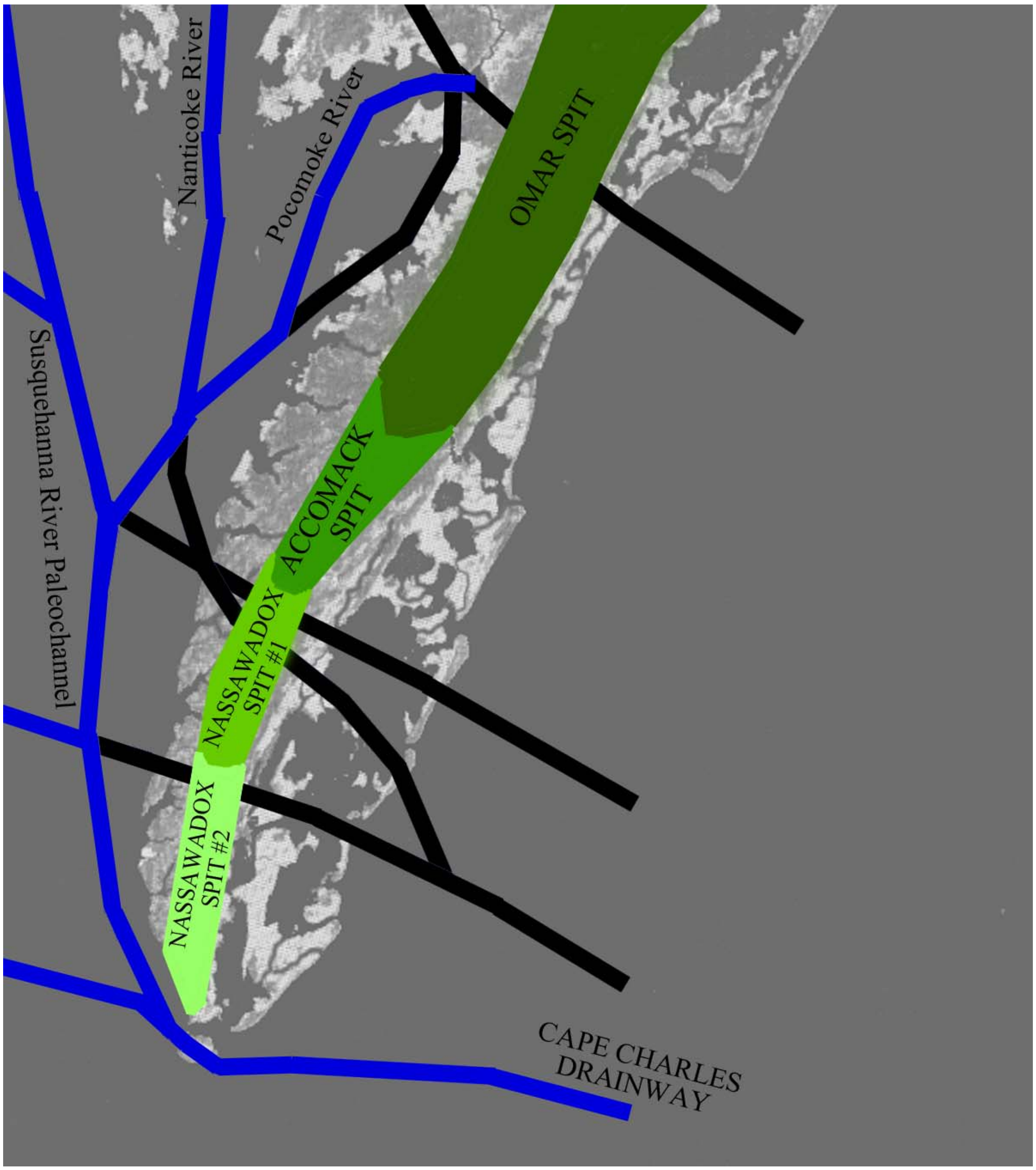


Figure 3. Geology of the Lower Delmarva Peninsula.

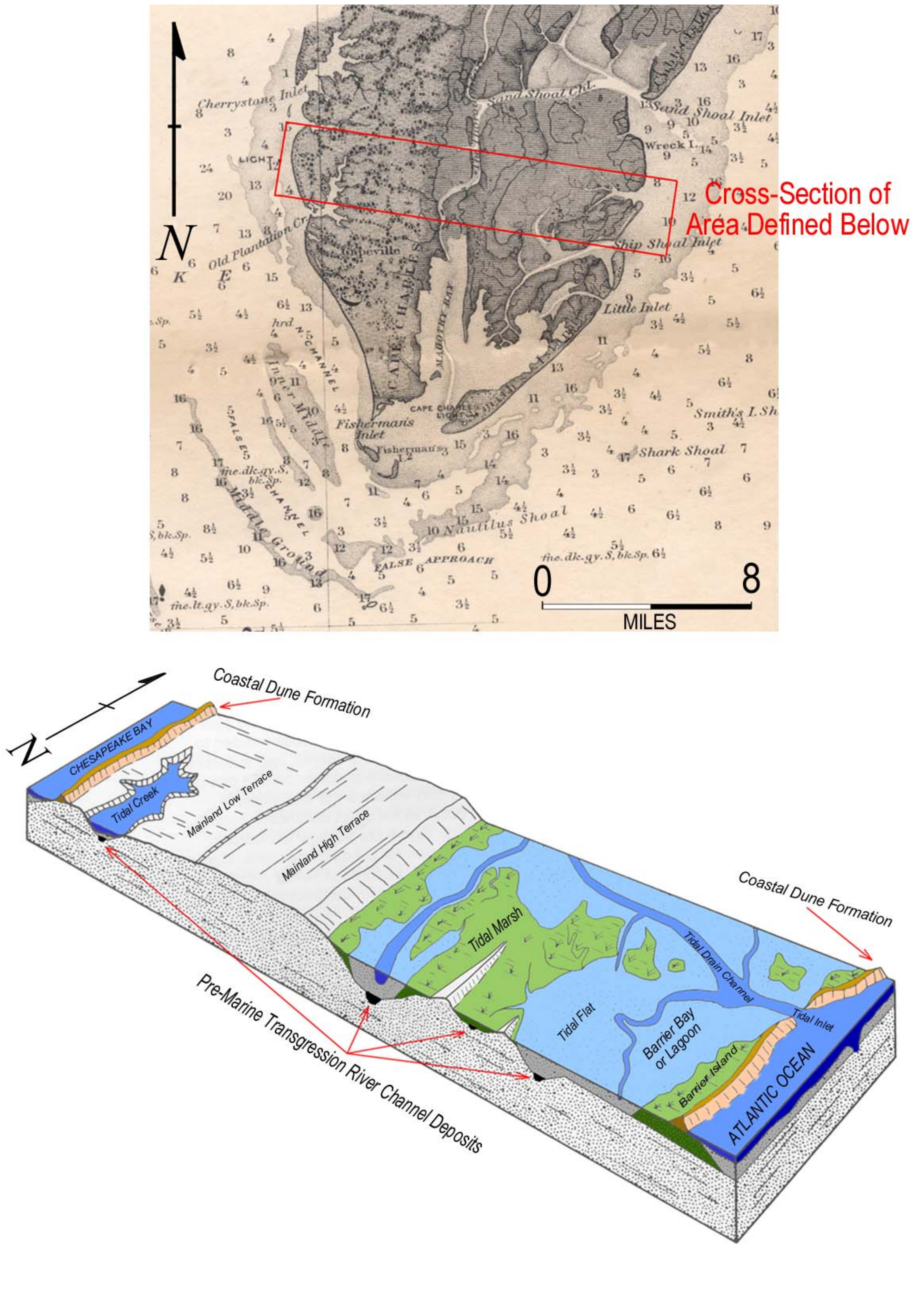


Figure 4. Geological Cross-Section of the Lower Delmarva Peninsula Showing the Drowned and Filled River and Stream Valleys near Mockhorn Island.

Given the recent and long-term geologic history, it is evident that the Mockhorn Island area is archaeologically complex and unique relative to the types of landscapes that have survived Holocene marine transgression. Mockhorn Island represents the upland ridge situated near the confluence of a major watershed tributary and the Susquehanna River. Aside from mainland near Cape Charles, all of the confluence point landscapes along the Chesapeake Bay south of Havre de Grace, Maryland have been completely drowned or largely inundated. With respect to the glacial-era shorelines, Mockhorn Island is the closest non-inundated terrestrial landscape to the Atlantic coastline circa 13,000 to 15,000 years ago. The island is approximately 55 miles west of the Norfolk Canyon area, which would have been the primordial Chesapeake Bay circa 18,000 years ago. The remaining areas along Delmarva's current Atlantic seashore would have been 65 to 70 miles inland of the glacial maximum coastline. As sea levels rose during the Holocene, Mockhorn Island and the river systems associated with its landscape would have been one of the first areas associated with Delmarva's tributary systems to develop an estuarine environment. The uniqueness of this portion of the Delmarva Peninsula would have made the Mockhorn Island region extremely important to numerous prehistoric peoples, but for radically different ecological and environmental reasons (see Lowery 2003a: Figure 3.14 - 3.17).

Previous Research

An archaeological shoreline survey funded by the Threatened Sites Program at the Virginia Department of Historic Resources was conducted along all of the Atlantic coastal shorelines of Accomack and Northampton Counties in 2001 and 2002 (Lowery 2003a). During this survey numerous prehistoric archaeological sites were discovered along the shorelines of Mockhorn Island and the adjacent mainland (see Figure 5). Most of the sites revealed Archaic-era and Woodland-era diagnostic artifacts. Interestingly, a large number of the sites produced Paleo-Indian era diagnostic artifacts. The archaeological remains discovered during the survey only reinforce the ideas relative Mockhorn Island's geology and the uniqueness of its landscape (compare Figure 4 with Figure 5).

The archaeological sites discovered by Lowery (2003a) on Mockhorn Island were largely concentrated along the west side of the island. The west side is more obviously eroded because of the observed steep bank-cuts and scoured beaches. The sites along the west side of the island revealed large quantities of debitage, primarily quartzite. Given that the west side is more accessible, has many exposed banks-cut and beaches, and seemed to have a high percentage of prehistoric stone waste debris, it is believed that this portion of the island is heavily surface collected by avocational archaeologists. Prior to examining Mockhorn Island, Lowery (Ibid) had predicted that a low exposed ridge (see Figure 6) along the east side of the island should contain and reveal an amazingly rich archaeological site. After many failed attempts to reach and examine the east side of the island, the area was finally accessed on October 13, 2001. During the shoreline examination, three sites (i.e., 44NH440, 44NH441, and 44NH442) were discovered and all were clustered near the low exposed ridge that had been predicted to contain archaeological remains. The archaeological materials associated with the sites found along the east side of Mockhorn Island were numerous and the diagnostic remains indicated that this landscape was periodically occupied during the Paleo-Indian period, the Archaic period (see Figure 7), and the Woodland period (see Figure 8). Proportionately, 44NH440 produced an extremely large assemblage of artifacts. The density of artifacts is surprising considering the low rates of shoreline erosion noted in the area over the past 45 years (see Figure 9). When 44NH440 was discovered, cultural features were also observed along the shoreline (see Figure 10).

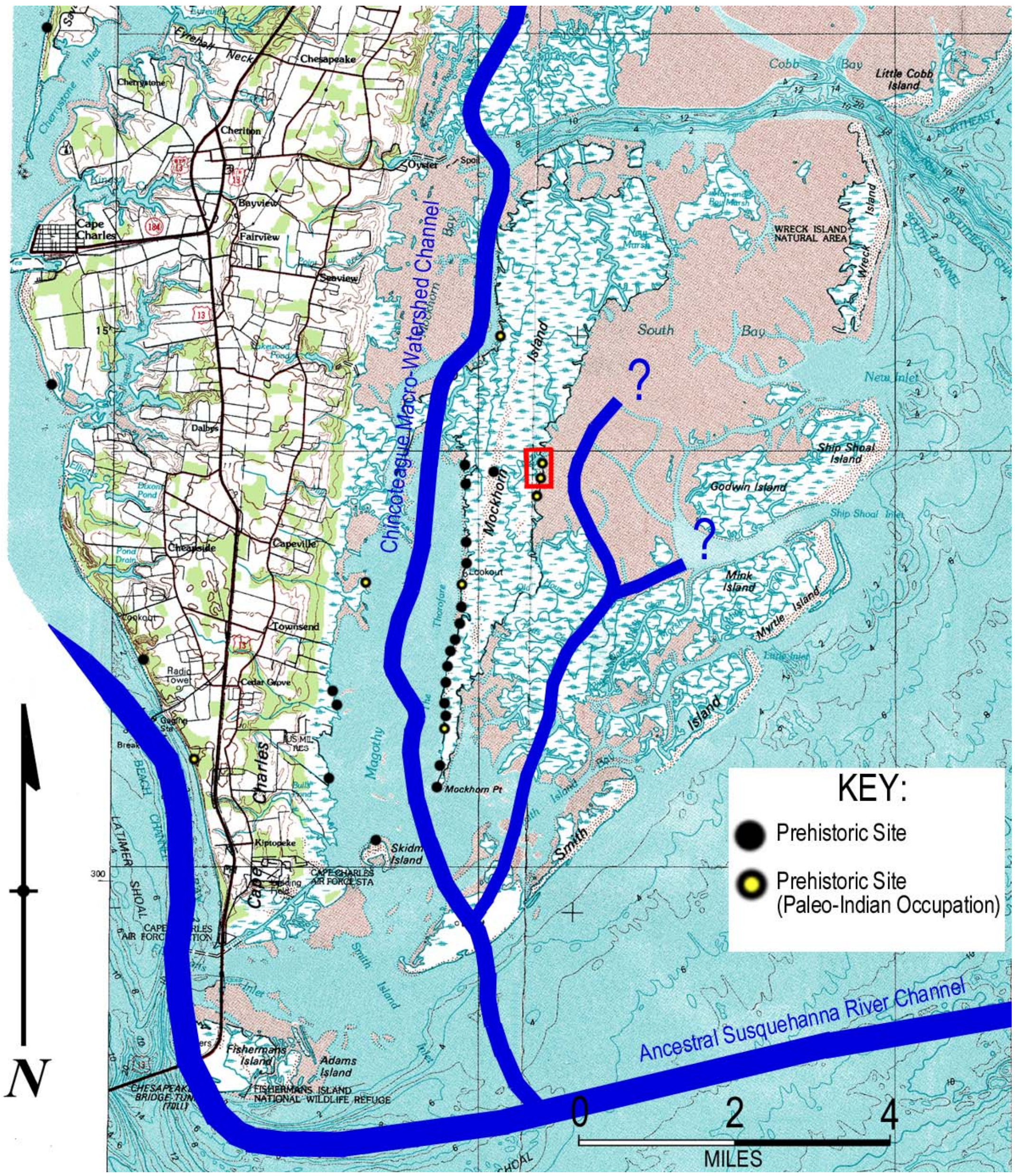


Figure 5. Mockhorn Island and the Mainland Archaeological Sites Plotted with the Late Pleistocene Drowned and Filled River and Stream Valley Systems.

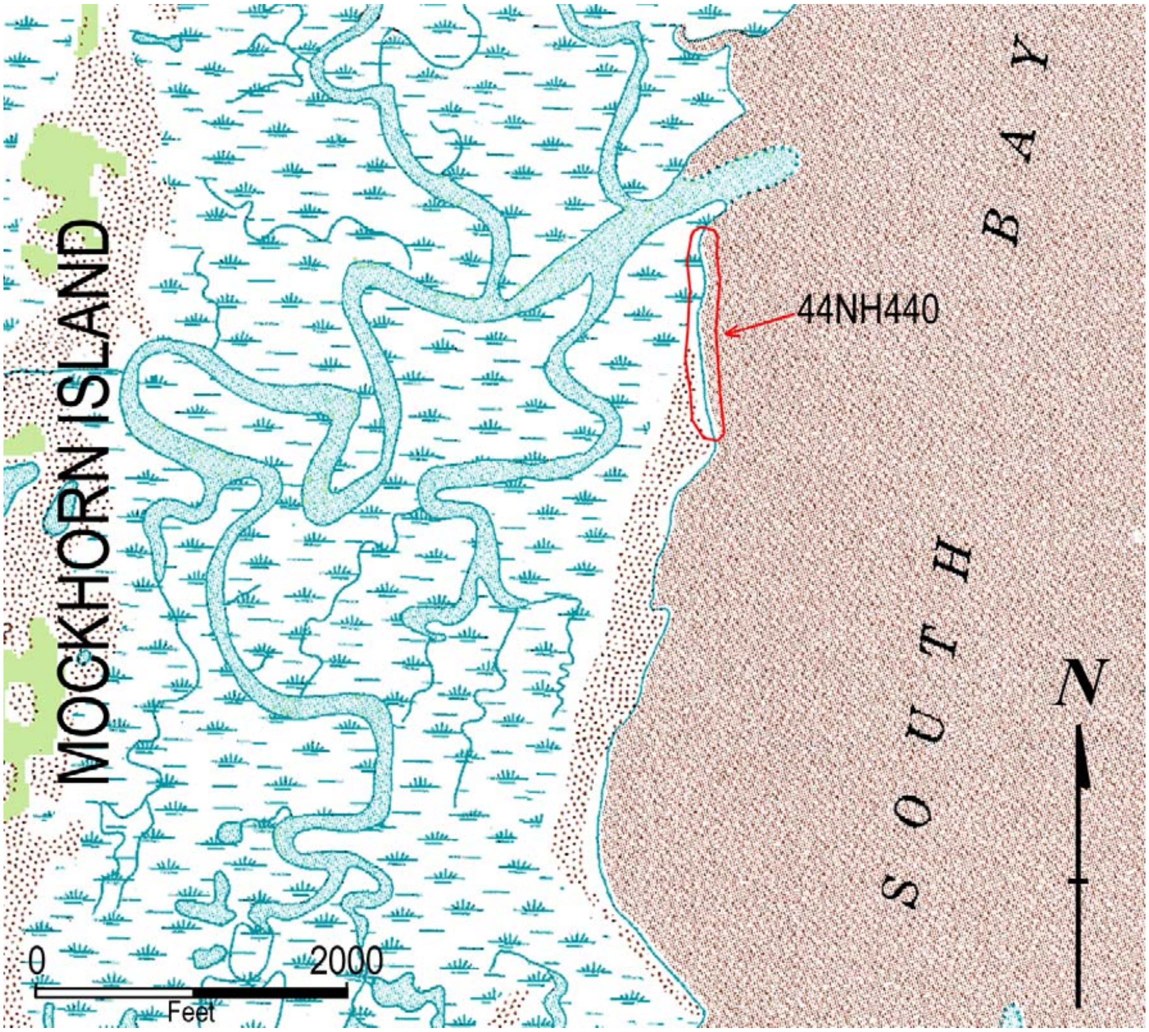


Figure 6. Low Ridge on the East Side of Mockhorn Island Associated with 44NH440 (Plotted on U.S.G.S. 1989 7.5 Minute *Townsend* Quadrangle).

Figure 7. Paleo-Indian Period and Early Archaic Period Diagnostic Lithic Artifacts.

Figure 8. Woodland Period Diagnostic Ceramic Artifacts.

Figure 9. Shoreline Erosion Noted at 44NH440 over the Past 45 Years.

Figure 10. Prehistoric Cultural Feature Observed along the Shoreline at 44NH440 a Few Hours before Low Tide in the Fall of 2002.

2: Field Conditions, Archaeological Research Design, and Archaeological Field Methods

The purpose of this project was to explore the archaeological potential of buried inland and offshore deposits at 44NH440. A survey of the Atlantic shoreline on the Eastern Shore of Virginia in 2001-2002 recovered a dense accumulation of artifacts from the beach and inter-tidal zones associated with 44NH440. The chronological types of artifacts, the shoreline geological exposures, and the low level of historic shoreline erosion indicated that the area, designated Site 44NH440, held potential for intact multi-component human occupations, as well as inundated cultural occupations. It was these overall general assessments that prompted the work undertaken by the present project.

Because of the 4 to 4.5 feet tidal fluctuation along this particular section of the Atlantic seashore, the site and it's cultural occupation levels are inundated during each normal high tide. At low tide, a broad shelf of upland landscape was exposed adjacent to the shoreline. As such, the site posed some interesting archaeological challenges. One challenge relates to the tidal conditions. Excavations could only be conducted at low tide. Because the site was 8 miles from the nearest landing or port, access to the site could only be gained though the use of a powerboat. A 15 foot-long shallow-draft "Boston Whaler" with a 50 horsepower outboard motor was used to access the site. The boat could only function in water depths greater than one foot. Given the shallow nature of South Bay, this posed yet another challenge. Excursions to the site in the research boat had to be timed so that the tide was moderately high or roughly 4 hours before maximum low tide. At low tide, South Bay could not be entered because it was too shallow or almost completely dry depending on the seasonal tidal extremes. Also at maximum low tide, the boat was stranded off of the site and within South Bay (see Figure 11) until the approximately 3.5 hours into the next flood tide. This leads us into yet another archaeological challenge. The South Bay is not marked with navigable channel markers and contains many ever-shifting shallow bars and numerous oyster reefs. Along with a hand-held GPS monitor, certain land bearings were used to successfully navigate between the site and the landing. Visible conditions above the water, on the surface of the water, and below water were important navigation concerns. Therefore, navigation after sunset or during intense fog was not possible. With respect to sunset, access to the site had to occur only during those weeks when the tide was low at or near mid-day. With respect to fog, weather conditions had to be monitored via weather forecasts and in-the-field observations. The final archaeological challenge also relates to the weather. Wind intensity and wind direction were major impediments to the fieldwork at 44NH440. Because of the fetch properties of the area and the overall shallow nature of the bay waters, winds greater than 15 miles per hour coming out of the North, Northeast, East, and Southeast made boating to and from South Bay extremely hazardous.

Figure 11. Stranded Boat Used as Transportation to 44NH440 at Low Tide.

Project Goals

Several basic questions organized the undertaking associated with the research at 44NH440. On the whole the goals were simple, aimed mainly toward evaluating the condition of 44NH440, an archaeological site in the process of becoming inundated by the Atlantic Ocean. A combination of terrestrial and underwater archaeological sampling, and geoarchaeological assessment, were employed. The research topics addressed are as follows:

1. Identify the coastal processes that are impacting the site and its cultural resources;

2. Assess the erosional and depositional history associated with the Mockhorn Island area, focusing specifically on 44NH440;

3. Sample the buried deposits for archaeological materials or strata and evaluate the prospects for significant contextual information;

4. Conduct limited offshore sampling to determine the potential for intact archaeological material in areas affected by marine transgression; and

5. Summarize the fieldwork and suggest future research questions that could be resolved

Prehistoric Cultural Context

Through archaeological survey and excavation, the general prehistoric cultural sequence of Delaware and Maryland is somewhat understood (Custer 1984 and 1989, Dent 1995, and Kraft 2001). With respect to the Virginia portion of the Delmarva Peninsula, limited research has been conducted to address and synthesize its unique prehistoric cultural sequence (Lowery 2001, Rountree and Davidson 1997, William and Mary Center for Archaeological Research 1999, and Wittkofski 1982 and 1988). The following is a brief overview of the cultural sequence of these regions. The dating scheme used has converted traditional C14 years for the recognized cultural periods (see Custer 1989, Dent 1995) to the currently accepted or define calendar year equivalent ages (see Roberts 1998: 253).

Paleo-Indian Period (15,000-11,600 Cal. Yr. BP)

Paleo-Indian occupations at the Paw Paw Cove site in Maryland, dating to approximately 13,200 BP through 12,900 BP, are presently the only documented archaeologically buried evidence for human occupation on the Delmarva Peninsula (Lowery 2002a). The Paw Paw Cove site is located along the west side of the Delmarva Peninsula and it includes a complex of localities that have revealed numerous fluted Clovis points and formal flake tools in eroded shoreline and buried contexts. Presently, these localities are situated around the shoreline of the Chesapeake Bay. In the past these localities represented upland interfluve areas situated around several springs and spring-fed wetlands. It is likely, however, that people were here earlier than Clovis and other intact Paleo-Indian era sites remain to be discovered. Evidence suggests that humans reached southern Virginia (Cactus Hill) by at least 15,000 calendar years BP (McAvoy and McAvoy 1997). Some people have argued that the first inhabitants were fairly dispersed and highly mobile, relying mostly on game resources, and using open campsites for habitation (Custer 1989, and Dent 1995). Custer (1989) has emphasized that Paleo-Indians utilized cryptocrystalline lithic materials from primary quarries at the northern extreme portion of the Delmarva Peninsula and secondary cobble sources along the southern sections of the Chesapeake Bay to manufacture stone tools. Custer and Stewart (1990) have developed a model for Paleo-Indian settlement within the Middle Atlantic region with hypothesized band territories. Lowery and Custer (1990) suggested a cyclical movement pattern for the Delmarva Peninsula. Current research (Lowery 2002a) has challenged some of these views and indicates fairly restricted movement patterns for Clovis-age peoples living on the Delmarva Peninsula with stone tool technologies oriented around primary coastal plain lithic materials (i.e, orthoquartzite, petrified wood, silicified sediments) and a variety of secondary paleochannel cobble lithic materials.

Around 12,900 BP, there is geomorphological and paleoclimatic evidence that a major cooling episode occurred and loess deposited as fluvio-glacial outwash in the ancestral Susquehanna River valley was reworked by intense winds and deposited over a large upland portion of the northwestern Delmarva Peninsula (Foss et al. 1978, and Lowery 2002a). It is arguable that most of the Paleo-Indian sites in the northwestern sections of Delmarva are buried beneath Younger Dryas era loess deposits (Ibid). In the interior sandy sections of the Delmarva Peninsula, aeolian processes were reworking and depositing former marine and fluvial sands as late glacial dune landforms (Markewich and Markewich 1994). Presently, Paleo-Indian era sites in the interior Delmarva drainage divide would be associated with a mixture of deflated landscapes, as well as, buried landscapes.

During the early portions of the Paleo-Indian period circa 19,000 years BP, sea levels were approximately 110 meters (358 feet) lower. At the terminus of the Paleo-Indian period, sea levels were approximately 65 meters (211 feet) lower than present. Not surprisingly, virtually all of the present terrestrial Paleo-Indian sites on the Delmarva Peninsula are in upland areas situated near interfluves. The Paleo-Indian settlement patterns along the coastal plain are highly biased by Late Pleistocene and Holocene marine transgression. Currently we do not have substantive Paleo-Indian settlement data for the floodplain and river settings, the major river confluence points, and the coastal environments of the Delmarva coastal plain. With respect to coastal environments during the Paleo-Indian period, we do know that the types of shellfish resources attractive to later peoples were readily available to these Late Glacial cultures on the continental shelf east of the present coastline (see Thieler et al., 2000).

Early Archaic Period (11,600-10,000 Cal. Yr. BP)

Early Archaic occupations at the Paw Paw Cove site (Lowery 2002a) and the Crane Point site in Maryland (Lowery and Custer 1990), as well as, the Hughes Complex in Delaware (Lowery 1999) presently provide some of the best archaeologically evidence for Early Archaic era human occupation on the Delmarva Peninsula. The Crane Point site and the Hughes Complex sites include assemblages made up of large numbers of projectile points, debitage, formal flake tools, flaked stone adzes, gouges, or celts, and some plant processing tools (i.e., pitted stones or nutting stones). Both of these sites or site complexes seem to represent repeatedly occupied residential localities. Numerous other Early Archaic era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Custer 1986 and 1989, Lowery 1999). It is likely that the site data indicate a larger population during the Early Holocene compared to the Late Pleistocene. Like the Paleo-Indian era, some researchers have argued that the Early Archaic inhabitants were highly mobile, relying on plant and animal resources, and using open campsites for habitation (Custer 1989, and Dent 1995). McAvoy (1992) and McAvoy and McAvoy (1997) have suggested that the Early Archaic groups living in Virginia were far more mobile than their Paleo-Indian predecessors. Unlike the Paleo-

Indian period, Early Archaic peoples heavily utilized cryptocrystalline lithic materials from the primary quarries located near the northern extreme portion of the Delmarva Peninsula (Lowery and Custer 1990). Secondary cobble sources and primary lithic resources within the coastal plain only supplemented the Early Archaic stone tool kits, which were based predominantly on exotic cryptocrystalline and exotic non-cryptocrystalline (i.e., rhyolite) lithic materials (Custer 1986). Long-distance cyclical movement patterns are indicated for the Early Archaic-era cultures living on the Delmarva Peninsula (Lowery and Custer 1990). Models for Early Archaic settlement patterns and demography have been proposed for portions of the Middle Atlantic region (Custer 1990, Parker 1990).

Around 11,600 BP, there is geomorphological and paleoclimatic evidence that a major warming episode associated with the beginning of the Holocene occurred on the Delmarva Peninsula (Kellogg and Custer 1994, and McWeeny and Kellogg 2001). In the coastal plain, there is again some evidence for aeolian processes reworking and depositing sands along inland dunes (Markewich and Markewich 1994, Ivester et al. 2001, and Otvos and Price 2001). Some have suggested that the Holocene dune building and reworking activity was limited to the crests of some of thick dunes (Ivester et al. 2001). It is arguable that some of the Early Archaic sites in the interior sandy sections of Delmarva are buried beneath locally reworked sands. Lowery and Custer's (1990) work at the Crane Point site indicates reworking of the Pleistocene-age loess sediments, which ultimately buried a hearth feature with diagnostic stone tools. Presently, Early Archaic era sites on the Delmarva Peninsula should include a mixture of deflated landscapes, as well as, buried landscapes. It is suggested that the deflation of landscapes associated with historic-era agricultural processes may have greatly impacted the observed overall patterning of Early Archaic era sites. For example, Custer's (1986: Figure 3) distribution of sites illustrates a dense accumulation of Early Archaic-era sites in the interior drainage divide of the peninsula. These sites are associated with very sandy soils easily susceptible to agriculturally induced erosion (Lowery 2001: 162-169). Like the regional Paleo-Indian site data, the Early Archaic era sites located in the silt-loam or loess dominated areas near the Chesapeake Bay are commonly found as buried or partially buried deposits (Lowery and Custer 1990, and Lowery 2002a).

During the early portions of the Early Archaic period circa 11,600 years BP, sea levels were approximately 65 meters (211 feet) lower. At the terminus of the Early Archaic period, sea levels were approximately 35 meters (114 feet) lower than present. Again, virtually all of the present terrestrial Early Archaic sites on the Delmarva Peninsula are in upland areas. The settlement patterns along the coastal plain for this period are highly biased by marine transgression. Currently we do not have substantive Early Archaic settlement data for the major floodplain and river settings, the major river confluence points, and the coastal environments of the Early Holocene period. With respect to coastal environments during the Early Archaic period, we do know that shellfish resources were readily available to these early cultures within the developing Chesapeake Bay (Cronin 2000).

Middle Archaic Period (10,000-6,800 Cal. Yr. BP)

Middle Archaic occupations at 18DO279-east in Dorchester County, Maryland (Lowery 1999), as well as, the Chance site in Somerset County, Maryland (Cresthull 1971 and 1972) presently provide some of the best archaeological evidence for Middle Archaic era human occupation on the Delmarva Peninsula. Numerous other Middle Archaic era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Lowery 1999 and Custer 1986). The dense number of archaeological sites associated with the Early-Middle Holocene indicates a larger regional population. Secondary cobble sources found locally are almost exclusively used to make stone tools. Even so, exotic non-local rhyolite has been found in Middle Archaic era assemblages (Custer 1986). The presence of non-local lithic materials found at Delmarva Middle Archaic sites may indicate the development of trade and exchange networks. The heavy reliance on local lithic resources may indicate more localized Middle Archaic-era territories. The Middle Archaic-era mobility seems to be very restrictive compared to the previous Early Archaic-era cultures living on the Delmarva Peninsula. Models for Middle Archaic settlement patterns and demography have been proposed for portions of the Middle Atlantic region (Custer 1990, Parker 1990).

The beginning of the Middle Archaic period is closely linked to the beginning of the "Hypsithermal" climatic event. Some researchers have referred to this era as the "Delmarva Desert" period (Millis et al. 2000). The warming episode associated with the beginning of the Holocene continued and may have created drought-like conditions on the Delmarva Peninsula (Kellogg and Custer 1994, and McWeeny and Kellogg 2001). Dune building and sand reworking activity during the Early-Middle Holocene may have been limited to localized droughty denuded landscapes susceptible to wind activity or in areas where large quantities of parent sand material were readily available, which were exposed to intense winds. Within the Delmarva area, there are large numbers of Middle Archaic sites found in agriculturally disturbed tilled fields regardless of the parent soil type (i.e., sand, silt, or loam). These observations indicate that only a few intact or buried Middle Archaic sites may be present in the interior or in areas adjacent to the modern Chesapeake Bay. Even so, large areas along the developing Atlantic coastline during the Middle Archaic period may contain buried archaeological components. As sea levels rose along the Atlantic coast, onshore aeolian processes combined with the observed droughts may have stimulated the migration of dunes farther inland. As such, Middle Archaic-era human occupation sites along the Atlantic coast of Delmarva may be buried or stratified.

During the early portions of the Middle Archaic period circa 10,000 years BP, sea levels were approximately 35 meters (114 feet) lower. At the terminus of the Middle Archaic period, sea levels were approximately 10 meters (32 feet) lower than present. Again, virtually all of the present terrestrial Middle Archaic sites on the Delmarva Peninsula are in areas that were upland settings between 10,000 and 6,800 years ago. The settlement patterns and the types of focal points for human occupation within the Delmarva coastal plain over this period are again highly biased by the effects of marine transgression. Currently we do not have substantive Middle Archaic settlement data for the major floodplain and river settings, the major river confluence points, and the coastal environments of the Early-Middle Holocene period. Even so, some potential late Middle Archaic-era cemeteries have been reported in inundated contexts situated near drowned river confluence areas (Lowery 2003b). As indicated earlier, we do know that shellfish resources were readily available to the Middle Archaic cultures living within the developing Chesapeake Bay (Cronin 2000). The archaeological procurement settings for shellfish and marine resources would be largely inundated, as well.

Late Archaic Period (6,800 – 3,100 Cal. Yr. BP)

Numerous Late Archaic era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Custer 1989, Dent 1995, Reinhart and Hodges 1991). The dense number of archaeological sites associated with the Late Archaic period would tend to indicate a large regional population. Like the Middle Archaic period, secondary cobble sources found locally are extensively used to make stone tools. Non-local materials, such as, rhyolite are found at most Late Archaic-era sites (Custer 1989). More importantly, caches of rhyolite bifaces have been found at some Late Archaic-era sites (Ibid). Another exotic non-local lithic material found at some sites includes steatite, which was primarily used to make stone bowls. Caches of steatite bowls have been reported at some Delmarva sites (Lowery 1999). Also, caches of ground stone axes have been found (Lowery 1999). The presence of non-local lithic materials and the presence of caches would indicate the establishment of trade and exchange networks and regular periodic use of certain areas. Probably, the most unreported aspect part of the Delmarva Late Archaic period are the cultural influences from peoples living outside the region. Laurentian Archaic contact, whether direct or indirect, from cultures occupying the eastern Great Lakes area are indicated by the presence of ground slate knives, ground slate points, and stone gouges (Lowery 2003b). Long-distance trade and exchange via the Laurentian Archaic peoples may be suggested by the occurrence of hammered copper points, crescent knives, adzes, and fishhooks that are found at a few sites on the Delmarva Peninsula (Ibid). These utilitarian copper artifacts are identical to "Old Copper" culture utilitarian tool types found in the western Great Lakes area. The styles of Late Archaic copper artifacts found locally should be contemporaneous with the Laurentian cultures living in Quebec, Ontario, and New York (Chapdelaine et al. 2001: 102-110). These exotic items are obviously the result of long-distance trade and exchange with cultures far removed from the Delmarva area. All indications would suggest that Late Archaic-era mobility was limited compared to some earlier cultures. Even so, trade and exchange seemed to have fluoresced during the Late Archaic-era. Models for Late Archaic settlement patterns and demography have been proposed for sections of the Middle Atlantic region (Reinhart and Hodges 1991).

The Late Archaic period is marked by a series of climatic changes that suggests warm and wet conditions initially, changing to warm and dry conditions, and finally ending with wet and colder conditions (Kellogg and Custer 1994, McWeeny and Kellogg 2001, Fiedel 2001, and Custer and Watson 1987). Within the macro-Delmarva area, there are large numbers of Late Archaic sites found in agriculturally disturbed tilled fields regardless of the parent soil type (i.e., sand, silt, or loam). Sea level circa 6,800 years BP was approximately 10 meters (32 feet) lower than present. By the end of the Late Archaic circa 3,100 years BP, sea level had risen to approximately 4 meters (13 feet) lower than present. The agriculturally tilled field observations may indicate that only a limited number of intact or buried Late Archaic sites are present in the interior upland tilled areas of the modern Delmarva Peninsula. Given the sea level history, some Late Archaic era estuarine resource procurement sites may be buried below tidal marsh deposits in inundated upland settings. Current archaeological data indicates that the region's Late Archaic peoples were exploiting estuarine and marine resources (Custer and Lowery, n.d.). Along the Atlantic seaboard, transgressive barrier island processes may prove that some of the Atlantic coastal sites are offshore or buried below coastal dune formations.

Early Woodland Period (3,100 - 2000 Cal. Yr. BP)

Only a limited number of Early Woodland era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Custer 1989, Dent 1995, Fiedel 2001, Reinhart and Hodges 1991). Several researchers have addressed the limited number of archaeological sites associated with the Early Woodland period. Some have suggested that the fewer number of sites would tend to indicate a smaller regional population. Others have suggested that the lack of "good" diagnostic stone tools might explain the fewer numbers of Early Woodland sites. Like the Late Archaic period, secondary cobble sources found locally are extensively used to make stone tools. Non-local materials, such as, rhyolite are found at some Early Woodland-era sites (Custer 1989). Local-style ceramic technologies fluoresced during Early Woodland period. Varieties of exotic lithic artifacts from the Great Lakes region, the western New York area, and the Ohio Valley drainage are present in some Delmarva Early Woodland mortuary features and at various habitation sites. Exotic styles of artifacts, such as birdstones, have been found on the Delmarva Peninsula that would be indicative of "Glacial Kame" and "Meadowood" cultures (Converse 1979, Townsend 1959). A few "turkey-tail" blades have also been found on the Delmarva Peninsula made of Wyandotte Chert from Indiana. These "turkey-tail" points would be indicative of the "Red Ochre" culture (Converse 1979, Ritzenthaler and Quimby 1962). Interestingly, the "Glacial Kame" and "Red Ochre" items may have arrived here on the Delmarva Peninsula via the Meadowood trade network associated with the peoples living in the area of modern western New York (Granger 1978). Meadowood type points and blades made of Onondaga Chert from New York and Ontario and burials dating to roughly 2,700 years BP (Bastian 1975) have been found on the Delmarva Peninsula with caches of copper beads. During the latter portion of the Early Woodland period, Adena items from the Ohio Valley appear in the archaeological record of the Chesapeake Bay area (Ford 1976, Custer 1989, and Dent 1995). The Meadowood-era trade seems to have developed along the Susquehanna and Delaware River systems, whereas the Adena-era trade seems to have developed along the Potomac River system. Adena-era trade from the Ohio Valley to the Delmarva Peninsula and within the Chesapeake Bay area is suggested by the presence of diagnostic early to middle Adena artifacts found in dated mortuary features (Ford 1976). Trade in Atlantic coast marine shell (Ritchie 1969: 196) may explain the presence of exotic non-local items on the Delmarva Peninsula during the Early Woodland period. Finally, models for Early Woodland era settlement patterns and demography have been proposed for sections of the Middle Atlantic region (Reinhart and Hodges 1991).

The Early Woodland period is marked by a climatic-era with wet and colder conditions (Kellogg and Custer 1994). Within the macro-Delmarva area, there are some Early Woodland sites found in agriculturally disturbed tilled fields regardless of the parent soil type (i.e., sand, silt, or loam). Sea level circa 3,100 years BP was approximately 4 meters (13 feet) lower than present. By the end of the Early Woodland period circa 2,000 years BP, sea level had risen to approximately 1.25 meters (4 feet) lower than present. The presence of Early Woodland sites found in agriculturally tilled fields may indicate that only a limited number of intact or buried Early Woodland sites are present in the interior upland tilled areas of the modern Delmarva Peninsula. Given the sea level history, a large number of Early Woodland-era estuarine oriented prehistoric occupation sites may be buried below tidal marsh deposits in inundated upland settings. Along the Atlantic seaboard, transgressive barrier island processes may prove that some of the Atlantic coastal sites are buried below coastal dune formations.

Middle Woodland Period (2000 - 1000 Cal. Yr. BP)

Numerous Middle Woodland era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Custer 1989, Dent 1995, Reinhart and Hodges 1992). The density of sites may indicate an increase in regional populations or an intensive focus of occupation in the coastal plain. With respect to stone tool kits, secondary cobble sources found locally are only occasionally used to make stone tools. Non-local materials, such as, rhyolite are found at most Middle Woodland-era sites (Custer 1989). Argillite, which has traditionally been lumped as a non-local lithic material, is also found at most Middle Woodland-era sites. Along some watersheds draining into the Chesapeake (i.e., the Miles River, the Choptank River, and the Little Choptank River), numerous large biface caches have been discovered (Custer 1987). Local-style ceramic technologies continued during Middle Woodland period. Exotic lithic artifacts from the Ohio Valley area are present in some early Delmarva Middle Woodland mortuary features and these have traditionally been associated with the "Delmarva Adena Complex". Copper breastplates, cannel coal psuedo-bifaces, and Hopewellian-style blades have been found on the Delmarva Peninsula that would logically be more suggestive of "Hopewellian" contacts from the Ohio Valley than the traditionally accepted Late Adena links (Lowery 2003b). Interestingly, these exotic Hopewellian artifacts have been found in association with local rhyolite Fox Creek points and blades at the Frederica site in Delaware (Ibid). A radiometric date on the Frederica materials indicates a range of A.D. 391 to A.D. 531 (Custer et al. 1990), which would be too young for the Ohio Valley Adena culture. Trade in Atlantic coast marine shell and fossil sharks teeth from geologic deposits along the shore of the Chesapeake Bay may explain the presence of exotic Hopewellian items on the Delmarva Peninsula during the early portion of the Middle Woodland period. During the latter portion of the Middle Woodland period, Kipp Island or Intrusive Mound-like materials appear in the archaeological record of the Delmarva Peninsula (Ibid). These outside influences again originate from the Great Lakes or Ohio Valley region and would suggest something more than simple trade and exchange. Custer et al. (1990) believes that the Kipp Island or Intrusive Mound-like materials found associated with Delmarva's Webb phase indicate an actual migration of peoples into the area. During the entire Middle Woodland period, there is evidence of intensive use of estuarine and marine resources. Large shell middens with oyster, soft-shell clam, razor clam, hard-shell clam, ribbed mussel, bay scallop, and whelk are found along the shorelines of the Delmarva. The stabilization of sea level rise during the Middle and Late Woodland periods may have resulted in a larger, more evident archaeological expression of regional marine resource use in terrestrial settings. Finally, models for Middle Woodland era settlement patterns and demography have been proposed for sections of the Middle Atlantic region (Reinhart and Hodges 1992).

The Middle Woodland period is marked by a climatic-era with initial warm and wet conditions changing to warm and dry conditions associated with the "Medieval Warm Period" (Cline et al. 2001, Millis et al. 2000). Within the macro-Delmarva area, there are numerous Middle Woodland sites found in agriculturally disturbed tilled fields regardless of the parent soil type (i.e., sand, silt, or loam). Sea level circa 2,000 years BP was approximately 1.25 meters (4 feet) lower than present. By the end of the Middle Woodland period circa 1,000 years BP, sea level had risen to approximately .75 meters (2.5 feet) lower than present. Interestingly, several sites in the region (i.e., 18DO30, 18DO424, 44NH435, 44NH436, and 44NH437) indicate aeolian dune formation and the subsequent burial of Middle Woodland and pre-Middle Woodland archaeological components along widely separated sections of coastline adjacent to the Chesapeake Bay (Cline et al. 2001, Lowery 2001). These observed synchronic natural site burial processes maybe associated with the warm and dry conditions of the "Medieval Warm Period". In selected areas with copious amounts of parent sand material subjected to drought conditions and intense winds would result in natural dune formations burying some archaeological sites. Even so, the observed macro-regional unweathered nature of diagnostic rhyolite Middle Woodland artifacts may suggest that the aeolian processes may have been more extensive and the natural burial processes may have impacted numerous regional archaeological sites. Given the sea level history, a fewer Middle Woodland-era estuarine and marine oriented prehistoric occupation sites would be buried below tidal marsh deposits in inundated upland settings. Along the Atlantic seaboard, transgressive barrier island processes may prove that some of the Atlantic coastal sites were buried below coastal dune formations.

Late Woodland Period (1000 - 400 Cal. Yr. BP)

Numerous Late Woodland era sites have been found along the eroded shorelines and within the ploughed fields of Delmarva (Custer 1989, Dent 1995, Reinhart and Hodges 1992). The density of sites may indicate an increase in regional populations or an intensive focus of occupation in the coastal plain. With respect to stone tool kits, secondary cobble sources found locally are almost exclusively used to make stone tools. Local-style ceramic technologies continued during Late Woodland period. The lack of exotic or non-local lithic artifacts in Late Woodland assemblages suggests that the broad-based exchange networks were disrupted or severely attenuated (Stewart 1989, 1994: 87-

89). It has been suggested that trade in marine shell and soapstone pipes may have continued during the Late Woodland period (Ibid). Models for Late Woodland era settlement patterns and demography have been proposed for sections of the Middle Atlantic region (Reinhart and Hodges 1992). Late Woodland era sites vary in size depending on the setting and like other Woodland era sites produce obvious features (Custer 1989). With respect to the Delmarva Peninsula Late Woodland cultures, regional peoples seem to have practiced a wide-variety of subsistence strategies and seem to have had diverse social organization patterns. There is virtually no evidence for agriculture on Maryland's eastern shore. Current research at the Holland Point site in coastal Dorchester County, Maryland (Walker 2002) revealed no evidence for the use of cultigens. Meanwhile, the peoples living on the Virginia section of the Delmarva seem to have practiced an agricultural lifestyle (Rountree and Davidson 1997). Custer (1989) indicates only a limited use of cultigens for the Late Woodland peoples living in Delaware. Hunted and gathered resources, such as deer, nuts, seeds, and berries, seem to have provided the bulk subsistence resources. For most of the Delmarva Peninsula during the Late Woodland period, there is evidence of intensive use of estuarine and marine resources. Large shell middens with oyster, soft-shell clam, razor clam, hard-shell clam, ribbed mussel, bay scallop, and whelk are found along the shorelines of the peninsula. The stabilization of sea level rise during the Late Woodland period may have resulted in a larger, more evident archaeological expression of regional marine resource use in modern terrestrial settings.

The LateWoodland period is marked by a climatic transition from warm and dry conditions associated with the "Medieval Warm Period", circa 1,200 to 800 calendar years ago, to an era of colder winter temperatures associated with the "Little Ice Age", circa 600 to 150 calendar years ago (Cline et al. 2001, Kutzbach and Webb 2001, Millis et al. 2000). Periods of protracted droughts have also been reported for the latter portion of the Late Woodland period (Stahle et al. 1998). Brush (2001) has reported evidence of extensive fires and possible forest burning events during the Late Woodland period. These fires may have been the result of cultural burning episodes. Numerous burned and presently inundated upland forests have been observed beneath a mantel of tidal marsh deposits in Dorchester and Somerset counties, Maryland and in Accomack County, Virginia. Within the macro-Delmarva area, there are numerous Late Woodland sites found in agriculturally disturbed tilled fields regardless of the parent soil type (i.e., sand, silt, or loam). Sea level circa 1,000 years BP was approximately .75 meters (2.5 feet) lower than present. By the end of the Late Woodland period circa 400 years BP, sea level had risen to approximately .125 meters (4 inches) lower than present. Aeolian dune development observed during the Middle Woodland-era may have continued in selected areas of the Chesapeake with copious amounts of parent sand material subjected to drought conditions and intense winds. Given the sea level history, few Late Woodland sites originally situated along coastlines would have been buried below tidal marsh deposits in inundated upland settings. From circa 2,000 years ago to present relatively stabilized sea levels in and around the Chesapeake Bay may have resulted in numerous sites being lost to shoreline erosion. Along the Atlantic seaboard, transgressive barrier island processes may prove that some of the Atlantic coastal sites were buried below coastal dune formations.

Field Methods

Overview of Previous Fieldwork

During the shoreline survey Lowery (2003a) identified a large cultural assemblage from 44NH440. The field methods during the initial survey, which located the site, were simple. All shorelines along the Atlantic seashore of Virginia's Eastern Shore were examined at low tide for evidence of eroded prehistoric and historic occupations. Prior to the fieldwork, however, the soil maps associated with the coastal areas of Northampton and Accomack Counties were critically evaluated for potential archaeological sites. During this evaluation, the various sections of Virginia's Atlantic coast were subjected to two forms of assessment. One form of assessment evaluated the aerial images associated with the soil maps for distinctive evidence of shoreline erosion. Erosion, not accretion, was essential for recognizing and documenting archaeological sites. The second form of assessment evaluated the soil types and the landforms defined in the published soil map images. This evaluation essentially subjected the region to a model for prehistoric archaeological site prediction developed and refined by Lowery (1997 and 2003a) for the Delmarva Peninsula. As a result, the location of 44NH440 was predicted prior to the documenting fieldwork.

Part of the original fieldwork was to define the cultural chronologies recognized at the site based on the artifacts discovered during the survey. The assemblage found at the site during the survey consisted of Paleoindian, Early Archaic, Middle Archaic, Late Archaic, Early Woodland, Middle Woodland, and Late Woodland prehistoric archaeological components (Lowery 2003a: 206). A possible Contact era component may also be located at the site (Ibid). The site was examined four times, and all artifacts exposed on the shoreline were collected. The cultural chronologies originally defined for 44NH440 may need to be revised based on new information. Keith Egloff (personal communication 7/16/02) of the Virginia Department of Historic Resources examined the ceramic assemblage collected from the site and concluded that the Late Woodland era Townsend ware defined for the site was most likely a more refined late Middle Woodland era Mockley ware. Since triangular points alone can not be considered "hallmark" indicators of the Late Woodland period (see Katz 2000), it would seem that 44NH440 did not have diagnostic Late Woodland era materials. The potential Contact era component originally defined for the site was based solely on a single gunflint. This artifact alone could simply represent a lost Historic era isolate. Given the new data, it would seem that 44NH440 was occupied from the Paleoindian period through the late Middle Woodland period. After the late Middle Woodland era the site seems to have been abandoned.

In comparison to the artifact assemblages found at other archaeological sites on Virginia's portion of the Delmarva Peninsula (see Lowery 2001; and 2003a), the assemblage collected from 44NH440 is remarkably large. Lowery (2003a: 208) noted that the erosion at 44NH440 would seem to be mild or less than 1 foot per year. This observation is clearly illustrated in Figure 9. The low rate of erosion at 44NH440 combined with the large artifact assemblage found during the initial fieldwork suggests that the site is indeed a major archaeological site. Matter of fact, it is arguable that

44NH440 was a “virgin” site, until Lowery’s (Ibid: 101-175) model predicted the site’s location and ultimately documented it during the Atlantic seashore survey.

Current Field Methodology

During the initial shoreline survey, Lowery identified features exposed along the shoreline at 44NH440 (see Figure 10 and Figure 12). It was also evident that a heavily bioturbated organic midden with cultural material was located at the site (Figure 13). Sub-soil deposits that seemed to show evidence of stratification were situated below the midden and the features. Because of the uniform nature of the fine sands associated with the sub-soil deposits, it was interpreted that these sediments were derived via aeolian processes. The age of the presumed aeolian deposits was not known at the time. As such, the terrestrial depositional sequences and the cultural stratigraphy associated with the site were targeted as aspects of investigation.

With respect to many archaeological sites on the Delmarva Peninsula, 44NH440 is somewhat unique. The site has revealed a large assemblage of prehistoric cultural materials in an area that has minimal erosion. The site is located along a section of coastline that experiences a daily 4 to 4.5 foot average tidal fluctuation. Finally, the offshore waters adjacent to the site are flushed by the Atlantic Ocean and are for the most part visually clear. The clarity of the water contrasts with the visibility of the Chesapeake Bay. As such, the setting of the site provided a unique chance to assess the processes associated with marine transgression and how these processes impact archaeological deposits. The ramifications of this research would allow a more critical evaluation of how post-Pleistocene sea level rise may have impacted prehistoric sites on the Mid-Atlantic continental shelf over the past 13,000 years or more.

In addressing the depositional sequences and the cultural stratigraphy, five locations were chosen along the shoreline for 1-x-1-m test units (Figures 14, 15, 16, 17, 18, and 19). These were placed in areas where the shoreline exposures provided evidence for intact cultural deposits, as well as, in areas that should provide evidence about the formation processes associated with the landform. Also, Dr. John Wah described a series of soil profiles generated by auguring (see Figure 20) for the Mockhorn Island area that helped determine the excavation techniques to be employed and provide a broader perspective on the regional site formation processes. Given the soil auger data, the bank profile data, and the degree of bioturbation via fiddler crabs, it was determined that excavations should involve the removal of bulk natural stratigraphic strata. Each natural stratum observed in the excavation units was water-screened separately through a 0.64-cm wire mesh. Anomalies considered to be potential features were recorded in plan and profile, and test unit profiles were drawn. Information about soils, artifacts, and stratigraphy was recorded on standardized forms. The soils in the auger holes and associated with the excavation units were described using standard USDA textural terminology and Munsell soil color descriptions.

Figure 12. Possible Prehistoric Cultural Feature Observed along the Shoreline at 44NH440 in the Fall of 2002.

Figure 13. Bioturbated Prehistoric Organic Midden with Prehistoric Ceramics Observed along the Shoreline at 44NH440.

Figure 14. Excavation Unit 17.5 N – 9E at 44NH440.

Figure 15. Excavation Unit 0N – 3E at 44NH440.

Figure 16. Excavation Unit 5S – 5W at 44NH440.

Figure 17. Excavation Unit 9S – 3E at 44NH440.

Figure 18. Excavation Unit 14S – 3E at 44NH440.

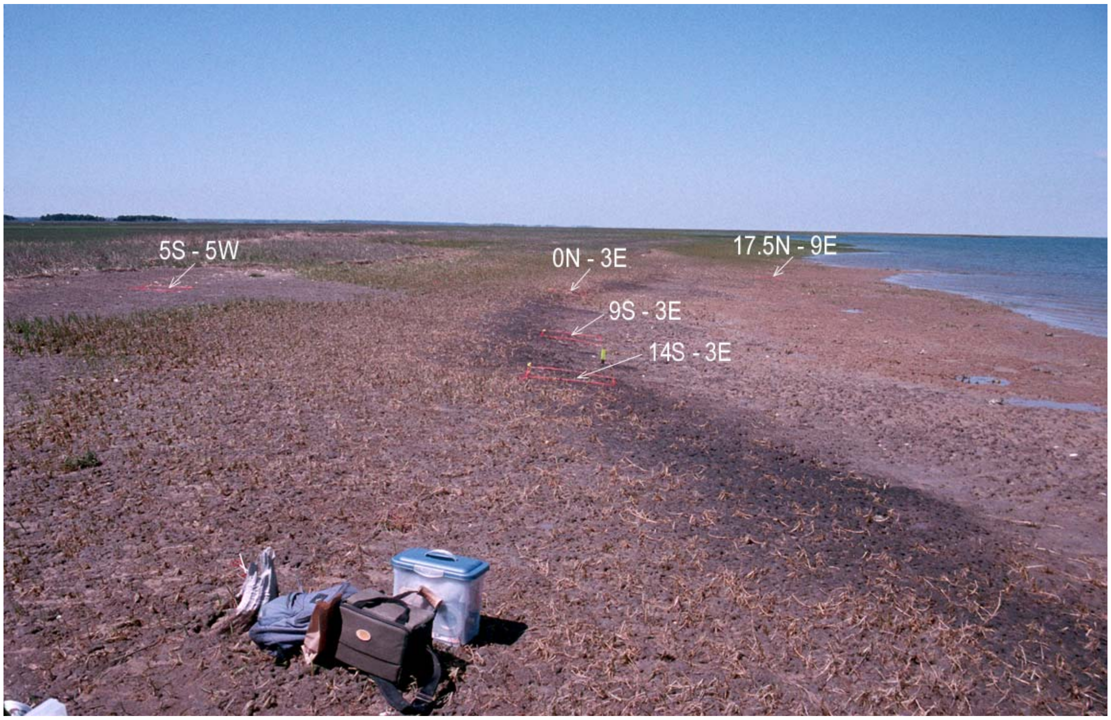


Figure 19. General View of the Excavation Unit Layout at 44NH440.

In trying to assess some of the processes associated with marine transgression, shoreline erosion, and the impacts that these interrelated processes have on archaeological deposits, an experiment was devised for the shoreline area of 44NH440 based on the methodology described by Lowery (2001: 186-189). The experiment was devised to monitor the redeposition of artifacts along shoreline sites with specific geometries and individualistic wind and fetch related erosion processes (Lowery 2003a: 260-261). Four random localities along the shoreline were selected as potential drop-off localities for ceramic tiles. All of the tiles had standard 2-x-2 inch dimensions. The tiles were painted (e.g., blue, green, yellow, and red-orange) and color-coded to the individual drop-off localities. To improve long-term tile visibility, a small corner of each tile was painted bright orange-red. Twelve tiles were deposited at each separate locality at the same time and a correspondingly color-coded wooden stake was driven into the ground, which helped to mark each drop-off locality for future reference (see Figure 21 and 22). In theory, the experiment would help assess and monitor the littoral movement of artifacts along the shoreline. Over time, the distance and direction of tile movement from the parent drop-off area would also help determine the redeposition processes unique to 44NH440. Finally, the number of retrieved tiles collected at the end of the experiment would help monitor the natural reburial processes occurring along the shoreline. It is believed that these data are important to critically evaluate the patterning of artifacts, the density of artifacts, and the cultural chronologies recorded at individual shoreline sites.

Figure 20. Soil Auguring on the Shoreline near South Bay.

Figure 21. Items Used in the Tile Erosion – Redeposition Experiment at 44NH440.

Figure 22. Yellow Colored Tiles and Stake Placed along the Shoreline at 44NH440.

3: Geoarchaeological Investigations

Location and Background

Mockhorn Island is located off the southeast Atlantic coast of Northampton County, Virginia (see Figure 2). Numerous historic and prehistoric archaeological sites are found on the island. Several sites located on Mockhorn Island were documented during an archaeological survey (Lowery 2003a) of the Atlantic seashore. One of these sites was designated as 44NH440 and named the Upper Ridge site. The area encompassing the site is defined in Figure 6 and it is plotted on the Townsend USGS 7.5-minute quadrangle map. The site is 2.35 miles (3.78 kilometers) west of the mainland portion of Northampton County, Virginia. The closest inlet to the Atlantic Ocean is Ship Shoal Inlet, which is 4.59 miles (7.38 kilometers) east-southeast of the site. Three geologically young Atlantic coast barrier islands are located immediately east of the site (i.e., Wreck, Ship Shoal, and Myrtle Islands). Other minor islands situated east of the site, but not directly adjacent to the Atlantic Ocean, include Goodwin's and Mink Islands. These are also geologically recent.

44NH440 was selected as an archaeological site worthy of follow-up investigations primarily because the site revealed cultural features. The site also had dense evidence of multi-component prehistoric occupations. The site was in an Atlantic coastal setting, which is an area that is archaeologically poorly understood. The site also had not been impacted by historic activities and the large shoreline assemblage did not indicate that the area had ever been surface collected.

Geoarchaeological and geological studies were undertaken at the site over the period between July 2002 and April 2003. The process began with a through understanding of the previous geological studies that had been conducted in the region (see Morton and Donaldson 1973; Shidler et al. 1984; Finkelstein and Kearney 1988; Oertel et al. 1989; Foyle and Oertel 1992; Oertel and Kraft 1994; Oertel and Foyle 1995). The process of understanding the geology of the region included numerous conversations with Dr. George Oertel at Old Dominion University. His contributions were immensely important to the geological understanding of the region. The geoarchaeological investigations at the site also included soil descriptions based on auguring conducted by Dr. John Wah of the University of Maryland. Dr. John Wah's soil investigations were conducted on April 6, 2003. A tile redeposition experiment was performed by the principle investigator along the shoreline to address artifact movement and site formation processes. Finally, a Mockhorn Island site visit with Dr. Dan Wagner of Geo-Sci Consultants and Dr. Michael Waters of Texas A&M University was conducted to get additional outside geoarchaeological observations about the region.

Geologic and Ecologic History of Mockhorn Island

The recognition that 44NH440 has revealed evidence for numerous prehistoric occupations, which span 13,000 years, is evident in Lowery's (2003a: 206-208) artifact inventory collected from the shoreline area. What attracted prehistoric peoples to this isolated marshy shoreline over the past 13,000 years? Obviously, the region has changed ecologically and climatically over this period of time. 13,000 years ago sea levels were 80 meters (260 feet) lower than today. When the site ceased to be occupied approximately 1,200 years ago, sea levels were only 1 meter (3.25 feet) lower than today. Climatically the area has experienced dramatic shifts from cold to warm and preciptation has fluctuated from dry to wet many times in the past. What attracted ancient people to 44NH440 can be linked to the geology of the area and the types of ancient landforms associated with the Atlantic coastal zone. The following discussion hopes to address the geological history of Mockhorn Island.

The basement sediments associated with Mockhorn Island were deposited during the last high sea stand (i.e., isotope stage 5e) about 125,000 years ago. During this high sea stand, sea levels were 5 to 6 meters or 16 to 20 feet higher (Groot and Jordan 1999). During this high sea stand, the littoral movement of sediments southward along the coast created an extension of the Delmarva Peninsula referred to as the second Nassawadox spit (Oertel and Foyle 1995). As a result, a former low sea-stand paleochannel of the Susquehanna River (i.e., the Eastville channel) was in-filled with coastal sediments (see Figure 3). Because sea levels were higher, the area presently east of the mainland area of Northampton County, Virginia consisted of a series of offshore linear sand bars. One of these sand bars forms part of the basement landmass that was too later become Mockhorn Island.

As sea levels fell during beginning of the last Ice Age (i.e., isotope stage 4), the Susquehanna cut a new channel (i.e., the Cape Charles channel) and joined forces with the York River watershed. The former Cape Charles channel is located immediately south of Mockhorn Island (see Figure 5). More importantly with respect to 44NH440, the former offshore linear sand bars became dry land and their orientation sculpted the drainage patterns east of Northampton and Accomack Counties. Coastal geologists have documented some of these former river valleys near Mockhorn Island (Shidler et al. 1984; Finkelstein and Kearney 1988; Foyle and Oertel 1992). The intensity of the winds during the last ice age, the cold dry climatic conditions, as well as, the sandy nature of the primary sediments resulted in aeolian dune formation. The linear nature of the modern elevated hummocks that traverse the island in a north-south pattern represent some of these Ice Age aeolian dune landforms (Figure 23). Approximately 35,000 to 25,000 years ago (i.e., isotope stage 3), sea levels rose to 30 meters or 97 feet below present and the climate was cool and very moist during this short interstadial. As a result, vast swampy peat bogs formed along sections near the Atlantic Coast of Virginia's Eastern Shore. Finkelstein and Kearney (1988) and Cline et al. (2001) have dated organic deposits and peat associated with the stage 3 interstadial on Mockhorn Island and along the mainland. Some of the Pleistocene vertebrate remains found along Assawoman, Metompkin, and Cedar Islands may have eroded from offshore deposits of similar age.

During the last glacial maximum circa 18,000 to 21,000 years ago (i.e., isotope stage 2), sea levels again dropped markedly to approximately 110 meter or 358 feet lower than present. The intensity of the winds during this very cold glacial event combined with the cold dry climatic conditions, and the sandy nature of the primary sediments resulted in continued aeolian dune formation and aeolian deflation. Aeolian sands buried some of the former peat bogs. The linear dune ridges of Mockhorn Island continued to build. Finally, after the grips of the last glacial maximum ceased, sea levels rose rapidly and the oceanic waters eventually drowned the former glacial upland landscapes during the Holocene. Over the period between the last glacial maximum and the late Holocene, humans occupied the landscape of Mockhorn Island. Some of these landscapes are now inaccessible. Other portions of the Mockhorn Island landscape (i.e., 44NH440) just barely escaped the processes associated with Holocene marine transgression.

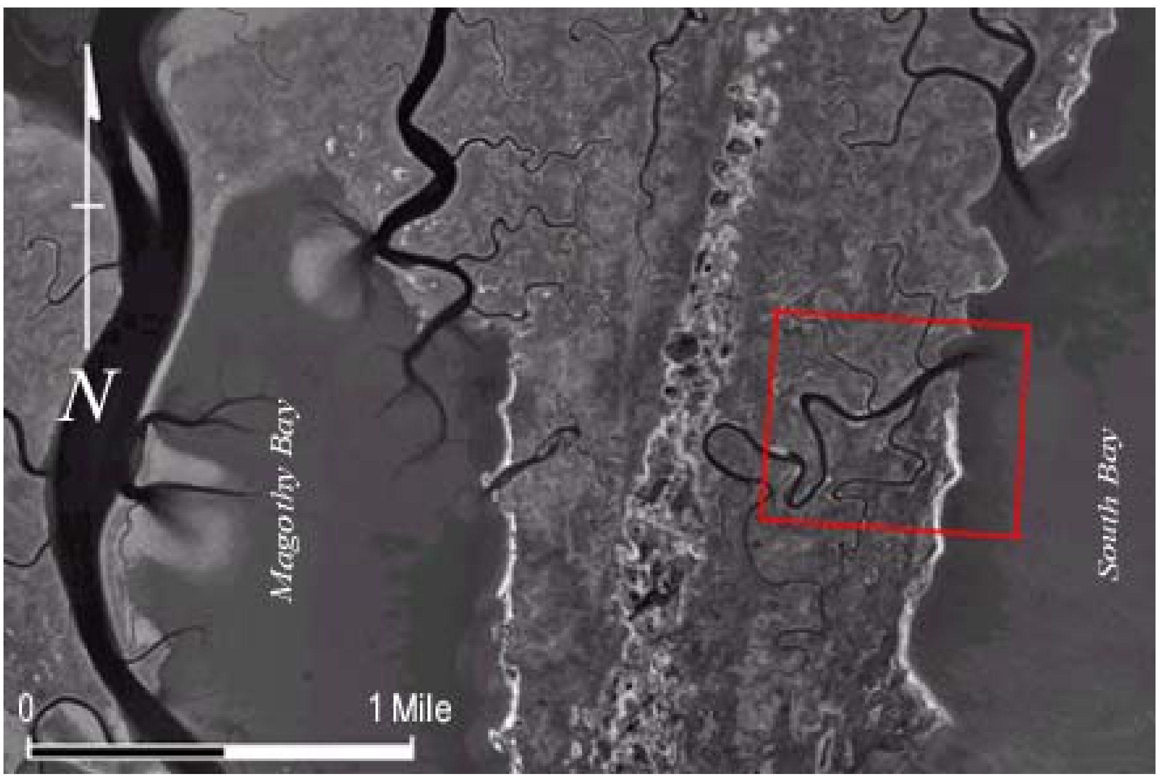


Figure 23. Linear Hummock Ridges on Mockhorn Island and the Study Area Associated with 44NH440.

Figure 23 illustrates the central portion of Mockhorn Island as it appears today. The study area associated with 44NH440 is outlined in Figure 23. Figure 24 attempts to illustrate the ecological and recent geological changes that have occurred at 44NH440 between 13,000 years BP and 1,200 years BP in the outlined area defined in Figure 23. During the Paleo-Indian period, 44NH440 was an upland ridge associated with a series of freshwater run-off streams and possibly springs (Figure 24, top). The site was immediately west of a tributary river system that ultimately emptied into the Susquehanna River. During the middle Holocene as sea levels rose rapidly (Bratton et al. 2003), the tributary river system east of the site would have been the first portion of the immediate landscape adjacent to the site to be impacted by saltwater intrusion. The effects of oceanic water intrusion should have influenced the river system situated between Mockhorn Island and the mainland (see Figure 5) even slightly earlier. By 3,000 years ago, the marine transgression processes, the littoral movement of sediment along the coast, and the periodic over-wash storm events would have in-filled the low valley east of the site with coastal sediments. Tidal marshes should have formed within the mix of sand, shell lag, and silt. From a geologic time-scale, the ecology of the region had changed markedly. From a human perspective, the ecological change was more gradual. By 3,000 years ago, 44NH440 was essentially a forested linear ridge similar to examples along the modern coastal sections of Accomack County, Virginia (see Figure 25). At this time, 44NH440 had a broad tidal marsh to the west and a shallow oceanic lagoon or bay to the east of the site (see Figure 24, bottom). Between 3,000 years BP and 1,200 years BP, the forest area along the ridge gradually decreased as a result of slower rates of sea level rise. Figure 26 illustrates the demise of a forest community along the west side of Mockhorn Island, Virginia as a result of sea level rise and more frequent tidal saltwater intrusion. Figure 27 illustrates the complete loss of forests along a linear ridge within a coastal section of Northampton County, Virginia. Sometime between 1,200 years BP and 800 years BP, prehistoric peoples less frequently revisited the linear ridge landform that presently encompasses 44NH440. The absence of Late Woodland era prehistoric ceramics would support this observation. At this time, 44NH440 may have resembled the landscape shown in Figure 27 and the ridge should have been inundated daily during the Late Woodland-era high-tide episodes. As a result, the ridge became less apparent as coastal overwash sediments and tidal marsh peat slowly engulfed the landform. During the Late Woodland-era, the central hummock ridge of Mockhorn Island may have become the focus of human occupation. Virtually all evidence associated with the once forested landform (see Figure 27) designated as 44NH440 decayed and disappeared (see Figure 19).

With respect to human use of the linear ridge associated with 44NH440, the ecology and the overall environmental setting changed radically throughout prehistory. Lowery (2003a) has developed a series of landform and ecological models for prehistoric human settlement and land-use on the Delmarva Peninsula. With this model, the ecological evolution of the landscape is very important for understanding why prehistoric peoples may have been attracted to a particular area. Understanding the geology and soils of a region, as well as, comprehending aspects of marine transgression and aeolian processes are important facets of Lowery's (Ibid) model. Given the landscape changes associated with 44NH440 shown in Figure 24, the site should fit into Lowery's (Ibid) Springhead, Interior Stream, and Sand Ridge pattern from the Paleoindian period through the end of the Middle Archaic period. During the Late Archaic period and Early Woodland period, sea level rise should have altered the ecology of the area so that 44NH440 would have been expressive of a Rivershore focus settlement pattern. At the end of the site's documented prehistoric record, the forested ridge would have been associated with a tidal marsh and a coastal bay setting. By the Middle Woodland era, the ecology of the area and the human use of the landscape would easily be characteristic of an Estuarine Wetland focus settlement pattern.

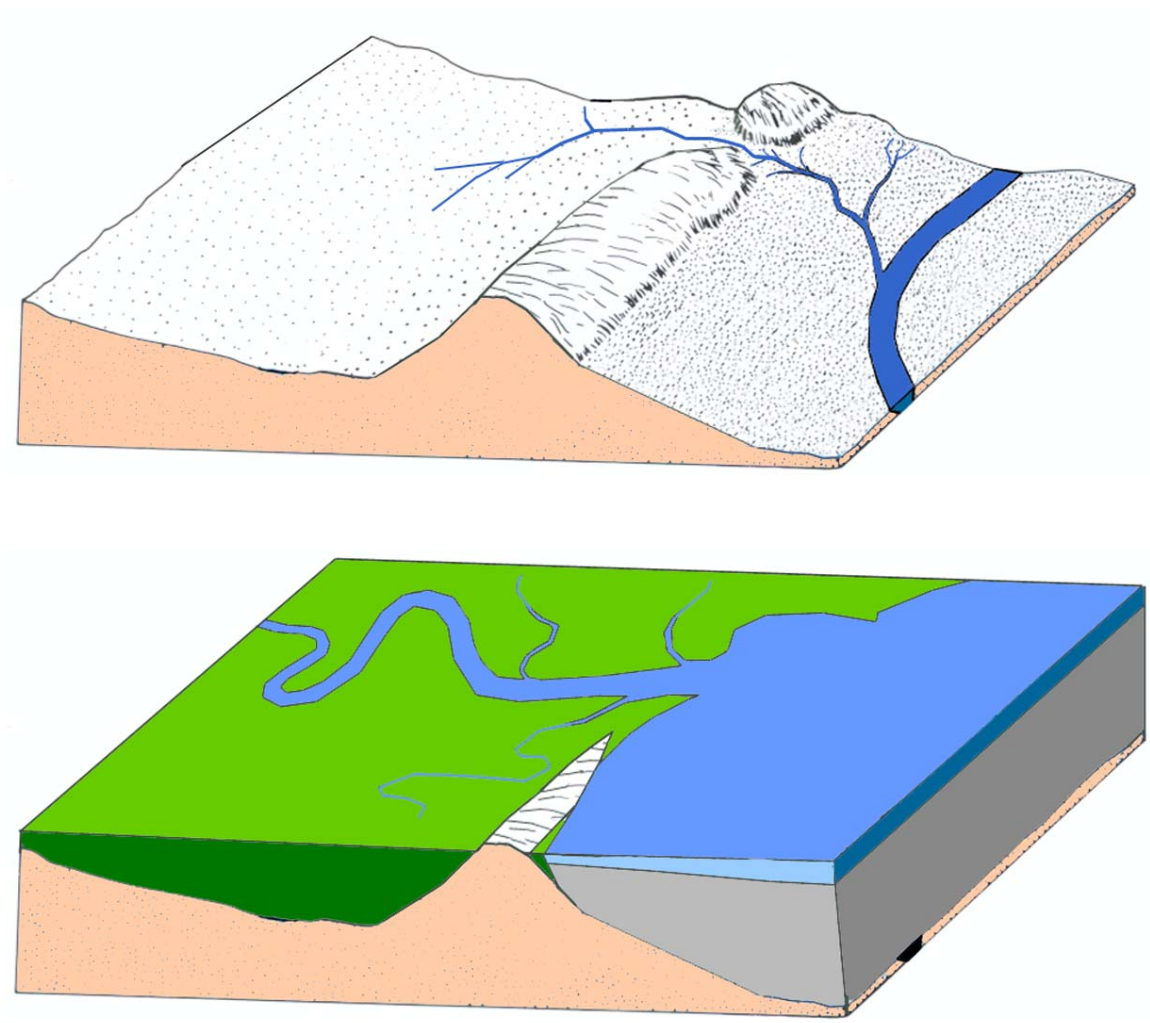


Figure 24. General Geological Processes Associated with 44NH440.

Figure 25. Forested Linear Ridge on Upshur Neck, Accomack County, Virginia.

Figure 26. Saltwater Stressed and Dying Forests on Mockhorn Island, Northampton County, Virginia.

Figure 27. Forest Killed by Coastal Saltwater Intrusion near the Ramshorn Channel Area, Northampton County, Virginia.

Soils Analysis

Dr. John Wah conducted the soils analysis of Mockhorn Island on 4/6/03. Sections of the island, an area inland of 44NH440, and an associated archaeological site south of 44NH440 were augered. The soil profiles and descriptions appear in Appendix I. The soils data combined with the regional geology and the archaeological data generated as a result of this project permits a more detailed evaluation of the landscape associated with 44NH440. General observations during extreme low tides also helped with this evaluation.

Figure 28 summarizes the site formation processes associated with 44NH440. The site is not heavily eroded and has not eroded appreciably over the past 45 years (see Figure 9). Even so, transect AA – BB in Figure 28 illustrates an area of tidal and coastal wave energy scouring that is occurring east of the buried ridge crest. This aspect is also clearly illustrated in Figure 19. In essence, the eastern portion of the ridge is being slowly "peeled" away by onshore wave energy. It is this erosive "peeling" process that uncovered all of the artifacts (Lowery 2003a: 206-208) found at 44NH440 when it was originally discovered in October, 2001. This process also exposed the cultural midden and all of the observed features noted at the site. Transect A – B, situated parallel to the shoreline, indicates that the former topographic relief dips towards the mouth of the creek along the northern section of the site. This is further supported by the disappearance of sub-soil deposits in the creek bank exposure at maximum low tide. Prehistoric cultural items have been found on top of the modern marsh in the area immediately south of the creek or immediately south of "B" in Figure 28. Generally, these artifacts are dark black, gray, or dark brown because of manganese or sulphid staining. The cultural items are originating from eroded strata that are largely inundated, anaerobic, and gleyed. With respect to Transect A – B, some of the artifacts found along the shoreline have a limonite coating. Near the area designated as "A" in Figure 28, some lithic artifacts have been discovered with a brilliant orange-light brown coating. When freshly damaged, all of these artifacts have a chalky layer immediately below the exterior and some are dark black or grey in the interior. Ellis and Deller (1986: 39-60) have noticed a similar process at the Tedball site where the lithic artifacts have a brown rind or limonite patina caused by a reaction of natural iron-rich minerals in the chert to the oxygen-rich waters of the Nipissing Phase high water event unique to the Great Lakes region. With respect to 44NH440, the sandy permeable nature of the parent soils and the long-term exposure to oxygen-rich oceanic waters seem to have created a situation conducive to the build-up of a limonite patina on some of the lithic artifacts.

The tidal marsh peat that surrounds the former ridge landform has buried a large portion of the site. Distinct tidal marsh peat strata can be observed along the bank cuts of the creek situated north of the site at maximum low tide. These strata could in essence be lumped as one organic unit. Even so, when eroded via tidal processes distinct layers are apparent. These layers maybe the result of minor pulses of sea level rise, overwash events that deposited reworked organic sediments, peat compaction due to age, or a combination of all of these processes. As such, Figure 28 designates two distinct tidal marsh peat strata (i.e., old and young). Importantly, there may be more than two tidal marsh peat strata associated with the site.

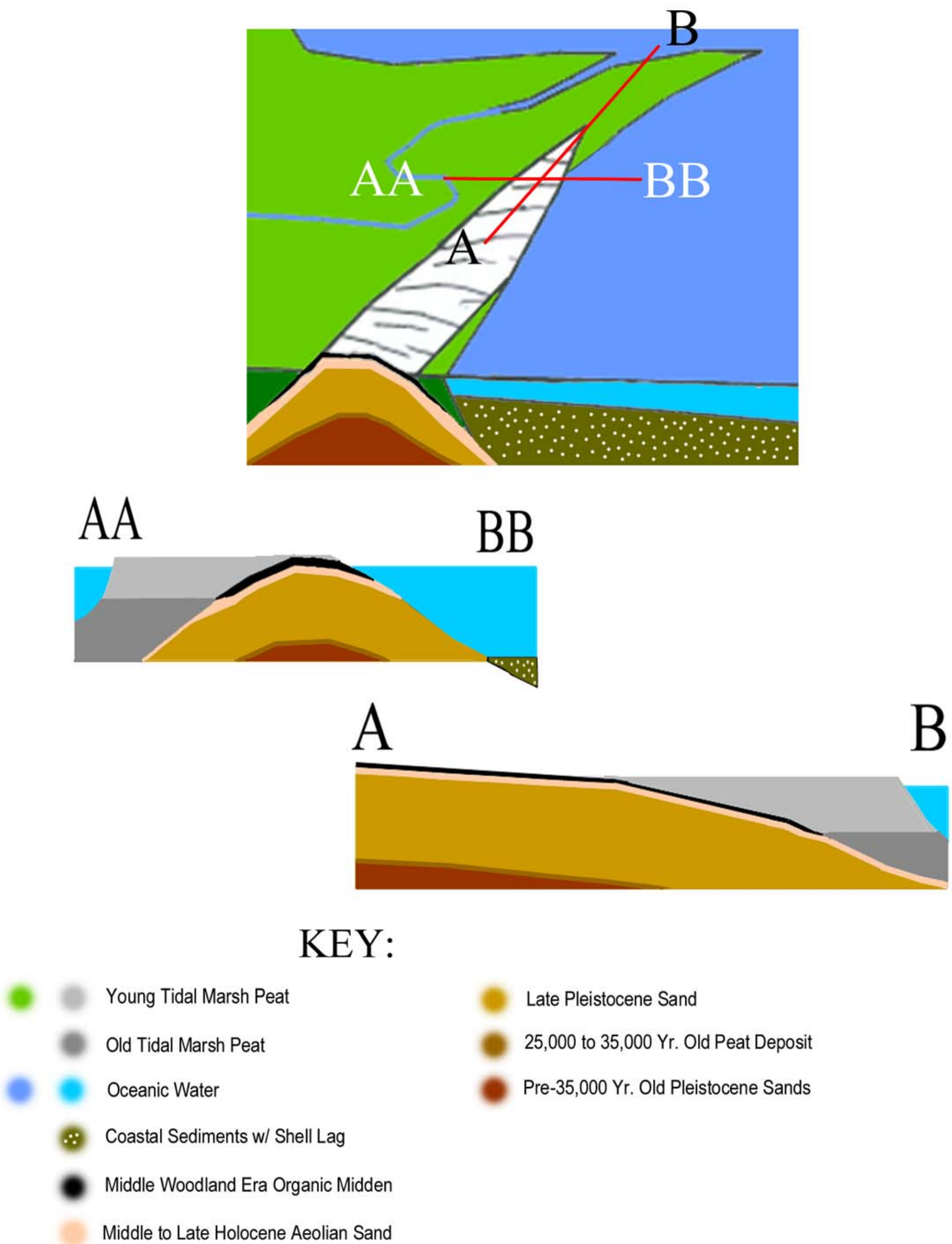


Figure 28. Soils and Site Formation Processes at 44NH440.

The Middle Woodland-era organic midden defined in Figure 28 corresponds to both the A1 and A2 soil horizons associated with the site (see Appendix I and Figure 13). Along the South Bay or east side of the ridge, the organic midden has been scoured away via wave energy and erosion. Along the west side of the ridge (section "AA") and along the north end of the site (section "B"), the midden is intact and buried. The deeply buried sections of the midden have escaped recent or modern bioturbation as a result of fiddler crab burrowing. Along parts of the ridge, the organic midden disappears and an earlier tidal marsh peat deposit is apparent. It is assumed that this transition marks the boundary between the former Middle Woodland-era marsh and the forested ridge covered with cultural refuse debris.

It is evident in Figure 19 and defined in Figure 28 that a lighter sandy stratum occurs immediately below the organic midden. The lighter sandy stratum is designated as the BEg horizon in Appendix I. Based on the uniform nature of the fine sands and the lack of soil development, it would seem that this stratum represents a distinct aeolian depositional event associated with the Middle to Late Holocene. The stratum must have been deposited when sea levels in the region were much lower because it extends underneath the "old" tidal marsh peat deposit.

The boundary between the BEg horizon and the underlying Bt1 horizon seems to represent an erosional event. The surface seems to be truncated (Dr. Dan Wagner: personal communication, 6/16/03). As such, it is assumed that some process, possibly aeolian erosion or deflation, has removed a portion of the original surface sediments associated with the Bt1, Bt2, and BC sediment package. Given the level of soil development within the sandy Bt1 and Bt2 strata exposed along the shoreline, it is believed that this sediment package is Late Pleistocene in age or roughly 13,000 to 25,000 years old. A buried peat layer and an organic-rich stratum are evident below the sandy strata in two of the soil profiles (see Appendix I). Though not radiometrically dated as part of this study, it is believed that the buried peat layer and the organic-rich stratum evident below Mockhorn Island correlates with the 23,000 to 34,000 year old surface reported by Finkelstein and Kearney (1988: 41-45) for the region. As such, this stratum in Figure 28 is recorded as the 25,000 to 35,000 year old peat deposit. Another sandy stratum is recorded below the peat deposit in one of the soil profiles. It is designated as pre-35,000 year old Pleistocene sands in Figure 28.

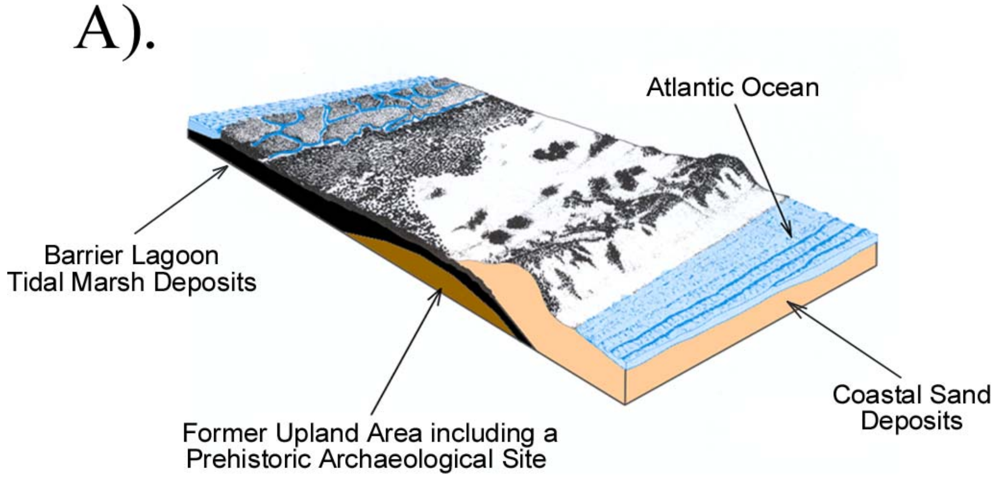
Archeological Implications and Discussion

From the standpoint of site formation processes, the soil analysis and the local geology provide important aspects relative to the site formation processes at 44NH440. The assessed depositional sequences indicate that the depths of the cultural strata at 44NH440 vary considerably across the site. The dense numbers of artifacts originally found at the site when it was first discovered combined with the historically documented low levels of shoreline erosion suggest that the site is archaeologically extremely rich. Even though portions of the site have been impacted by erosion and bioturbation, large sections of the site should be intact, inundated, and buried by the processes associated with Holocene marine transgression.

In the larger archaeological contexts outside of the boundaries of 44NH440, the observed site formation and burial processes have major archaeological implications for the Atlantic seashore of the Delmarva Peninsula. Unlike the Chesapeake Bay side of the Delmarva Peninsula, where contemporaneous coastal multi-component archaeological sites are usually quickly destroyed via fetch related erosive processes (see Figure 29). The archaeological sites along the Atlantic seashore seem to be buried before erosion could destroy the intact or buried cultural components. Figure 30 illustrates the observed natural processes of site burial along the Atlantic coast. The image simplifies the inland sand migration associated with barrier islands as sea levels rise. If sea levels continue to rise along the Atlantic, the processes illustrated in Figure 30 suggest that the current barrier island sands associated with Wreck Island, Ship Shoal Island, Myrtle Island, and Smith Island will migrate westward across Mockhorn Island. If this occurs, the only major natural destructive threat to the intact archaeological remains of Mockhorn Island will be inlet formation and the natural down cutting associated with tidal scouring (see Lowery 2003a: Figure 3.7).

Figure 29. Fetch-Related Erosion at 18DO371 on the Honga River, Dorchester County, Maryland.

A).



B).

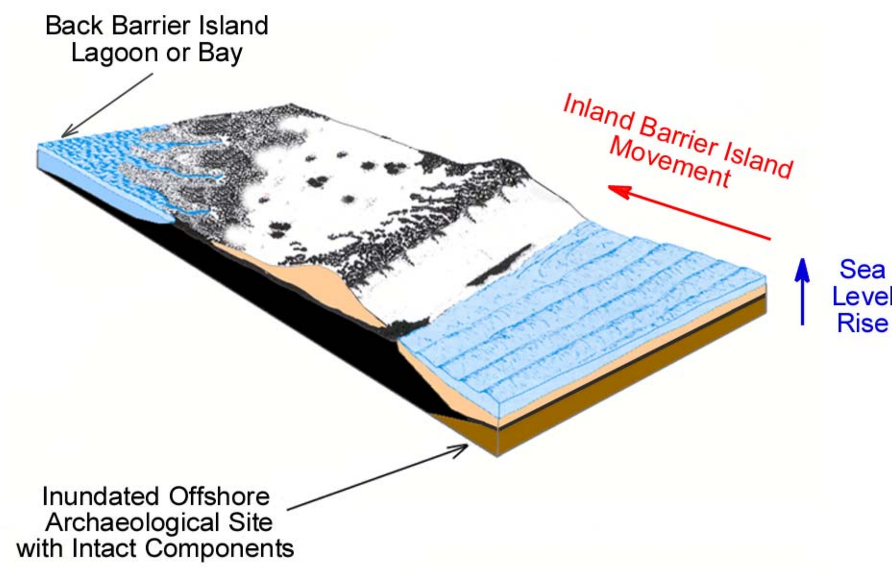


Figure 30. Natural Site Burial Processes Associated with Marine Transgression.

The degree of near shore coastal processes impacting drowned archaeological sites such as those illustrated in Figure 30B should vary depending on the rate of sea level rise. During protracted periods with stabilized or slow rates of sea level rise; the degree of site destruction via inlet changes should be greater. In contrast, periods with rapid rates of sea level rise should have associated inundated archaeological sites that are well preserved or largely intact. Figure 31 illustrates the continental shelf immediately east of Mockhorn Island, Virginia. The portion of the outer continental shelf in Figure 31 would have been rapidly inundated during the Late Pleistocene and Early Holocene. The site formation processes illustrated in Figure 28 for 44NH440 and the natural marine transgression burial processes shown in Figure 30 would suggest that an amazingly rich and intact prehistoric archaeological record would occur in the area shown in Figure 31. Only future underwater archaeological investigations will help address this hypothesis.

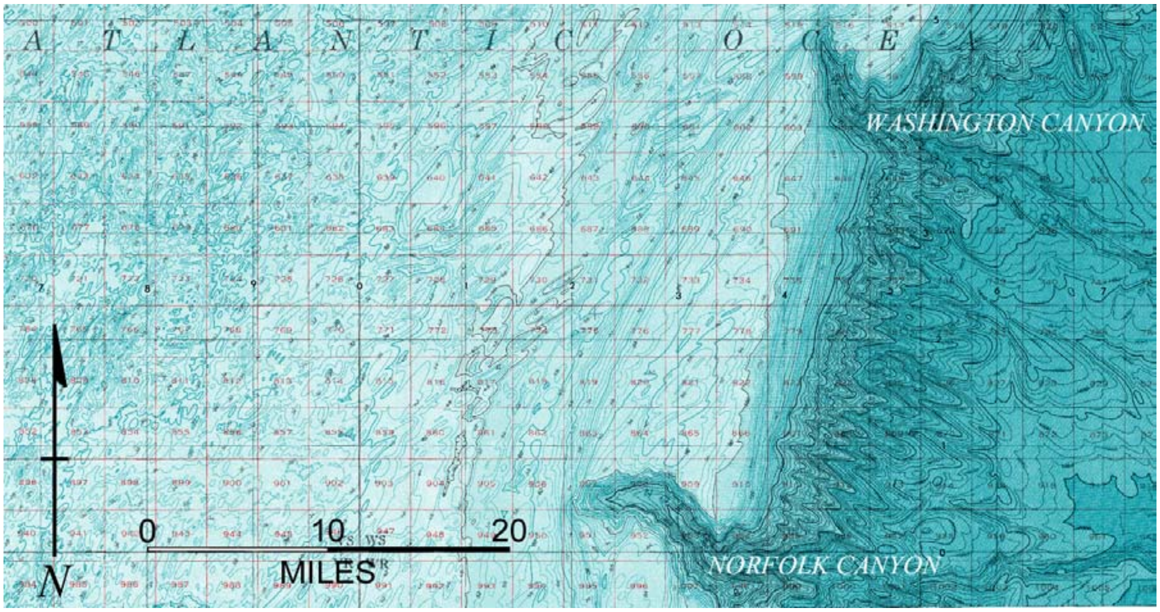


Figure 31. The Continental Shelf East of Mockhorn Island, Virginia.

4: Research Results

The research at 44NH440 was to include several avenues of investigation. As previously discussed, the soils, the geomorphological, and the site formation process studies were conducted prior to any test excavations. Even while in the field when conducting these initial investigations, discoveries were made that hinted to the importance of 44NH440 relative to Delmarva's prehistory. Along the shoreline within redeposited contexts, some artifacts were discovered that warrant some initial discussion. Though lacking context, these items can tell us a lot about the activities associated with 44NH440 during the Middle Woodland period and prior to the proposed test excavation research.

Figure 32 illustrates some of the items found along the shoreline at 44NH440 during the initial fieldwork. The items in Figure 32 along with the items illustrated in Figures 33 and 34 were collected because of the overall significance to regional prehistory. Figure 32A represents a Hopewell style point manufactured of Flint Ridge chalcedony from Ohio. Figure 32B represents a damaged Fox Creek stemmed point manufactured of rhyolite. Figure 32C is a damaged Jack's Reef corner-notched point manufactured of jasper. Figure 32D is the distal end of a biface manufactured from argillite. Figure 32E is a miniature or "non-utilitarian" copper celt. All of these items hint towards long-distance trade and exchange or outside influences into the region of southern and coastal Northampton County, Virginia. Except for the item illustrated in Figure 32A, all of the additional items previously discussed were found redeposited along the shoreline and lacking context. Figure 32A was found exposed along the shoreline bank-cut, embedded within the Middle Woodland organic midden (see Figure 28), and wedged between two fragments of Mockley ware.

Figure 32F – 32H, Figure 33, and Figure 34 illustrate some additional artifacts and items found along the shoreline at 44NH440. Figure 32F is a tooth from a Bull Shark (i.e., *Carcharhinus leucas*) and it is not fossilized. Figure 32G is the barb from a large sting ray (*Dasyatis* sp.?). It may be from a Southern Stingray (i.e., *Dasyatis americana*), which has been observed along Virginia's coast and can attain lengths of 10 feet (Murdy et al. 1997: 45). Both Figure 32F and Figure 32G were found exposed along the shoreline bank-cut and embedded within the Middle Woodland organic midden. Figure 32H is a very large bone fishhook fragment that is damaged and includes only the shank portion of the hook. The fishhook is stained by manganese or sulphidic minerals, which would indicate it originated from inundated contexts. Figure 33A illustrates a shell bead that was found along the shoreline. Other items, such as the stone drills (see Figure 33B and 33C) may have been used to manufacture the bead or similar beads. Interestingly, Figure 33B is a micro-drill typically associated with shell bead manufacture (Bostrom and Kinsella 2002). Figure 33D is a whelk (*Busycon* sp.?) columella core found along the shoreline bank-cut and embedded within the Middle Woodland organic midden. The central cores of the whelk were also used to manufacture shell ornaments by prehistoric peoples (Kraft 2001: Figure 6.10). The items discussed would suggest that the Middle Woodland occupants were fishing and manufacturing shell ornaments at 44NH440.

Figure 32. Lithic and Bone Artifacts found along the Shoreline at 44NH440 during the Fieldwork.

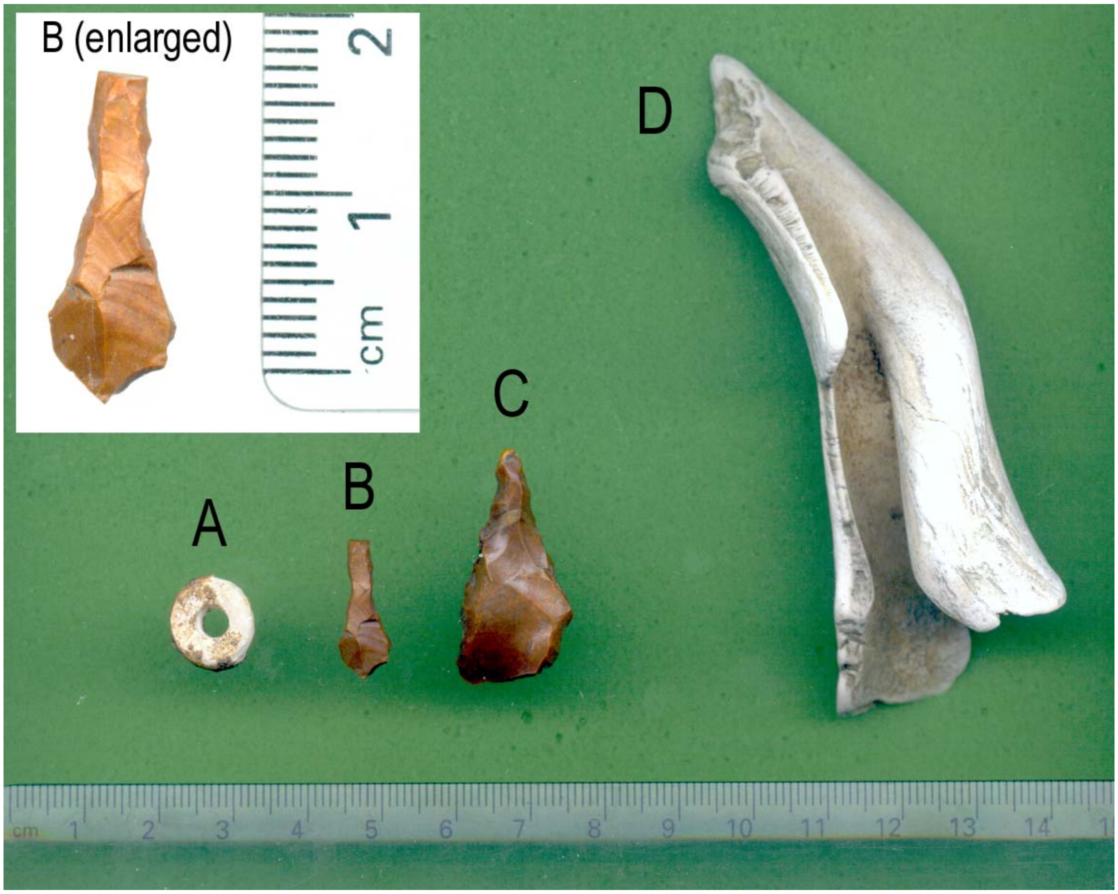


Figure 33. Lithic and Shell Artifacts found along the Shoreline at 44NH440 during the Fieldwork.

Figure 34 also provides some evidence about the prehistoric subsistence patterns at 44NH440 during the Middle Woodland period. Figure 34A is a fragmentary Bay Scallop (i.e., *Aequipecten irradians*), which was found along the shoreline bank-cut and embedded within the Middle Woodland organic midden. Figure 34B illustrates a small fragment of prehistoric shell-tempered Mockley ware that was tempered with crushed Bay Scallop shells. The enlargement illustrates the impression of the radial ribs indicative of the Bay Scallop even though the shell has long since dissolved away. These data would suggest that some scallops were harvested in the South Bay area possibly consumed and used to temper ceramic vessels. These vessels were also locally made, probably at or near 44NH440. The initial field research and selective surface collected assemblages from 44NH440 indicated that 44NH440 included significant archaeological remains even prior to the proposed test excavations.

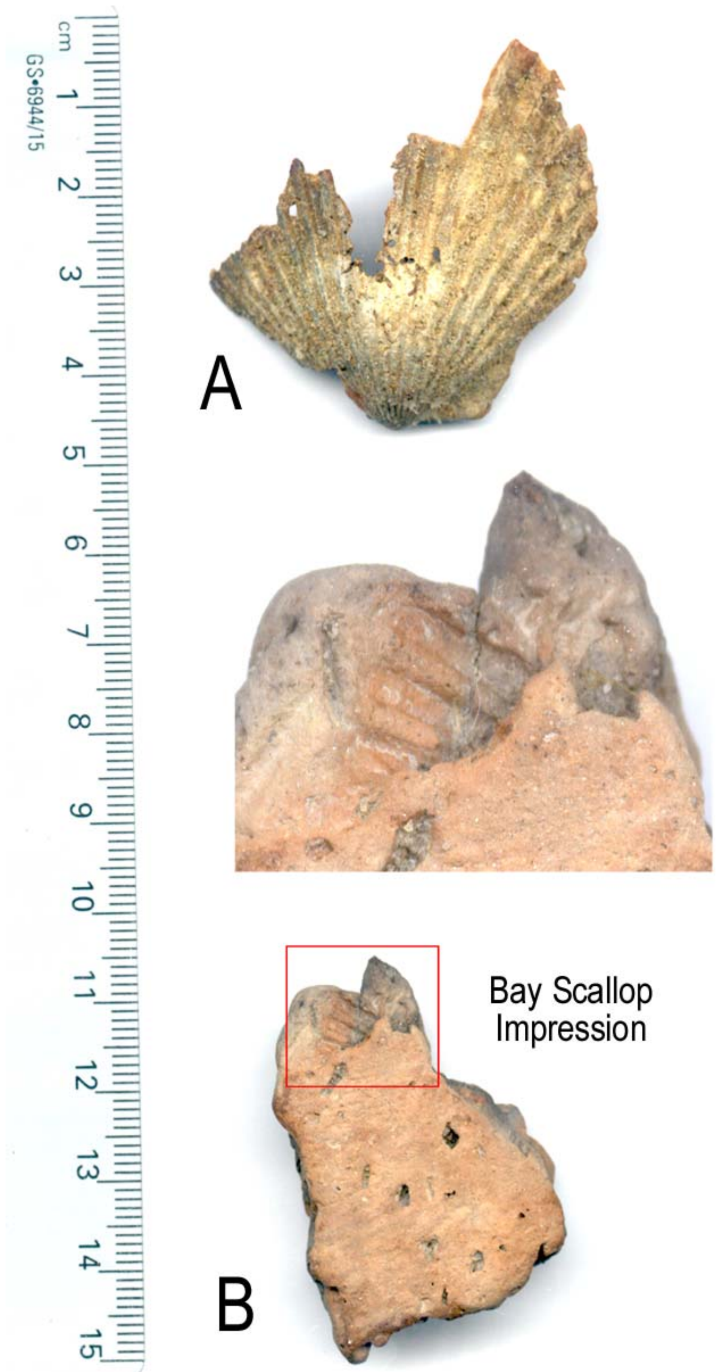


Figure 34. Ceramic and Shell Artifacts found along the Shoreline at 44NH440 during the Fieldwork.

Prior to the field excavations, the area encompassing the site was mapped (see Figure 35) at low tide. The five test excavation units were defined and plotted (see Figures 14, 15, 16, 17, and 18). The tile redeposition drop localities were denoted and potential features for future investigation were plotted. Only one of the observed features was selected for testing (see Figures 12 and 14), but others were mapped. Feature A in Figure 35 consists of an oyster encrusted 15 to 20 pound boulder of quartzite located offshore of the site. The boulder is only exposed at extreme low tide. Considering the geology, the boulder could only have been deposited at the site via anthropogenic processes. It may represent a prehistoric net weight or anchor. Feature B in Figure 35 includes a few hard clam (i.e., *Mercenaria mercenaria*) shells embedded and exposed within the bank profile approximately 3 feet below the modern marsh surface. The shells are within the tidal marsh matrix and may represent a cultural feature or an earlier natural overwash storm event. Feature C in Figure 35 is a small 10 to 15 centimeter circular organic stain filled with carbonized wood. Feature C may represent a prehistoric posthole or it may simply resent a former burned tree root. Feature D (see Figure 10) in Figure 35 is a large oblong or "kidney bean" shaped area of organic stained earth. Over the period of site examination, a hammerstone and some prehistoric pottery have been exposed within the surface of this feature. Future work at the site may eventually address these features and others yet undiscovered.

The surface landforms (see Figure 35) and the sub-surface geology (see Figure 28) provided the backdrop for understanding the cultural stratigraphy (if any) associated with 44NH440. The excavation units were generally confined near the apex of the former ridge. Even so, one of the units was situated west of the ridge apex to better understand how marine transgression may have impacted the site and any cultural deposits. Finally, the tile experiment drop localities had approximately the same linear placement along the shoreline. It was assumed that these drop locations would help better understand and quantify the linear movement of eroded artifacts along the shoreline. The map shown in Figure 35 served as the base image for recording and documenting all of the fieldwork conducted at the site.

Test Unit Results and Discussion

Five 1-x-1 meter test units were excavated along the shoreline and along the ridge associated with 44NH440. Test unit 17.5N-9E was situated over an observed organic stain or feature (see Figure 12) that was evident in the sub-soil. Three of the test units (i.e., 0N-3E, 9S-3E, and 14S-3E) were located along the shoreline on or near the exposed Middle Woodland-era organic midden. The final unit (i.e., 5S-5W) was situated back from the shoreline on the west side of the ridge crest and within an area impacted by coastal sediment overwash. Test unit locations were chosen based on the potential for prehistoric cultural deposits and to give sufficient understanding about how coastal processes along the Atlantic seashore impact former upland terrestrial archaeological deposits. All test unit elevations were taken using a string line level and each unit was excavated using the natural stratigraphy to designate distinct excavation levels. All of the sediments excavated were water-screened via South Bay. It would seem that all of the test units were above water (see Figure 36). At high tide, which occurs two times each day, four of the five test units were below water (see Figure 37). The fifth or supposed dry unit (i.e., 5S-5W) was also impacted by saltwater intrusion through the porous sandy and peat strata associated with the region's setting. Essentially, the archaeological investigations at 44NH440 represent research into a prehistoric site with inundated and semi-inundated deposits.

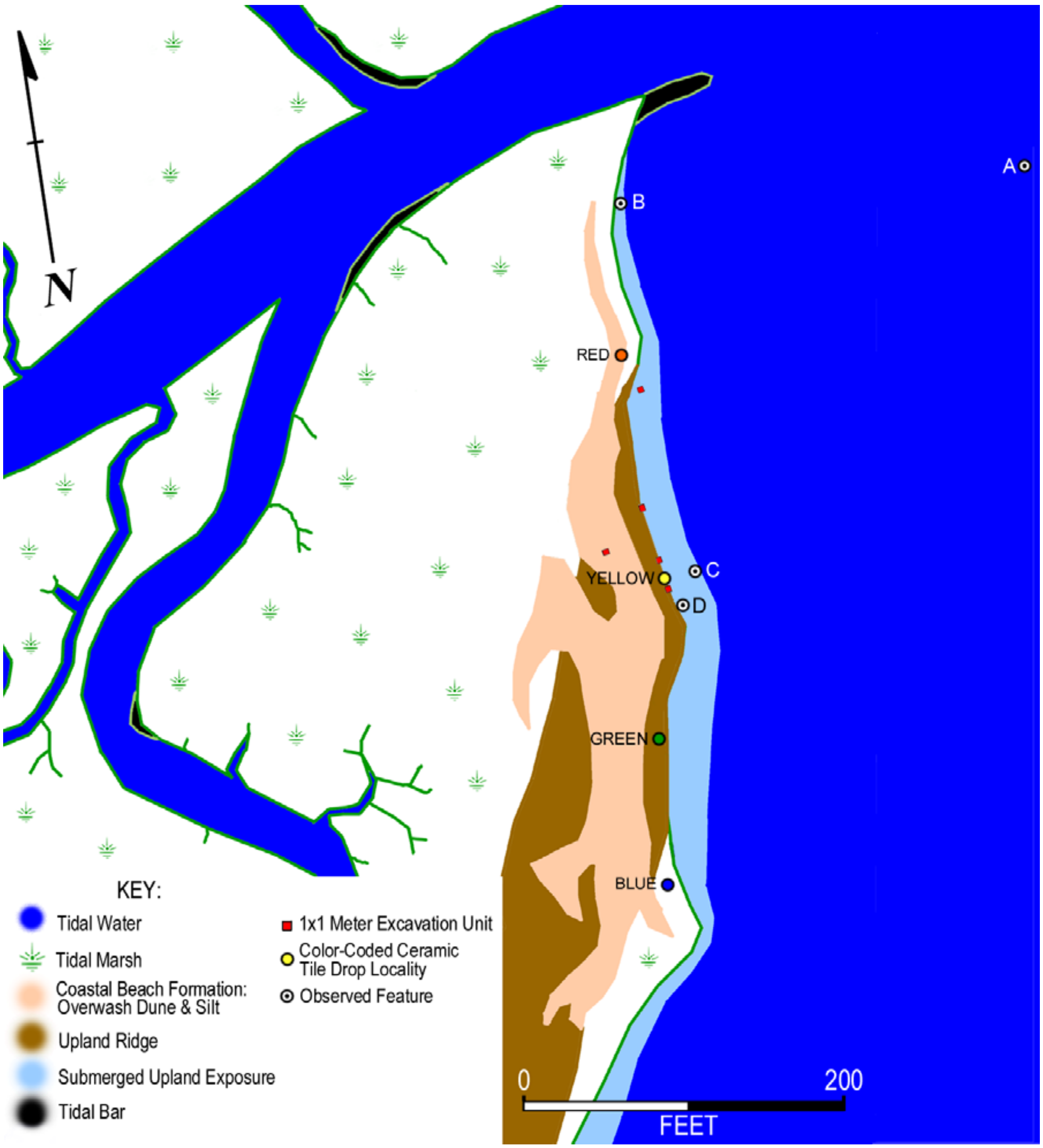


Figure 35. Map of the Investigation Area at 44NH440.

Figure 36. The Investigation Area at Low Tide.

Figure 37. The Investigation Area at High Tide.

Test Unit 17.5 North - 9 East. This unit was placed over a dark circular organic stain or feature that was observed when the site was first discovered (see Figure 12). The upper surface along this portion of the site had been eroded away, which exposed the sub-soil with the stain or feature. Given the observed stratigraphy noted for the site (see Figure 28), it is believed that the Middle Woodland-era organic midden and the Holocene sand stratum had been scoured away by onshore wave activity. Only the more erosion resistant Pleistocene sand and the organic intrusion into this stratum had survived the erosive scour of the wave energy. It was initially believed that the organic stain might be a cultural feature. When the unit and feature were cross-sectioned (see Figures 38 and 39), it became evident that the organic stain represented the remnants of a tree taproot. The carbonized wood had concentric growth rings indicative of the insitu growth of a tree. Therefore, the organic stain within the unit was not cultural. No prehistoric artifacts were discovered. Figure 38 shows the unit under excavation. Figure 39 shows the generalized profile of the unit. A former episode of fiddler crab bioturbation was evident by the tidal-filled and gleyed-colored sediments associated with burrows or tunnels. Excavations stopped at 30 centimeters below the ground surface.

Test Unit 0 North - 3 East. This unit was placed over a section of the exposed Middle Woodland-era organic midden (see Figure 40). The unit is the northern-most unit situated along the shoreline associated with the intact midden deposit. The unit also contained the thickest exposure of the midden (see Figure 41). When the unit was excavated, only the surface midden stratum contained cultural artifacts. Being on the surface, the midden and even portions of the sub-surface Holocene sand stratum were heavily bioturbated by fiddler crab burrowing activities. Even so, cultural artifacts were only found in the midden deposit. Figure 42 shows all of the artifacts that were water-screened from the midden stratum. Figure 42A is a whelk columella core. Figures 42B and 42C illustrate two chert flakes. One of the flakes (Figure 42B) has rounded cobble cortex and was derived from a cobble. Figures 42D and 42E illustrate two fragments of a very coarse sand-tempered cord-impressed ceramic vessel. These may be a local derivative of a Hell Island-like Middle Woodland type ware. Figure 42F illustrates two conjoining fragments of a Middle Woodland cord-impressed shell-tempered Mockley vessel with a coil break. Figure 42G represents the bottom portion of a net-impressed shell-tempered Mockley vessel. A single shell pattern impression along the edge of this specimen may be from the use of crushed ribbed mussel (i.e., *Modiolus demissus*) shell being used as a tempering agent. Figures 42H though 42L are small fragments of shell-tempered Mockley ware. The example shown in Figure 42J may be net-impressed. No prehistoric artifacts were discovered below the midden. Figure 40 shows the unit under excavation. Figure 40 shows the generalized profile of the unit. Excavations within this unit stopped at 40 centimeters below the ground surface because of the influx of water from the bottom and sides of the unit.

Figure 38. Photo of Unit 17.5 N – 9 E under Excavation.

Figure 39. Generalized Profile of Unit 17.5 N – 9 E.

Figure 40. Photo of Unit 0 N – 3 E under Excavation.

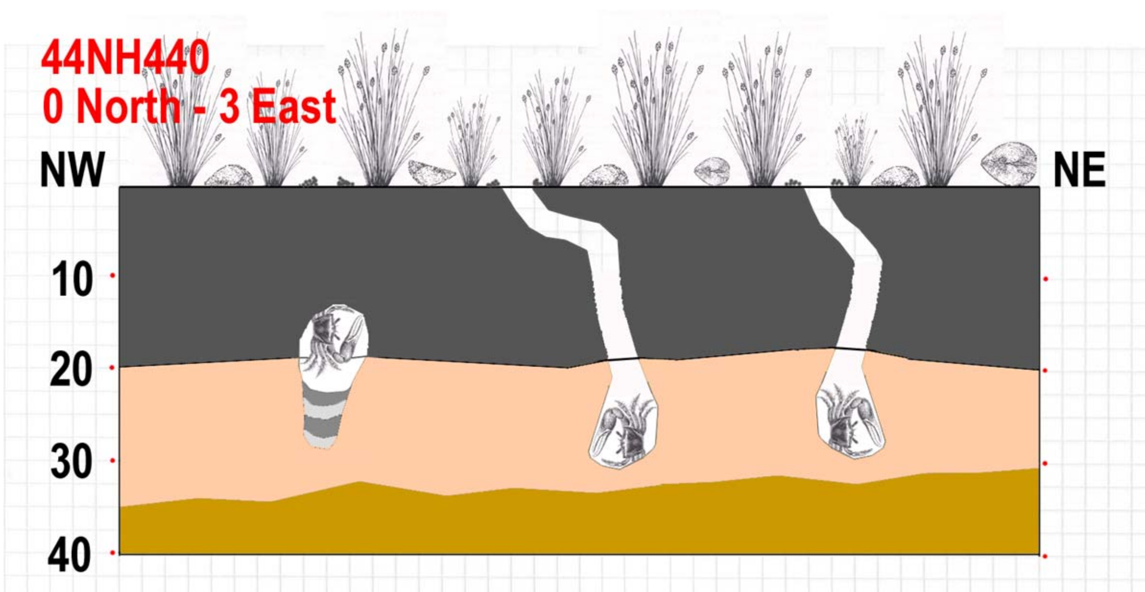


Figure 41. Generalized Profile of Unit 0 N – 3 E.

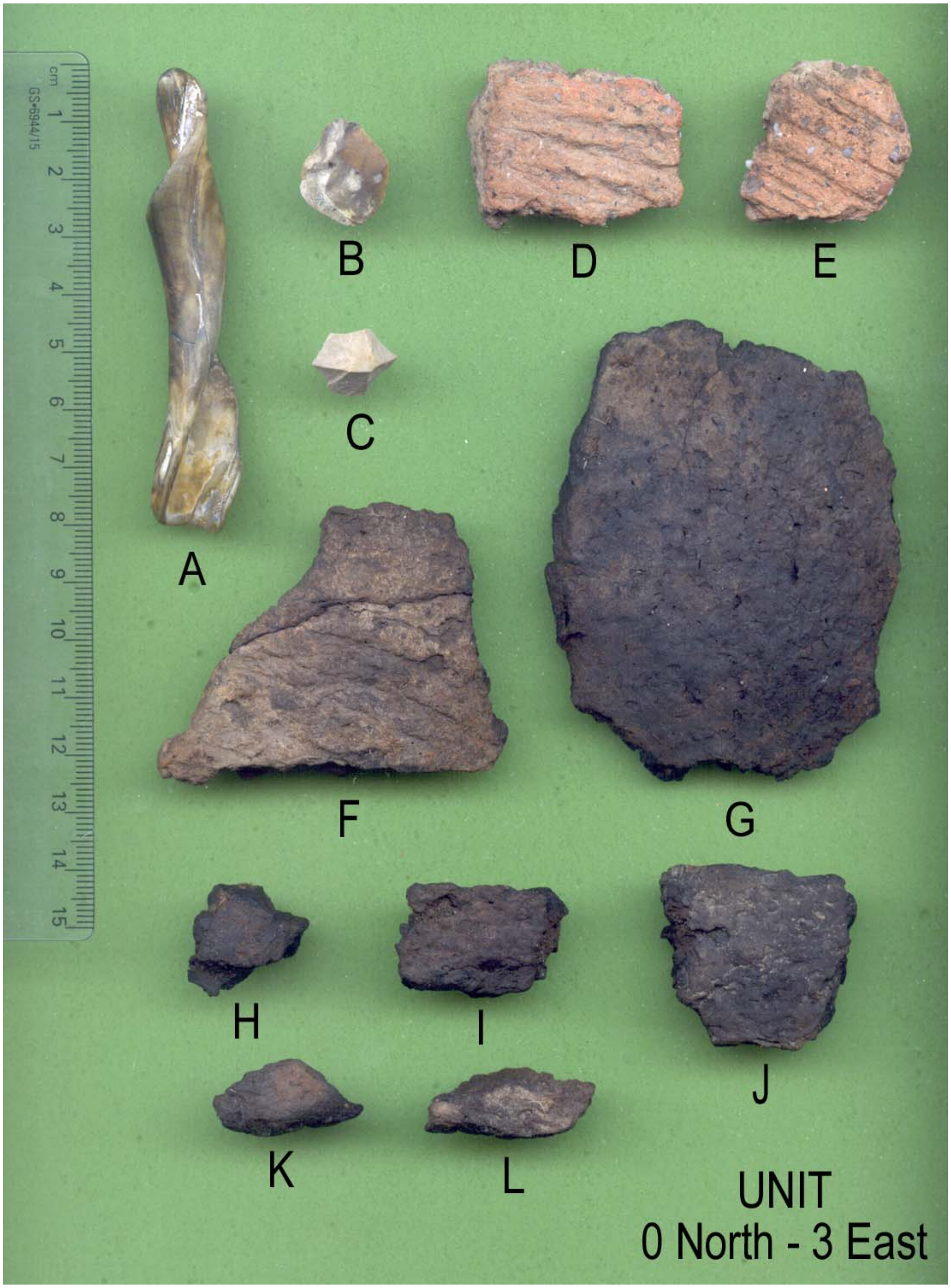


Figure 42. Artifacts Excavated from the Organic Midden Stratum associated with Unit 0 N – 3 E.

Test Unit 5 South - 5 West. This unit was placed west of the shoreline that contained the exposed Middle Woodland-era organic midden (see Figure 43). As such, the unit was topographically west of the crest of the former upland ridge landform (see Figure 35). The unit also represents the deepest unit excavated at the site (see Figure 44). When the unit was excavated, it became evident that a thick deposit of overwash silt blanketed the surface of Middle Woodland-era midden. A split-spoon auger was used to determine the depth to the midden level. The 54 to 58 centimeter surface stratum included a mix of gleyed silt, some shell bits, plant material, and some pockets of sand. The pockets of sand were exclusively associated with storm tide fiddler crab burrow in-filling events. No cultural material was found within the thick surface stratum at Unit 5 South-5 West. Twenty-five to thirty centimeters below the ground surface the unit was impacted by tidal infilling via water moving laterally through the sediments. Periodic pumping via a hand-pump kept the unit relatively dry. The Middle Woodland-era organic midden stratum was discovered immediately below the overwash silt layer. Diagnostic artifacts found within this layer are virtually identical to the specimens found east of this test unit and topographically at the surface. Figure 45 shows all of the artifacts that were water-screened from the midden stratum. Figure 45A includes five conjoined fragments of Middle Woodland cord-impressed Mockley ware. Figures 45B through 45E illustrate several additional small fragments of Mockley ware found within the midden. One of the fragments (Figure 45C) is tempered with crushed hard clam (i.e., *Mercenaria mercenaria*) shells. Figure 45F illustrates a resalvaged point fragment. A remnant transverse medial fracture along the base of the stem indicates that the point was derived from the distal end of a large biface or knife. This pattern of projectile point reuse has been noted at other Middle Woodland-era sites along the Chesapeake Bay associated with Fox Creek style points (Lowery 1999: 56). The point is also made from a light green chert, which may be Normanskill chert from the Hudson River area of New York. Caches of Normanskill chert Petalas style blades have been found associated with Fox Creek-era sites along the Choptank River in Maryland (Ibid). Figures 45G through 45L illustrate six unweathered argillite flakes that were found within the buried Middle Woodland stratum. These flakes seem to represent small biface thinning flakes or flake fragments. Interestingly, Lowery (2003a: 206-208) has reported argillite Fox Creek points from the surface collection recovered at 44NH440. Like Unit 0 North-3 East, a sandy stratum was detected below the midden. Because of the sandy nature of the deposit, tidal water rapidly filled the unit while excavating. Even so, the unit was excavated to a depth of 70 centimeters below the ground surface. Within the sandy stratum, cultural artifacts were discovered. These items are illustrated in Figure 46. Figure 46A represents a quartzite spokeshave made from a flake. Figure 46B represents a quartzite stemmed point similar to the Poplar Island type (Kent 1996: 23 and Figure 14), the Morrow Mountain II type (Coe 1964: 37-43), and the Stark stemmed type (Dincauze 1976: 29-37). Based on this observation, the projectile point could be between 7,500 and 5,000 years old or associated with the Middle to Late Archaic periods. Figure 46C illustrates a large quartzite flake also found within this stratum. Given the presence of rounded cortex, the artifact in Figure 46C derived from a large cobble. Figure 43 shows the unit under excavation. Figure 44 shows the generalized profile of the unit. Excavations within this unit stopped at 70 centimeters below the ground surface because of the influx of water from the bottom and sides of the unit.

Figure 43. Photo of Unit 5 S – 5 W under Excavation.

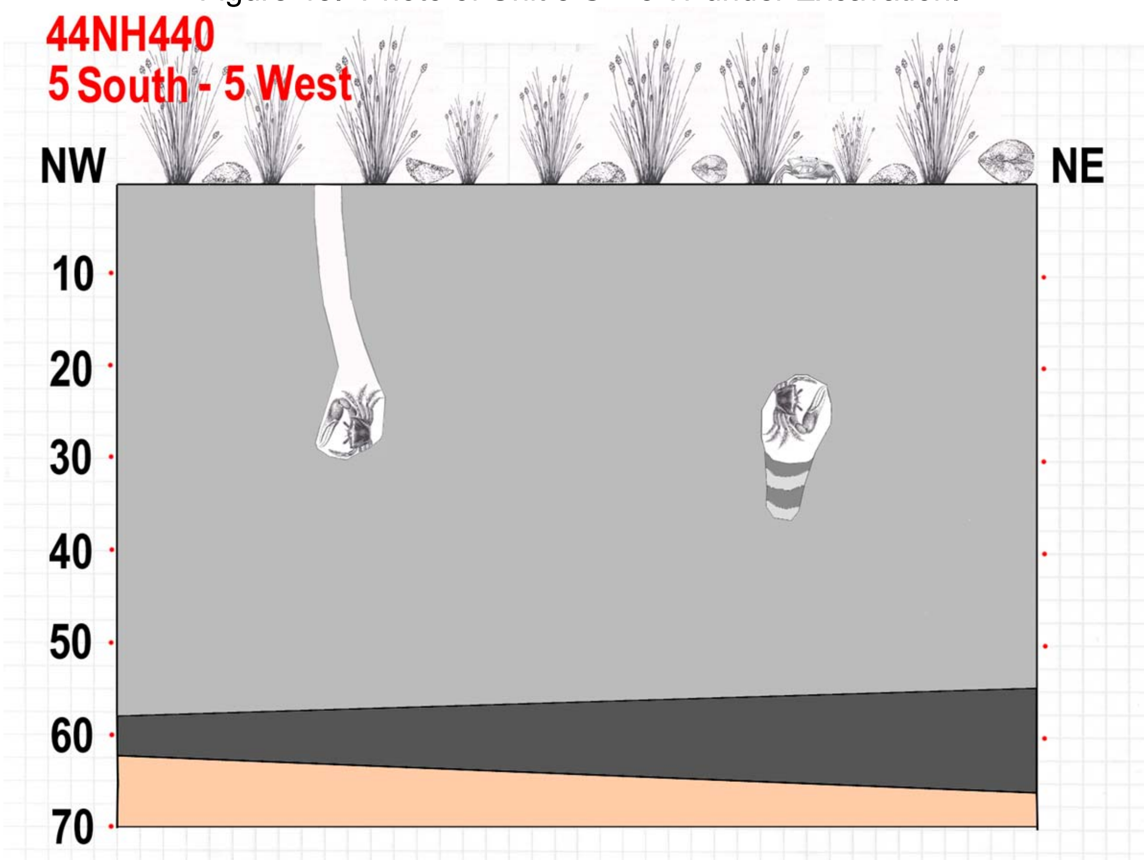


Figure 44. Generalized Profile of Unit 5 S – 5 W.

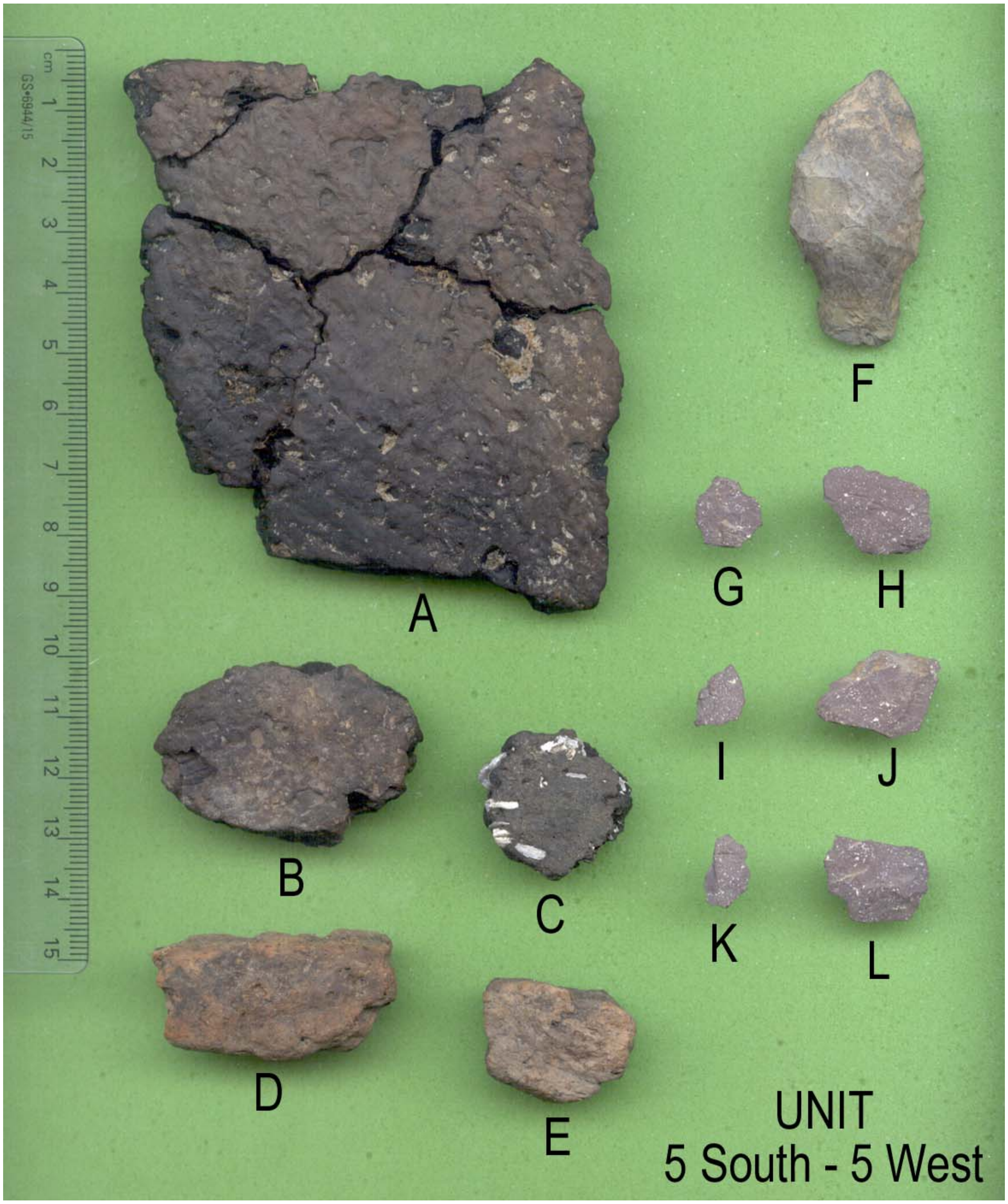


Figure 45. Artifacts Excavated from the Organic Midden Stratum associated with Unit 5 S – 5 W.

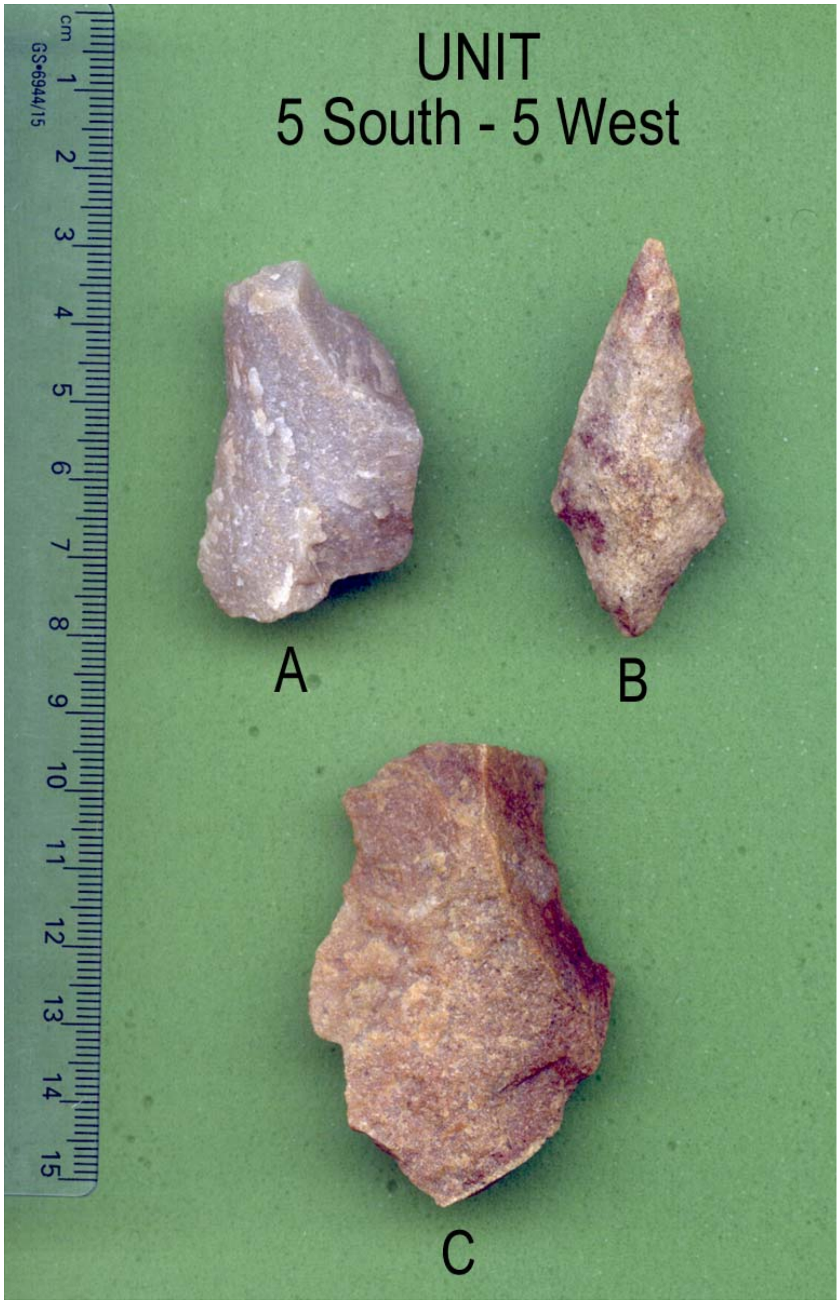


Figure 46. Artifacts Excavated from the Holocene Sand Stratum associated with Unit 5 S – 5 W.

Test Unit 9 South-3 East. This unit was placed over a section of the exposed Middle Woodland-era organic midden (see Figures 17). The intact midden deposit varied from 5 to 13 centimeters in thickness. Not surprisingly, the thin portion of the midden deposit is located on the east side of the unit towards South Bay. Tidal and wave energy scouring and erosion have naturally thinned the midden deposit along the eastern section of the unit. Only the surface midden stratum contained cultural artifacts. Being on the surface, the midden and even portions of the sub-surface Holocene sand stratum were bioturbated by fiddler crab burrowing activities. Even so, Middle Woodland cultural artifacts were confined to the midden deposit and had not moved down into the older strata. Figure 50 shows all of the artifacts that were water-screened from the midden stratum. Other artifacts excavated insitu within the midden stratum are illustrated in Figure 51. Figure 50A shows two conjoined fragments of a cord-marked Claggett ware vessel, which would be a late form of Mockley ceramics. Figures 50B through 50M illustrate several small pieces of Middle Woodland-era Mockley ware vessel fragments that were found while water screening the midden sediments. The specimens shown in Figures 50C and 50F are decorated with net-impressions. Figure 50N shows a small jasper flake found within the unit. Figures 50O and 50P represent basalt flakes with rounded cobble cortex that were also found while water screening the sediments in Unit 9 South – 3 East. Figures 47 and 48 illustrate an insitu cluster of artifacts excavated within the unit. These artifacts are shown in Figure 51. Figure 51A is a shallow side-notched type point that is similar to the Hopewell-like point illustrated in Figure 32A. If this artifact were made of rhyolite or argillite, it would easily fall within the Middle Woodland Fox Creek or Selby Bay notched type bifaces typically found within the Chesapeake Bay area (Lowery 1999: 56-57 and Figure 13H-I). The point illustrated in Figure 51A is made from a gray variety of chert. This chert could have originated from a large secondary cobble. The lithic material used to make the specimen also superficially resembles Indiana Wyandott or Harrison County chert, which has been found in Middle Woodland burial and cache contexts along the Chesapeake Bay (Ford 1976). Figure 51B is a large deer bone fishhook comparable to the specimen shown in Figure 32H. The fishhook was found underneath two conjoining fragments of Mockley ware (see Figures 48 and 51D) and has some damage to the barb portion of the hook. Figure 51C represents a tooth from the lower jaw of a Great White shark (i.e., *Carcharodon carcharias*). The tooth is not fossilized and its overall size would indicate that the shark was approximately 12.3 feet long (Kent 1994: 69 and Figure B.10). Figure 51D illustrates two conjoining fragments of a cord-impressed Mockley vessel. Figure 51E is a small fragment of cord-impressed Mockley ware vessel. Given the similar decoration and thickness, it may be part of the same vessel that produced the specimens shown in Figure 51D. No prehistoric artifacts were discovered below the midden stratum. Figure 47 shows the unit under excavation. Figure 49 shows the generalized profile of the unit. Excavations within the unit stopped at 30 centimeters below the ground surface because of the influx of water from the bottom and sides of the unit.

Figure 47. Photo of Unit 9 S – 3 E under Excavation.

Figure 48. Close-Up Photo of Artifact Cluster in Unit 9 S – 3 E.

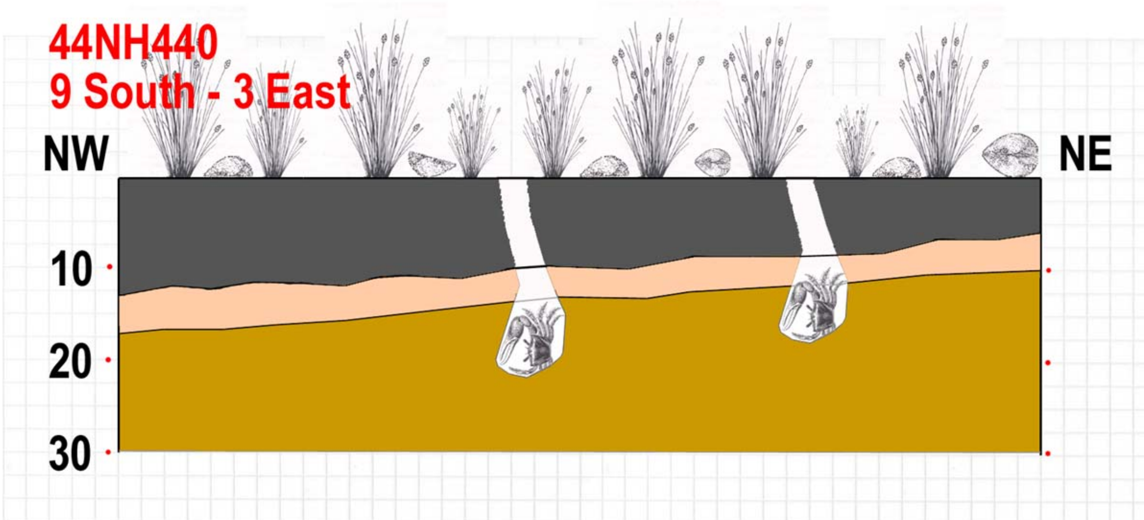


Figure 49. Generalized Profile of Unit 9 S – 3 E.

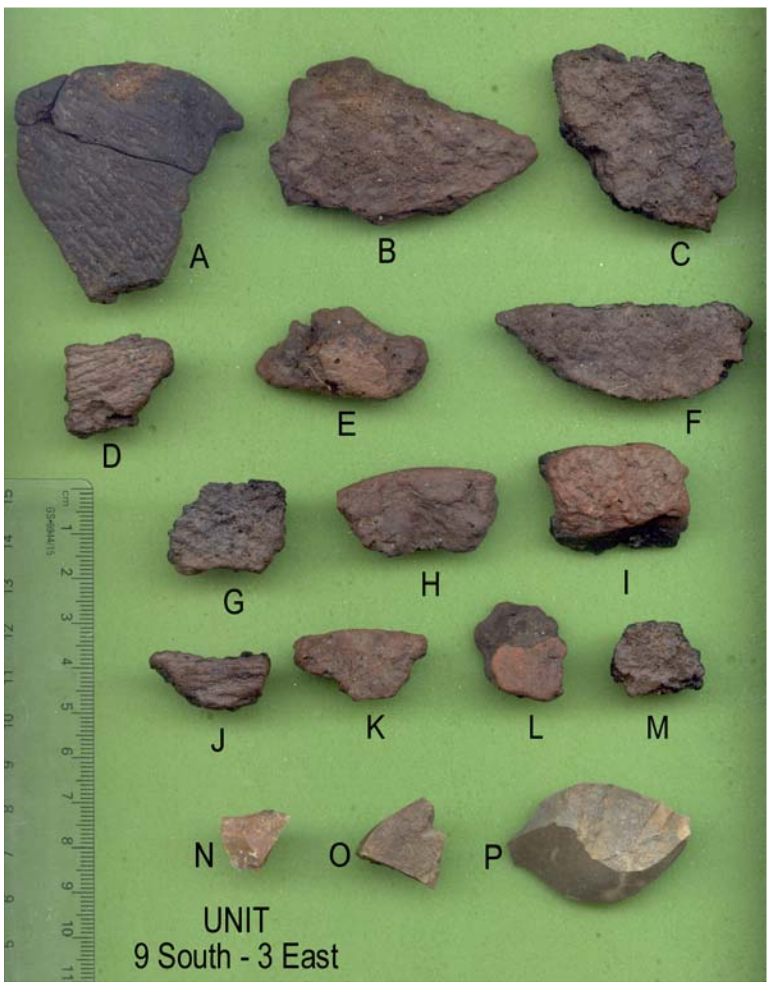


Figure 50. Artifacts Excavated from the Organic Midden Stratum associated with Unit 9 S – 3 E.

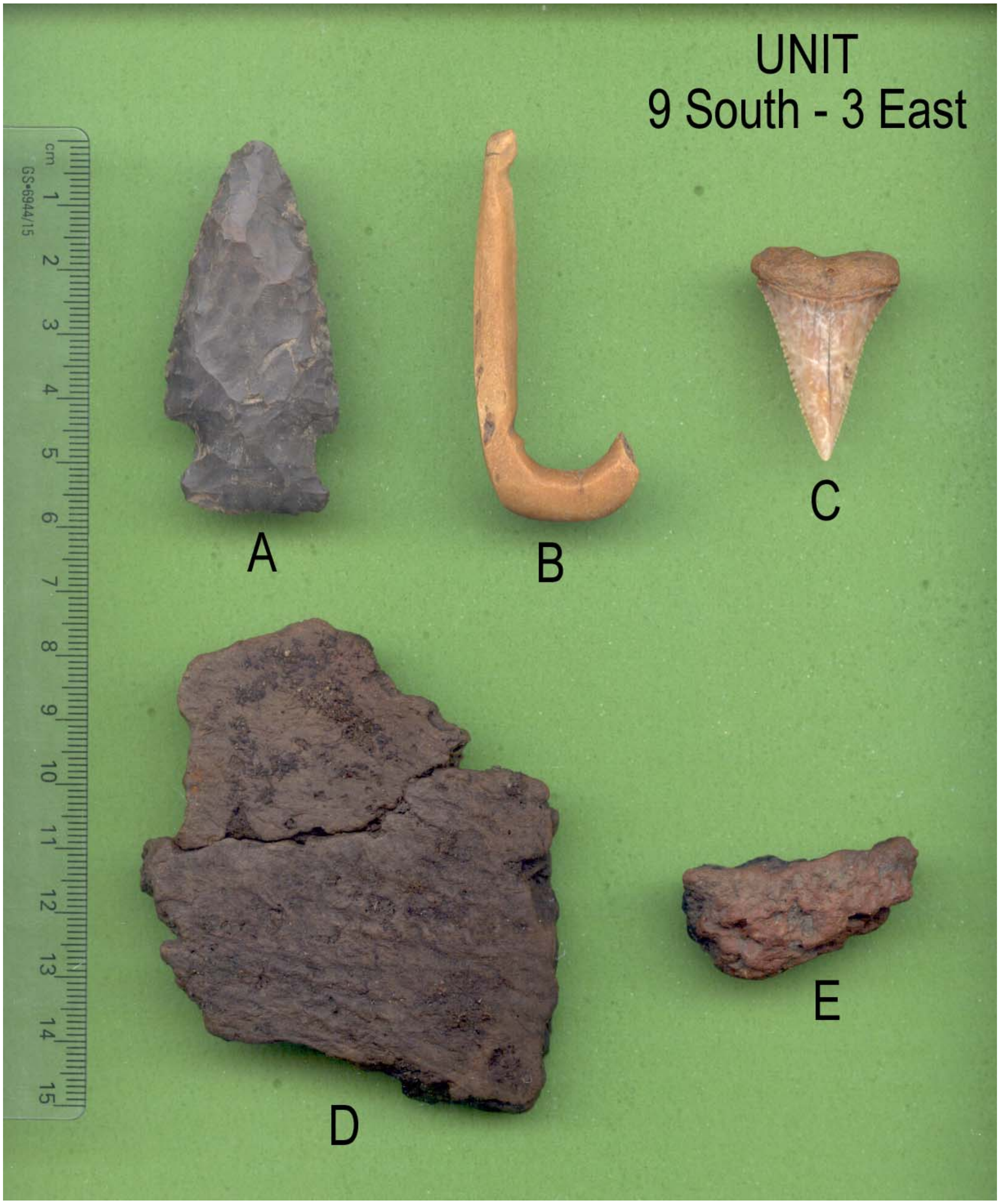


Figure 51. Cluster of Artifacts Excavated from the Organic Midden Stratum associated with Unit 9 S – 3 E.

Test Unit 14 South-3 East. This unit was placed over a section of the exposed Middle Woodland-era organic midden (see Figures 18). The intact midden deposit was very thin within this unit and varied from 7 to only 2 centimeters in thickness. Not surprisingly, the midden thinning is associated with tidal and wave energy scouring and erosion via South Bay. The unit was interesting because all of the recognized strata contained cultural material. Also the unit had the thickest deposit associated with the Holocene sand stratum excavated during this research. As indicated in Figure 18, the unit has evidence of bioturbation via fiddler crab burrowing activities. Even so, the data from the unit suggests some stratigraphically separated cultural components. Figure 55 shows all of the artifacts that were water-screened and excavated from the various strata within the unit. Figures 55A through 55G were found within the Middle Woodland midden stratum. Figure 55A is a non-diagnostic broken quartzite biface or preform. Figure 55B is a small fragment of a Mockley ware vessel. Figure 55C is a fragment of a very coarse sand-tempered cord-impressed ceramic vessel. Like the specimens illustrated in Figures 42D and 42E, this fragment may be a local derivative of the Hell Island Middle Woodland type ceramics. Figure 55D is a deer leg bone fragment. Figures 55E through 55G illustrate some fish bones that were found while water screening the midden sediments. These bones include a vertebra (Figure 55E) and two cranial bones (Figure 55F and 55G). Given the large size of the fish remains, they may represent the skeletal remnants of drum fish (i.e., *Pogonias cromis*). Figures 56A through 56B were found within the Holocene sand stratum. Figure 56A is a broken jasper Susquehanna broadspear, which has been heat-altered. Figure 56B may represent a damaged and highly resharpened Perkiomen-like point. Figure 53 shows a detailed image of the item shown in Figure 56B being excavated insitu. The specimen is made of chert. It is quite thin and made on a flake similar to the Susquehanna type point. These two artifacts seem to represent Late Archaic-era diagnostic projectile points. Figure 56C was found at the erosional contact between the Holocene sand stratum and the Pleistocene sand stratum. The artifact in Figure 56C is well made, has basal grinding, and has been asymmetrically resharpened. The specimen resembles some of the specialized Early Archaic scrapers reported on the Delmarva Peninsula (Lowery 2002b: Figure 2F). It is assumed that this artifact represents an Early Archaic diagnostic artifact. The artifact shown in Figure 56D was found immediately within the upper 3 centimeters of the Pleistocene sand stratum. The artifact shown in Figure 56D seems to represent the lower or basal section of a fluted Paleo-Indian style fluted point. As shown in Figure 7, both Paleo-Indian and Early Archaic-era diagnostic artifacts have been found at the site when it was initially discovered. The point in Figure 56D is made from chert and it has lateral edge grinding. Evidence of fluting is clearly apparent on both faces of the point. Even though the unit was bioturbated, the excavation data suggests that the site has some vertical cultural stratigraphy. Figure 52 shows the unit under excavation. Figure 54 shows the generalized profile of the unit. Excavations within the unit stopped at 30 centimeters below the ground surface because of the influx of water from the bottom and sides of the unit.

Figure 52. Photo of Unit 14 S – 3 E under Excavation.

Figure 53. Close-Up Photo of Artifact in Unit 14 S – 3 E.

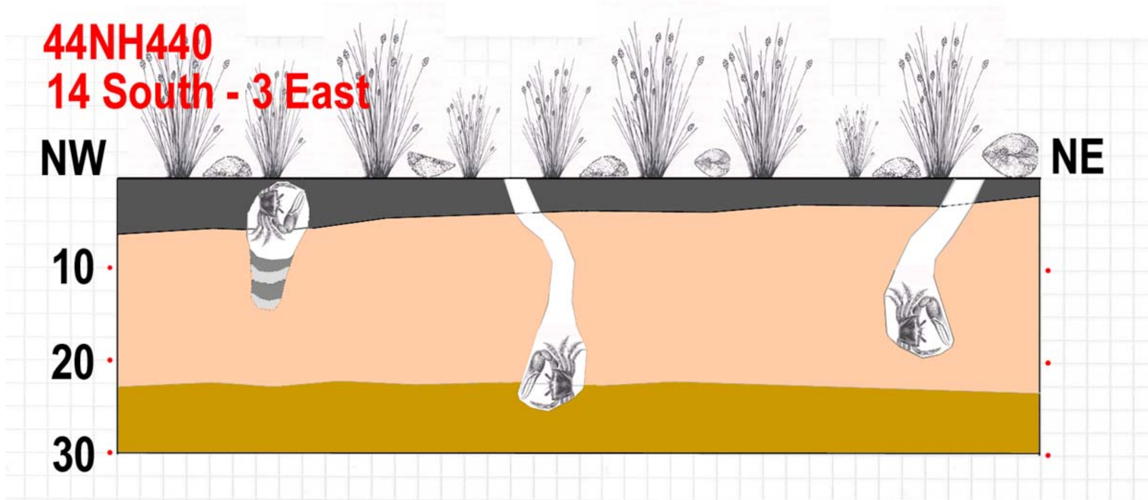


Figure 54. Generalized Profile of Unit 14 S – 3 E.

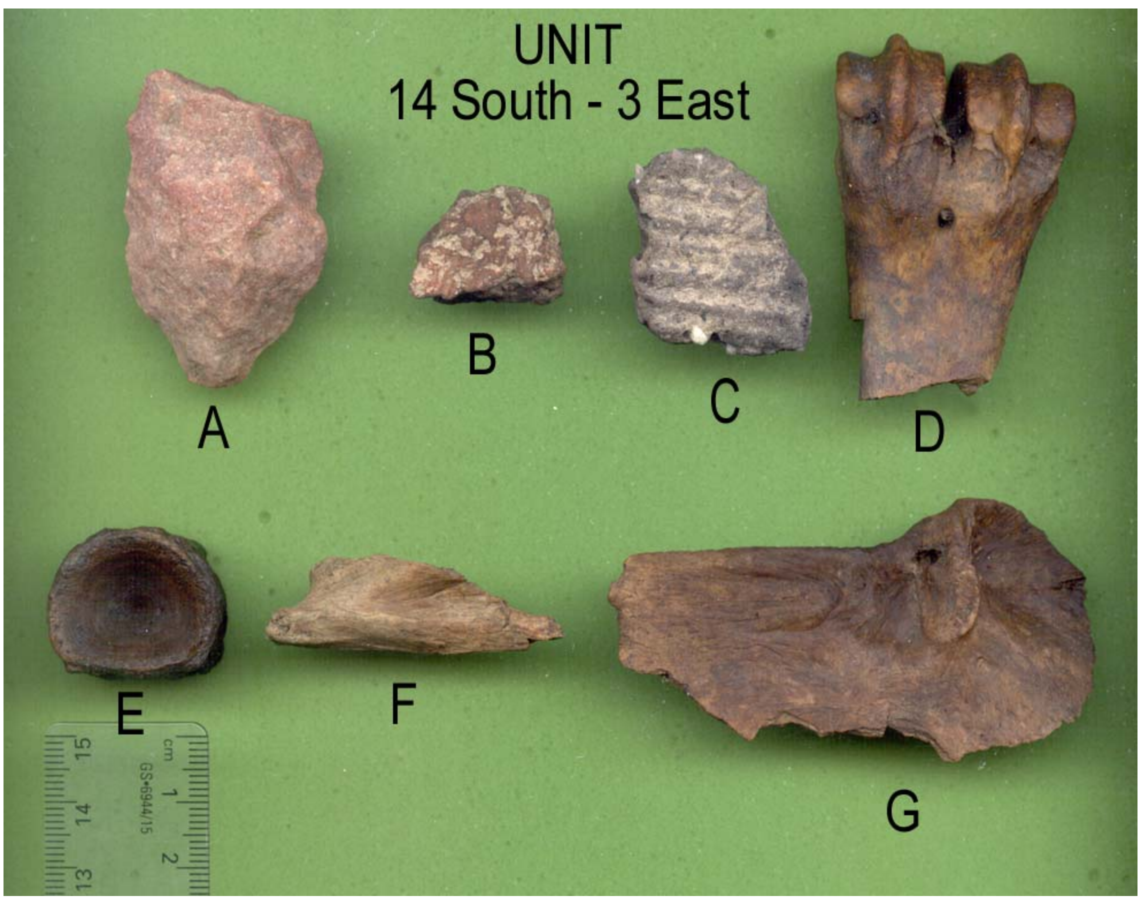


Figure 55. Artifacts Excavated from the Organic Midden Stratum associated with Unit 14 S – 3 E.

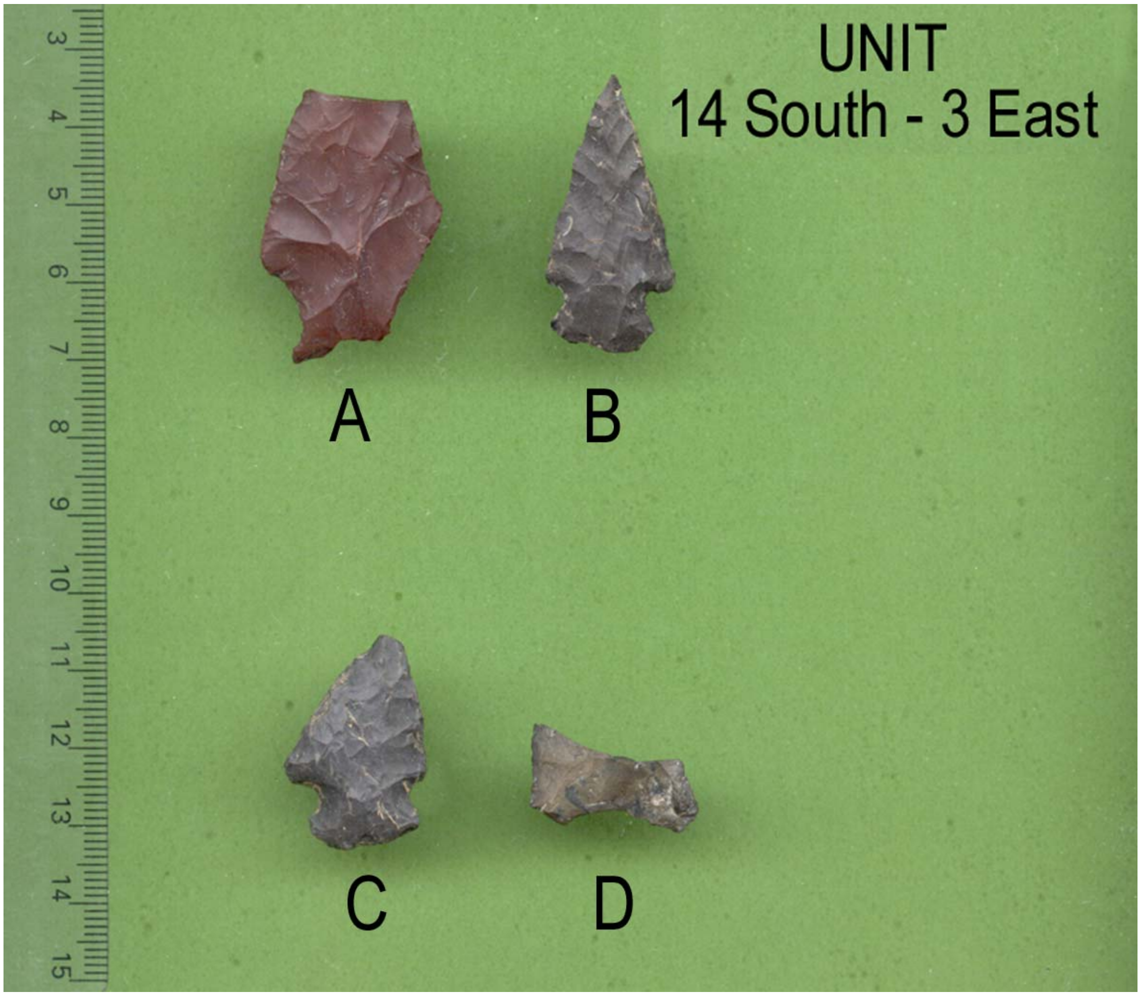


Figure 56. Artifacts Excavated from the Lower Strata associated
with Unit 14 S – 3 E.

Tile Experiment Results and Discussion

On 4/6/03, a ceramic tile redeposition experiment (see Figure 21) was put in place along the shoreline at 44NH440 (see Figure 22). Four locations were selected along the shoreline (see Figure 35) as ceramic tile drop locations. A color-coded wooden stake was driven into the ground at the point where the painted tiles deposited. Like the wooden stakes, the tiles were painted (e.g., blue, green, yellow, and red-orange). At each location, twelve 2-x-2 inch dimension tiles were deposited. The tiles were left unmonitored along the shoreline from 4/6/03 until 6/24/03. Over this period, the tiles were at the whim of nature, as well as, coastal processes.

The tile experiment was employed as a cheap and easy method to monitor the displacement of materials along the shoreline. The experiment was also employed as a method to monitor the presence/absence of a known number of items along a shoreline. It is recognized that coastal processes are quite dynamic and can displace cultural items, as well as, bury cultural items over short periods of time. In essence, the experiment served as a controlled way to monitor the displacement and the presence/absence of cultural items with a consistent size, exposure to comparable wind-wave energies, and subjected to coastal variables over the same time duration. The results of the experiment served as a way to better understand the shoreline geometries at 44NH440.

The fetch-related erosion and redeposition processes are the principle way sediments and artifacts are being moved along a shoreline. Lowery (2003a: 259-261 and Table A.6) has discussed how fetch-related erosion and the prevailing wind directions can impact and influence the quantity of artifacts found at eroding shoreline sites. At shoreline sites where the maximum fetch is not associated with a prevailing wind direction or storm wind direction, the quantity and diversity of the artifact assemblage collected from the shoreline site will be negatively impacted or influenced. In comparison, shoreline sites will have larger and more diverse artifact assemblages in settings where the maximum fetch is associated with a prevailing or storm wind direction. As such, each eroding shoreline site must be critically assessed based on its unique fetch-related erosion processes before researchers jump to any conclusions about a site's function, a site's size, a site's artifact assemblage, as well as, the cultural chronologies expressed at any given locality.

Figure 57 illustrates the wind directions and the fetch distances that would impact 44NH440. It is evident that northeasterly though southeasterly winds would be the principle wind directions that would impact the shorelines associated with the site. Interestingly, these wind directions are typically associated with coastal storms (i.e., hurricanes, tropical storms, and northeasters). As such, the average seasonal winds would have little impact on the site, its shoreline, and its archeological remains. In contrast, the infrequent coastal storms would cause havoc to this section of coastline.

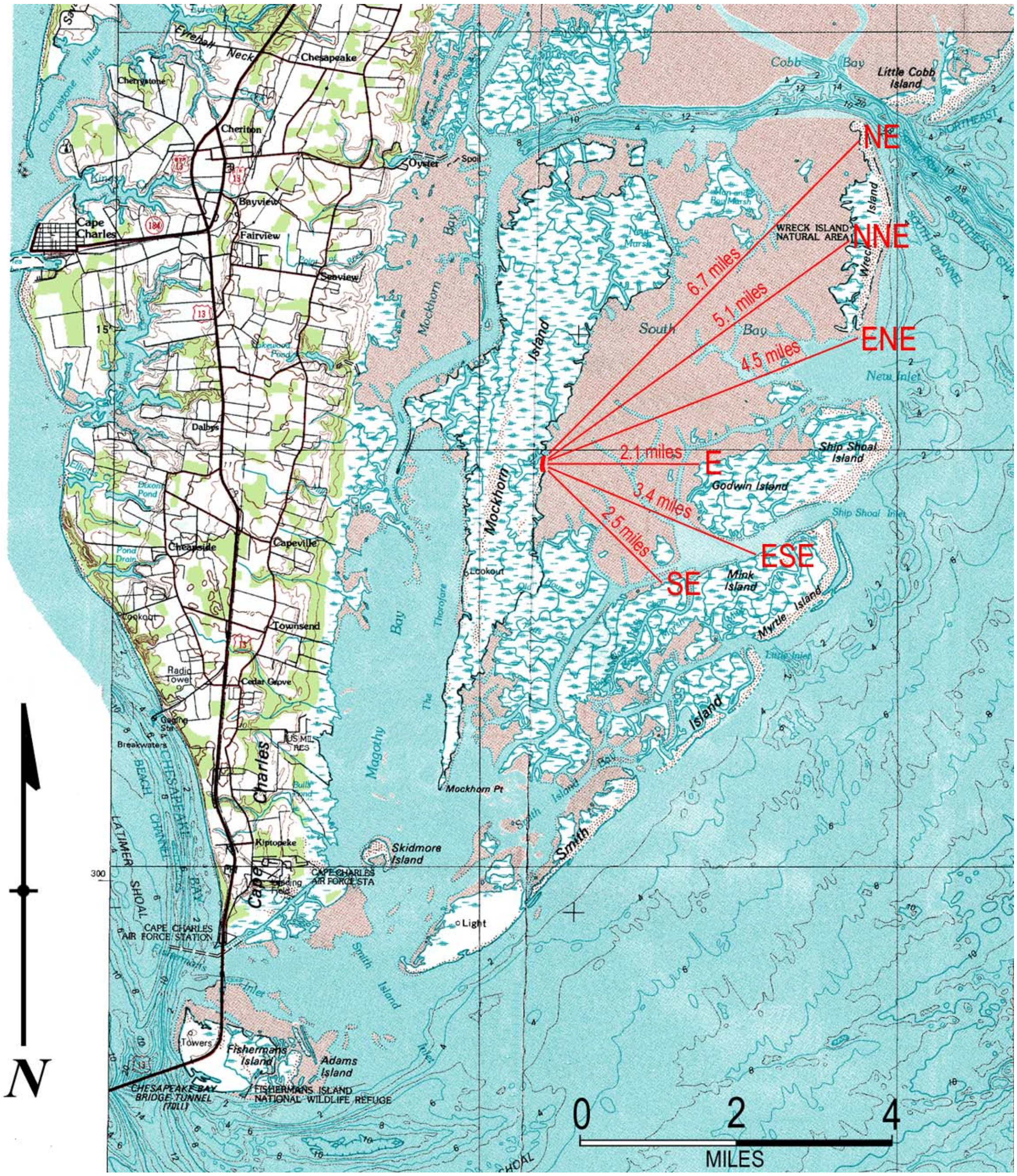


Figure 57. Dominant Wind Directions and Fetch Distances that Impact 44NH440.

After 80 days, the shoreline at 44NH440 was subjected to very detailed controlled shoreline collection. The collection was not geared towards gathering prehistoric artifacts. The collection was geared towards locating and documenting the ceramic tiles. Since the tiles were color-coded and twelve tiles were associated with each color-coded drop locality, the quest was to find all exposed tiles and monitor the movement of the 80-day period. When a tile was located, it was flagged with a correspondingly colored surveyors flag (see Figure 58). Since compass directions were important, the distance and tile movement patterns with respect to the drop locality were monitored and measured using a compass and a metric tape. The number of colored tiles retrieved and the resulting patterns were plotted (see Figures 59 through 62).

Figure 58. Flagged Red-Orange Tiles at 44NH440.

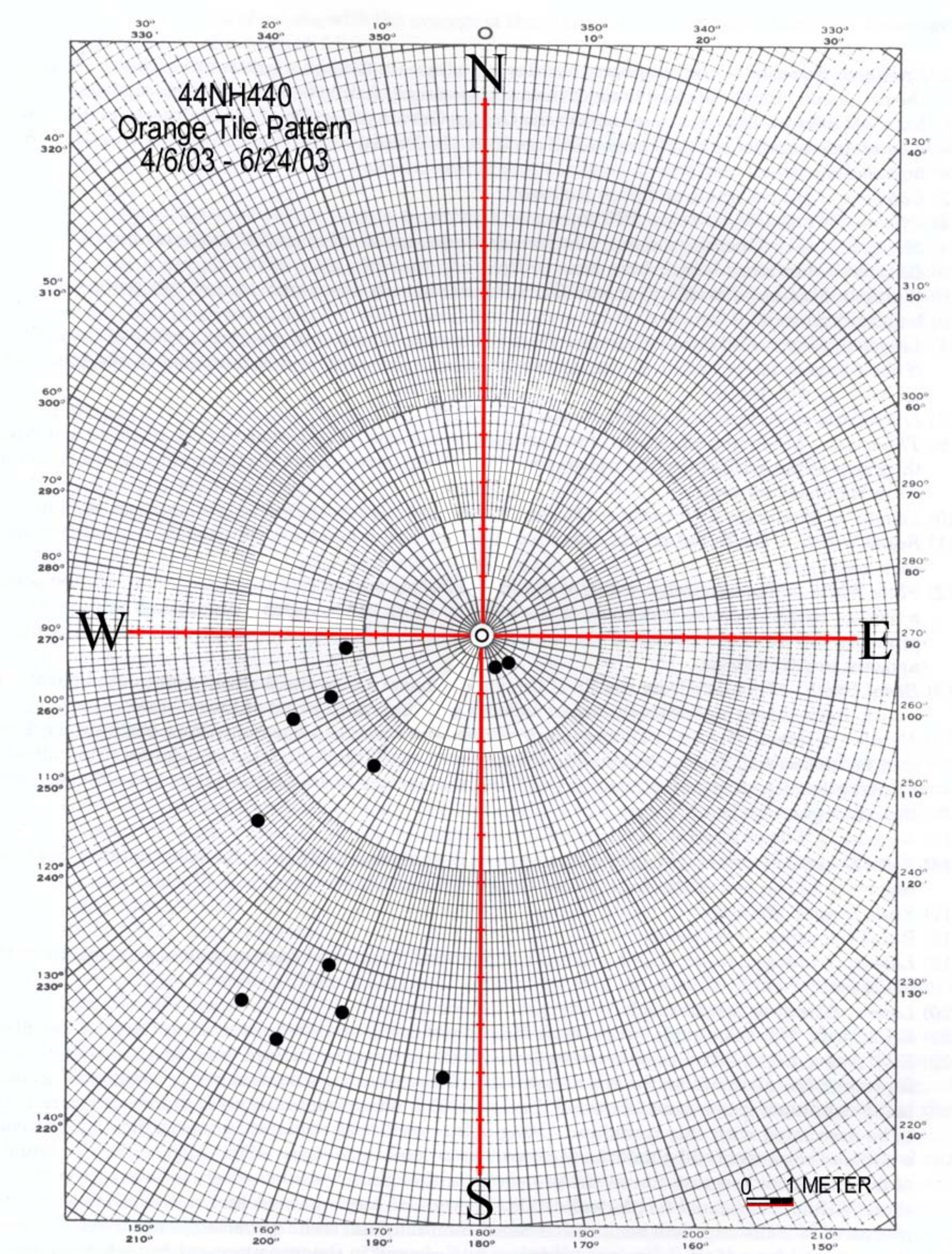


Figure 59. Red-Orange Tile Disbursement at 44NH440.

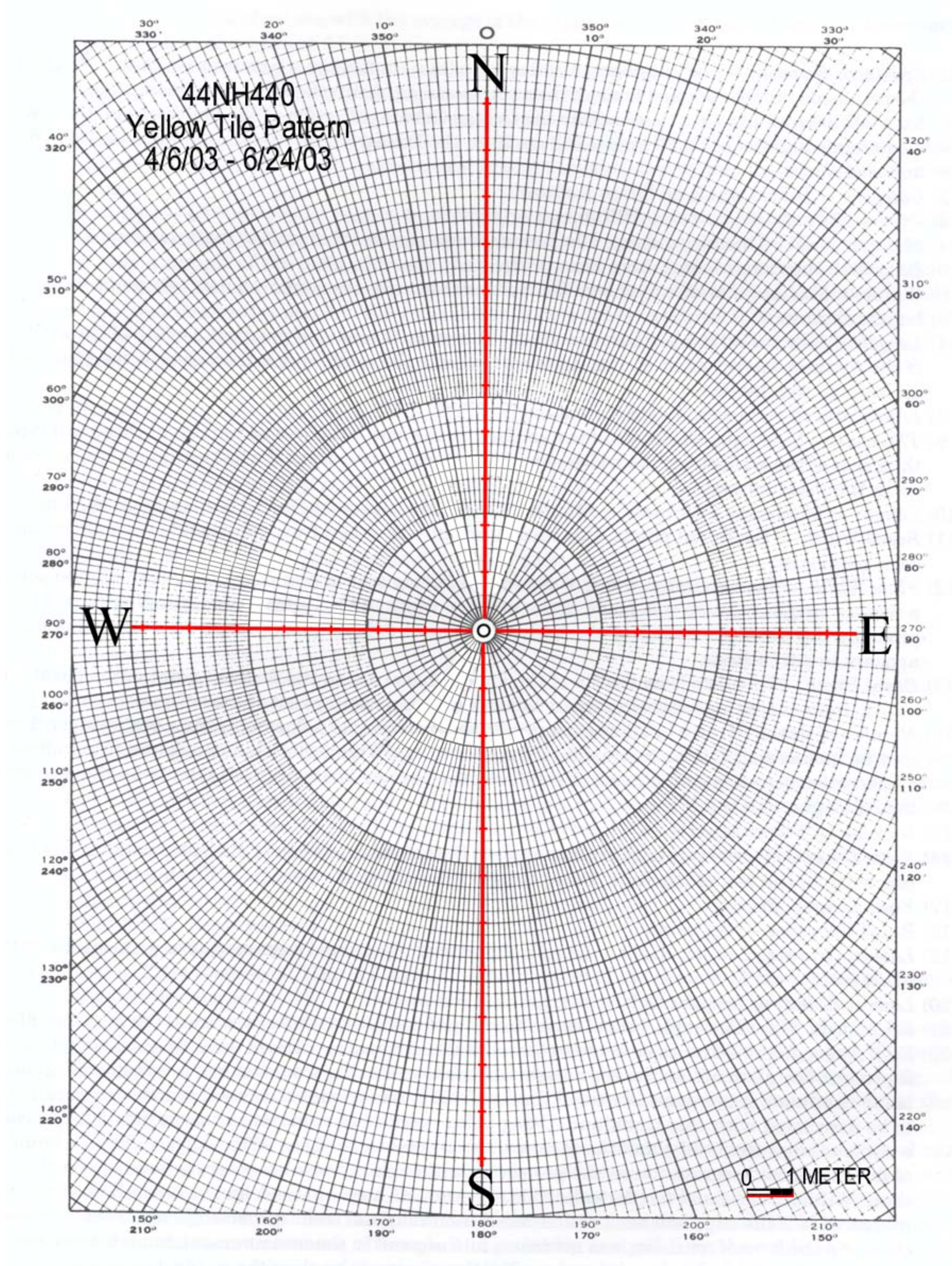


Figure 60. Yellow Tile Disbursement at 44NH440.

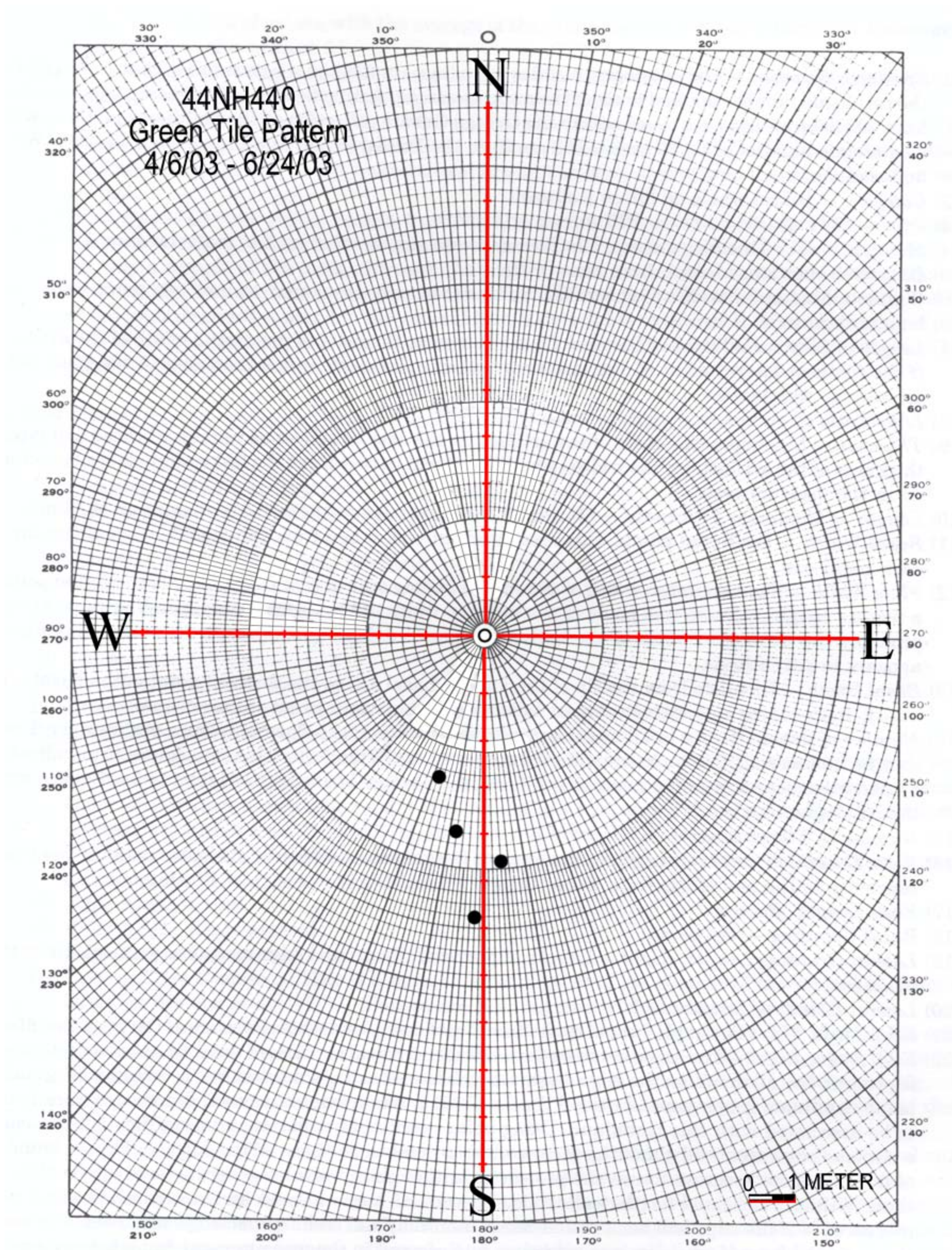


Figure 61. Green Tile Disbursement at 44NH440.

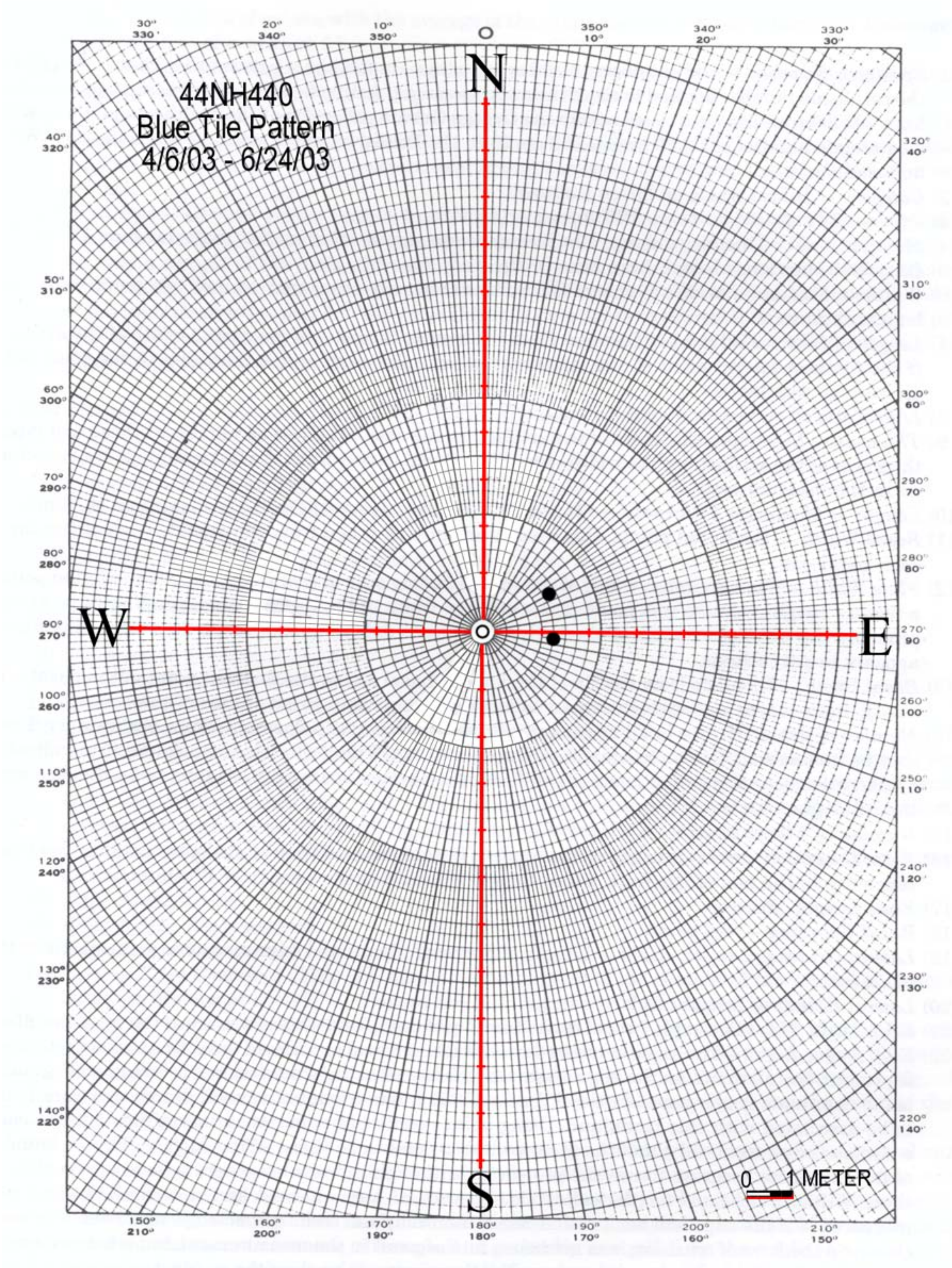


Figure 62. Blue Tile Disbursement at 44NH440.

Figure 59 illustrates the patterning and distance associated with the red-orange tiles after the 80-day period. Interestingly, all twelve tiles were relocated. The red-orange drop locality is the northern-most ceramic tile monitoring station established along the shoreline at 44NH440 (see Figure 35). Over the 80-day period, the majority of the tiles (10 out of 12) had moved to the west, southwest, and south. The greatest displacement distance is 9.1 meters. Two of the tiles had actually moved towards the southeast. Both tiles were in a small depression and "trapped" around the base of a tidal marsh plant.

At the yellow tile drop locality, none of the original twelve tiles could be relocated after 80 days (see Figure 60). The lack of yellow tiles can easily be explained by a thick surface covering of sand along this section of shoreline (see Figure 35). Even so, the lack of yellow tiles is important. All of these brilliantly colored 2-x-2 inch tiles were hidden from view! As such, the lack of apparent yellow tiles clearly illustrates how the deposition of coastal sediments can hinder archaeological interpretations at sites in coastal settings. What if these tiles represented Paleo-Indian points? What if these tiles were rhyolite artifacts? What if these tiles represented locally made shell beads? What if these tiles were fish bones? The lack of apparent yellow tiles clearly illustrates how coastal processes can influence archaeological interpretations about recognized cultural chronologies observed at a site, evidence for prehistoric trade and exchange for an area, observations relative to site function, and indications about prehistoric subsistence patterns in a region. More importantly, the lack of yellow tiles along this section of shoreline indicates the limitations for determining site size based on the patterning of artifacts in coastal environments.

Figure 61 illustrates the patterning and distance associated with the green tiles after the 80-day period. Only four tiles were relocated. The green drop locality is located along the southern shoreline area at 44NH440 (see Figure 35). Over the 80-day period, the tiles had moved consistently to the south. The greatest displacement distance is 5.75 meters. The minimum movement distance is 2.9 meters. Even though only four tiles were relocated, the tile movement direction would suggest that the wave and redeposition patterns are somewhat different along the southern area of 44NH440. The fact that only 33 percent of the tiles were relocated during the controlled shoreline survey, also illustrates how the deposition of coastal sediments can hinder archaeological interpretations at sites in coastal settings.

Figure 62 illustrates the patterning and distance associated with the blue tiles after the 80-day period. Only two of the original twelve tiles were relocated during the shoreline survey. The blue drop locality (see Figure 35) is located at the southern end of the archaeological site defined as 44NH440 (see Figure 6). Over the 80-day period, the two tiles had moved to the east and to the east-northeast. The greatest displacement distance is 1.3 meters. The minimum movement distance is 1.2 meters. Even though only two tiles were relocated, the tile movement direction would suggest that the wave and redeposition patterns are somewhat different along the southern end of 44NH440. At the southern end of 44NH440, it is apparent that a tidal marsh point has developed east of the submerged upland ridge (see Figure 35). Given the resultant tile patterning, it is suggested that this tidal marsh point is an accretional landform created as a result of the north-to-south littoral movement and deposition of sediments along the shoreline. What does this redeposition and accretion pattern really mean? Traditionally, the tidal marsh point has been used to designate the southern boundary of 44NH440. The presence of artifacts along this section of shoreline is usually very limited. But, is this the real boundary of the site or does it extend further south? Given the dynamics expressed by the tile movement configuration and the suggested sediment redeposition pattern (Figure 63), it is suggested that 44NH440 extends further south into the site area designated at 44NH441. The fact that only 16 percent of the tiles were relocated during the controlled shoreline survey at the blue tile drop station, again illustrates how the deposition of coastal sediments can limit archaeological interpretations at sites in coastal settings.

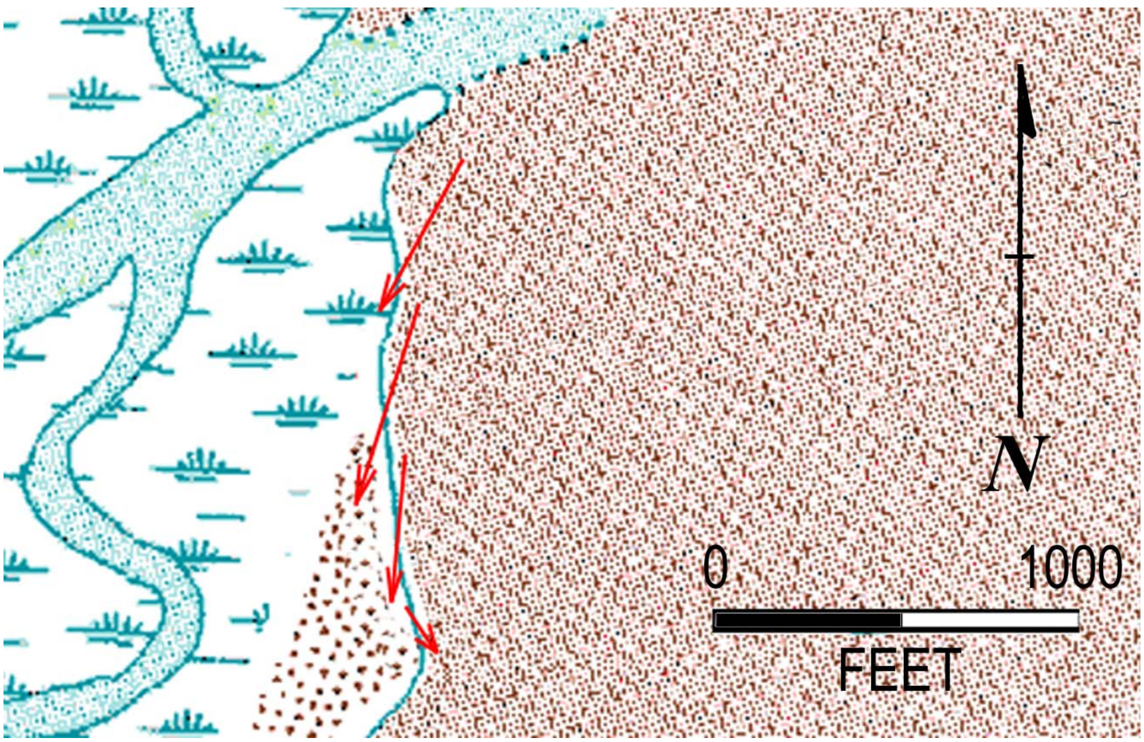


Figure 63. Pattern of Sediment Movement at 44NH440.

5: Research Summary and Management Recommendations

Research Summary

Archaeological evaluation and testing on Mockhorn Island in the area designated as 44NH440 included the excavation of five 1-x-1 meter test units, pedological studies, geomorphological investigations, and an assessment of the coastal processes impacting the site and its archaeological deposits. Amazingly, the research has revealed information about the processes of archaeological site inundation along Virginia's Atlantic seashore, general site formation processes specific to the Mockhorn Island area, information about prehistoric human subsistence patterns, as well as, data about potential prehistoric trade and exchange.

44NH440 is an inundated former upland site that seems to have been abandoned as a potential living area during the late Middle Woodland period. When the site was abandoned, it was more readily flooded during high-tide episodes. Periodic saltwater intrusion killed the forests located on the ridge and coastal sediment influx "leveled" the landscape. In other words, the topographic ridge became blanketed by offshore sub-tidal sediments east towards South Bay. Towards the central section of Mockhorn Island, overwash sediments in-filled the trough west of the ridge. 44NH440 looked less like a ridge and more like a tidal marsh with an interesting linear pattern of slightly elevated marsh plant species. Along the South Bay side of 44NH440, wind and wave activity scoured the upper surface of the site removing most of the Middle Woodland-era midden deposit. Sub-surface features and older more erosion resistant deposits have survived the fetch-related scouring of South Bay. Sediments eroded from 44NH440 are being moved south along shore and forming a "young" tidal marsh point. The sediments and cultural materials eroded from the shore are also moving inland and becoming redeposited on top of the current marsh surface. West towards the central ridge of Mockhorn Island, the archaeological strata at 44NH440 are completely intact, as a result of coastal infilling, tidal overwash episodes, and the formation of marsh peat deposits. Bioturbation has impacted the archaeological deposits, as well. The deeply buried deposits west of the ridge are presently too deep to be impacted by current fiddler crab burrowing activities. Importantly, the tests did not reveal any stratigraphic mixing between the Woodland, the Archaic, and the Paleo-Indian cultural levels. Internally, these levels may be mixed, however. From a much broader perspective, the data from 44NH440 would indicate that sea level rise or marine transgression along the Atlantic seashore of the Delmarva Peninsula would result in the burial and preservation of prehistoric archaeological sites (see Figure 30).

The general site formation processes for the Mockhorn Island area would indicate a landscape that was sculpted by wind prior to the coastal impacts to the region. The soils data (see Appendix A), the geological summary of the area (see Figure 28), and the archaeology (see Figures 38, 40, 44, 49, and 54) provide hints about the general site formation processes. The island's foundation consists of coastal sands. Peat deposits formed along sections of the island during the wet and cool episodes of the Wisconsin glaciation. During the last glacial maximum, sands eroded from the river valley systems (see Figures 4 and 5) via aeolian processes were deposited over landscape. At the end of the Wisconsin glaciation, humans occupied the landscape. It was an upland "washboard-like" landscape associated with springs, but situated near freshwater river systems that emptied into the Susquehanna. The landscape was only 40 to 50 miles from the ocean at this time. Given the limited archaeological record of the region, the Paleo-Indian artifact assemblages seem to be dominated by projectile points and knives. As such, hunting and processing activities are suggested.

During the earliest portion of the Holocene, aeolian erosion seems to have deflated portions of the Mockhorn Island landscape. The aeolian erosion may be linked to the Preboreal Oscillation. The presence of an Early Archaic period artifact at the erosional contact between the later Holocene sand stratum and the Pleistocene sand stratum would support this observation. Given the limited artifact data, it is assumed that upland hunting and processing activities were also performed in the region during the Early Archaic period. The coastline would have been 20 miles east of region at this time. It is uniformly clear that aeolian sands were deposited across the Mockhorn Island landscape during the middle and later portions of the Holocene. It is suggested that these sands were deposited during the "Hypsithermal" and maybe slightly later. The presence of mixed Middle and Late Archaic period diagnostic projectile points within this sand stratum would support this observation. The coastline over this period would have migrated inland and would have been situated approximately 5 miles east of Mockhorn Island during the Late Archaic period. It was during the Late Archaic period that the river systems around the island would have developed an estuarine environment. As such, the people living at 44NH440 may have still utilized the area as a hunting and processing locality. At this time, the subsistence base should have included estuarine resources, as well as, interior terrestrial resources.

During the late Holocene, South Bay developed as the barrier islands migrated inland and the estuaries around the island were completely flooded because of continued sea level rise. A forested linear ridge became the focus of human occupation. The human interest in this landscape is expressed by the dense accumulation of prehistoric ceramics, lithic artifacts, bone refuse, and shell items found at the site. During the Middle Woodland period, the human fascination with the area defined as 44NH440 fluoresced. A tidal creek defined the northern boundary of the ridge. South Bay defined the eastern flanks of the ridge and a tidal marsh bordered the western portion of the ridge (see Figure 24). The Middle Woodland peoples who occupied the area seem to have focused their efforts around the marine resources within the South Bay. The slow rates of sea level rise eventually killed the forest located on the ridge and the region was abandoned. Interestingly, this same sequence of environmental use and abandonment by prehistoric peoples along the developing Atlantic coastline would have occurred throughout prehistory.

Even though subsistence data are rare. The work at 44NH440 has provided some indirect evidence of the types of marine resources exploited by prehistoric peoples during the Middle Woodland period (see Figure 64). Aside from the deer bone found in the Middle Woodland organic midden, a wide variety of coastal resources were utilized. The use of fish resources is indicated by the remains of Bull shark, Great White shark, Stingray, and possibly Drum fish. Sharks are common residents of the barrier island lagoons. Badger and Kellum (1989: 130) illustrate a photo of several sharks caught in the area during a fishing trip in the 1930's. Sharks have been spotted in the area offshore and adjacent to the site. Local residents have indicated that Gargathy Creek in Accomack County is annually a recognized mating area for Bull sharks. Murdy et al. (1997: 32-33) mention that Bull sharks represent one of the dangerous visitors to the Chesapeake Bay in summer months. With respect to Great White sharks, they would be considered rare visitors to the region today. It is recognized that Great White sharks regularly eat sea turtles and seals (McCormick et al. 1963: 298-300). Sea turtles are common visitors to the barrier island lagoons and the tidal channel areas even today. In the past, sea turtles may have been annual visitors or they may even have nested on the barrier islands. Badger and Kellum (1989: 68) illustrate a Ridley turtle captured near Hog Island and note that the species was prized for "its flavorful meat and eggs". Harbor seals also occur today on the isolated barrier islands off of Virginia's coast (Eder 2001: 42-43). Seals are also mentioned in some of the early accounts of colonial Virginia (Wharton 1973). It is also noted that Great White sharks frequent the inshore shallow waters (3 feet or more) along North Carolina's coast from April through the summer (Schwartz and Burgess 1975: 36). Therefore, it is not impossible to suggest that during the Middle Woodland period Great White sharks frequented the area and were considered a potential food resource. Great White shark remains have been found within refuse deposits at other contemporaneous archaeological sites along the Northeast Atlantic coast (see Bourque 1995: 220; and Rojo 1990: 89-108). With respect to Drum fish and stingrays, Drum fish are frequently caught today (Badger and Kellum 1989: 128-132, 135, and 145) along Virginia's barrier islands. From personal experience, I can attest to the presence of large stingrays within the lagoons and bays behind the barrier islands (see Murdy et al. 1997: 44-52). The presence of fishhooks within the midden and net impressions on some of the prehistoric ceramics found at 44NH440 further supports the contention that fishing was a chore being practiced by the site's Middle Woodland occupants.

Other potential subsistence items indicated by the archaeological materials found at 44NH440 include bay scallop, oyster, hard clam, and ribbed mussel (see Figure 64). The crushed shell mixed in with the fired ceramics found at the site supports the use of these items. The exception being the single bay scallop shell found in the midden exposure. The Middle Woodland occupants at 44NH440 also exploited whelks. Both "left-hand" (i.e., sinistral) and "right-hand" (i.e., dextral) species are indicated. Given the modified nature, it is assumed that the species represented include *Busycon carica* and *Busycon contrarium*. The whelk species presently available in South Bay include the dextral knobbed whelk (i.e., *Busycon carica*), the sinistral lightning whelk (*Busycon contrarium*), the dextral channeled whelk (*Busycon canaliculatum*), and a rare sinistral form of the knobbed whelk (i.e., *Busycon carica*). The rare sinistral form of the knobbed whelk has also been reported from Avon, New Jersey (Morris 1951: 203).

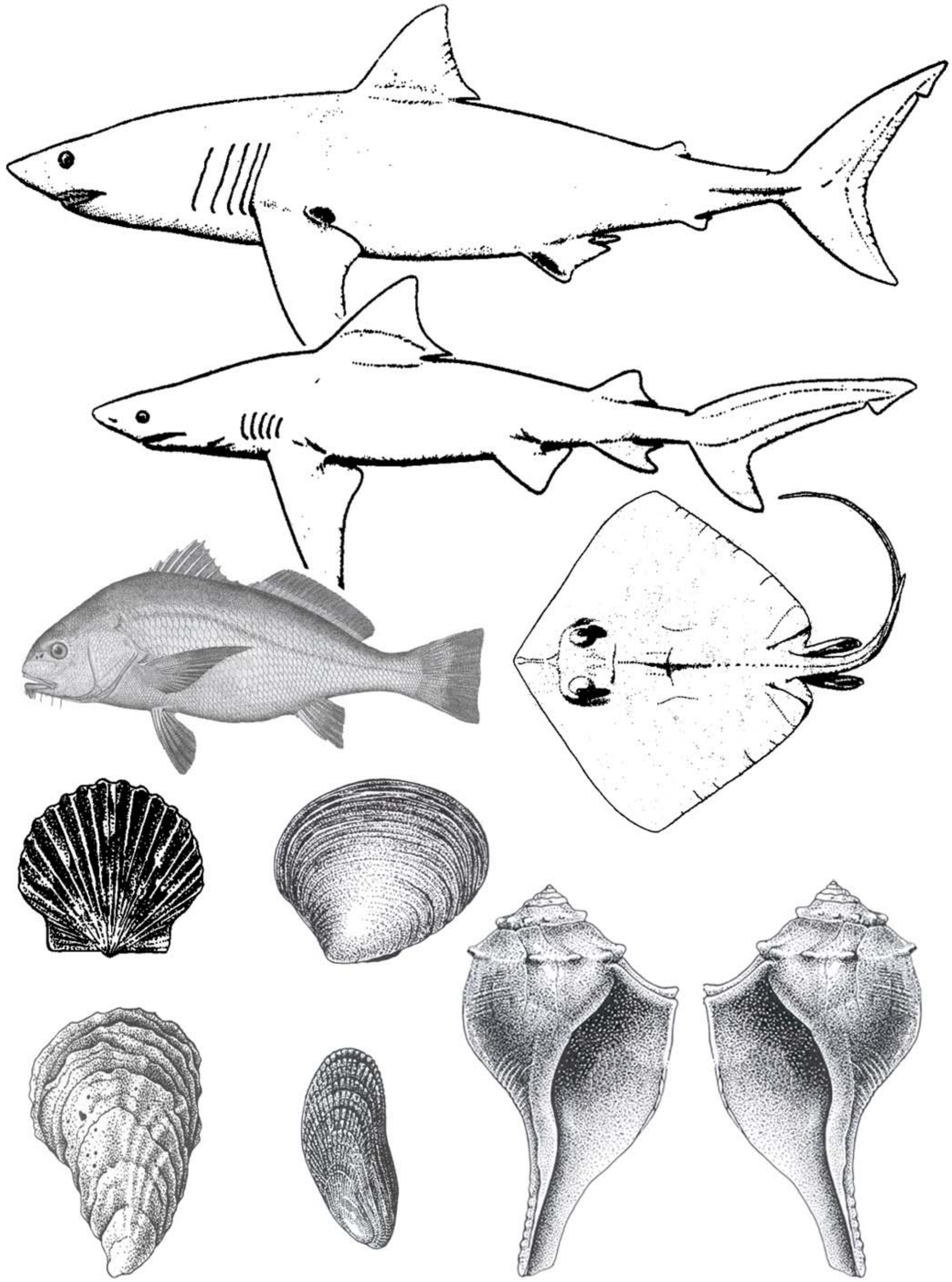


Figure 64. Coastal Human Subsistence Species at 44NH440.

The excavation and surface collection artifact data from 44NH440 also provides some information about prehistoric trade and exchange networks. These trade networks are indicated by some of the exotic lithic materials found at the site. Figure 65 illustrates the suggested directions and the types of material traded to or brought to the Mockhorn Island area by prehistoric peoples. It is important to note that some of these distinctive materials could probably have been collected or gathered much closer than the map portrays. Argillite and jasper have been found as pebbles, cobbles, and even boulders within some of the ancient fluvial deposits associated with the Delmarva Peninsula (Lowery 2002a). Cobbles of green chert, which resembles the New York Normanskill chert type, have also been found within Delmarva's paleochannel deposits. With respect to the Middle Woodland aspect to 44NH440, caches of large jasper, argillite, and Normanskill green chert Petalas blades have been found at other sites on the Delmarva Peninsula. A cache of over 120 large argillite Petalas blades was found at Horn Point along the Choptank River in Dorchester County, Maryland. A cache of 15 or more large jasper Petalas blades was found near Bruff's Island along the Miles River in Talbot County, Maryland. Finally, a cache of 20 or more extremely large green Normanskill chert Petalas blades was found along the Choptank River in Talbot County, Maryland. As such, the argillite, jasper, and green Normanskill chert artifacts found within Middle Woodland contexts at 44NH440 probably originated from the primary source areas shown in Figure 65.

Rhyolite was also found at 44NH440. Some of the rhyolite specimens resemble the rhyolite varieties found in Middle Woodland contexts along Maryland's eastern shore. The rhyolite specimens from Maryland's eastern shore originated from western Maryland and south-central Pennsylvania. A few of the Late Archaic broadspear specimens found at the site resemble the silicified rhyolite generally associated with North Carolina. The copper found at 44NH440 could have originated in the northeast or from the "classic" copper sources in the western Great Lakes region. Other small sources of copper are known for sections of the Appalachians. Fragments of steatite bowls were found immediately south of 44NH440 at the site designated 44NH441 (Lowery 2003a: 184-185). The source of these bowls could be linked to numerous steatite quarry sources along the Appalachians. Finally, a Flint Ridge chalcedony biface (see Figure 32A) found within the Middle Woodland midden at the site originated from primary quarries in Ohio. Lowery (2003a: 207) also reported a possible Upper Mercer chert biface from the site. The primary quarry source for the Upper Mercer chert biface would also be in Ohio. As such, it would seem that the Middle Woodland trade and exchange networks linked to the prehistoric peoples living on Mockhorn Island included the Ohio Valley. With respect to the Middle Woodland-era archaeological record of the Delmarva Peninsula, interaction with the cultures living in the Ohio Valley is not particularly unusual (see Ford 1976).

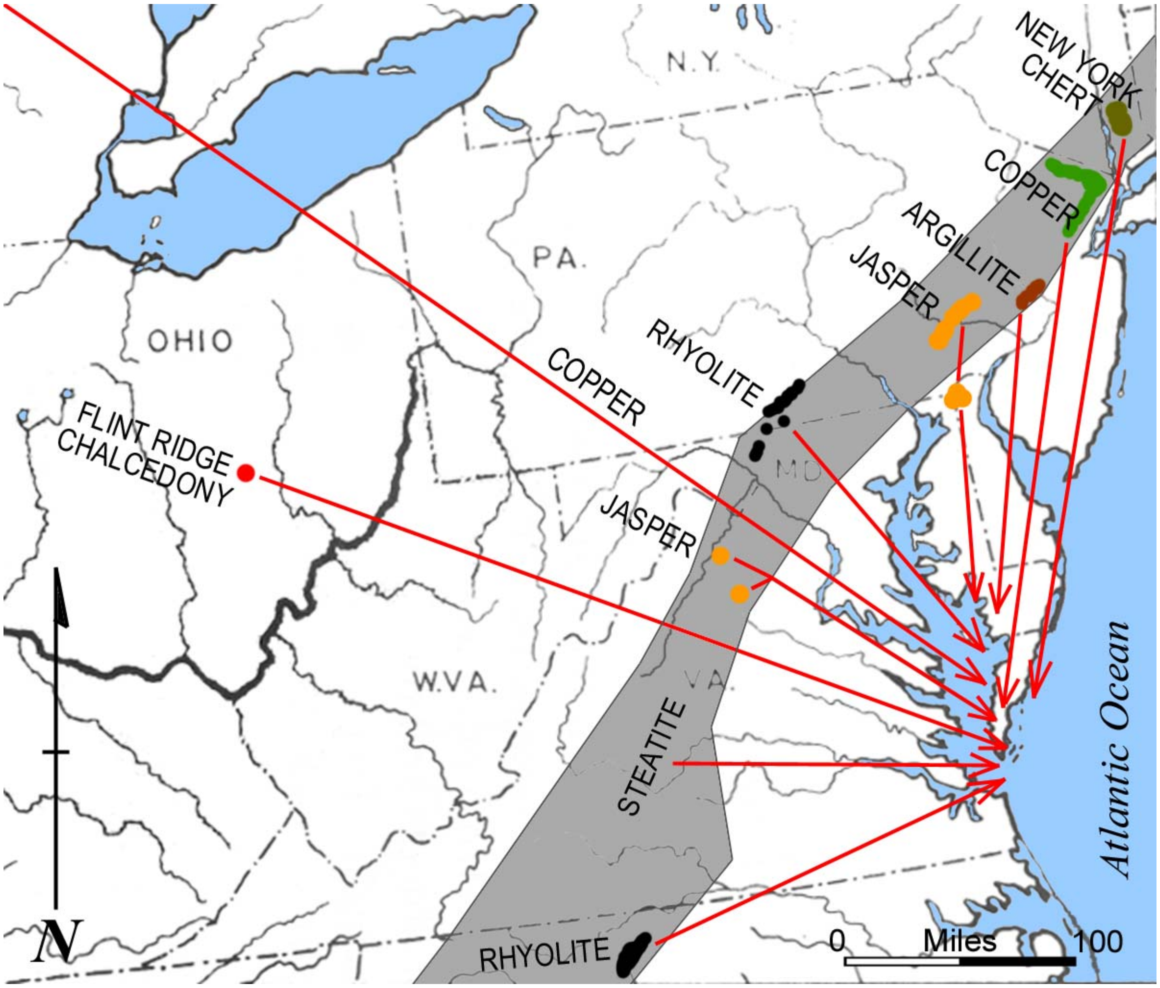


Figure 65. Potential Trade Networks based on Assemblage Data from 44NH440.

What did Mockhorn Island and the Atlantic seashore of Virginia offer local prehistoric peoples as a potential trade and exchange commodity? Figure 33 hints at one such commodity. Marine shell was a highly valued commodity among Native American communities. Prufer (1961: 562) notes that in 1873 the "Ojibwa were willing to pay the equivalent of thirty to forty dollars in furs for large marine shells". Matter of fact, Wise (1911: 60-61) notes the Virginia's seaside tribes had a regular mint for turning out "shell money". As such, shell seems to be a major commodity associated with regional trade and exchange.

Another such commodity for trade and exchange may still survive on Mockhorn Island. Within the wooded areas along the central ridge that extends the length of the island (see Figure 23), occurs a plant species that was valued by prehistoric peoples and occurs nowhere else on the Delmarva Peninsula. A species referred to as *Ilex vomitoria* or yaupon (see Figure 66) occurs in thick groves along the central ridge of Mockhorn Island. Rafinesque (1928) notes that *Ilex vomitoria* is collected with care and is an article of trade among the tribes. Lawson (1967) notes that during the early 1700's in North

Carolina *Ilex vomitoria* was sent from the coast to the westward Indians and traded or sold at a considerable price. With yaupon or *Ilex vomitoria*, native peoples in the southeast made the "black drink", which could induce vomiting (Hudson 1976). If properly treated, the leaves of *Ilex vomitoria* could also serve as a caffeinated tea. The current northern range of *Ilex vomitoria* is listed as northeastern North Carolina or southeastern Virginia (Tiner 1993: 134). It would seem that Mockhorn Island is the northernmost extent of the range of yaupon. MacDougall (2003: 633-647) has suggested that *Ilex vomitoria*'s range may be partly due to Native American planting via trade, transport, or cultivation of the species. If this is the case, the vestigial isolated population of *Ilex vomitoria* on Mockhorn Island may provide a clue about the area's significance to late prehistoric peoples. In 1622 Opecancanough (i.e., the brother of Powhatan) sent messengers to the Accomack councils, with orders for his dependents to gather a certain herb, which grew on the Eastern Shore and nowhere else, and send it to him (Wise 1911: 58). Was this herb *Ilex vomitoria* or something else? Helen Rountree (7/30/03: personal communication) has suggested that Opecancanough was referring to the Spotted Cowbane, *Cicuta maculata,* which is the most poisonous native wild plant in the whole Chesapeake region.

The work at 44NH440 has in essence posed more questions for future research. Even so, the work at 44NH440 has provided some amazing insights into an area that was largely understudied. In July 2000, I was given the responsibility to conduct a survey of the Atlantic seashore of both Accomack and Northampton counties, Virginia. Prior to the fieldwork, I had examined the soil surveys of the area, studied the aerial photographs of the region, inspected the historic maps of the coastline, and read all of the geologic investigations associated with the Virginia's barrier islands. In doing so, a small stretch of coastline along the east side of Mockhorn Island (see Figure 23) attracted my eye. The west side of Mockhorn Island also seemed as a blatantly obvious spot for prehistoric sites. But, it was felt that these may have been heavily collected. In contrast, it was felt that the remote nature of the east side of the island might have limited the amount of surface collecting via avocational archaeologists. At this time, I contacted Mr. Dave Hazzard of the Virginia Department of Historic Resources and told him about my prehistoric site predictions for the east side of Mockhorn Island. Given the geology, I also told him the area should have Paleo-Indian period diagnostics through Woodland period archaeological components. On October 13, 2000, the east side of Mockhorn Island was examined under the auspices of the archaeological survey for the first time. Three sites were located on this date. After six trips to these three sites, over 500 diagnostic projectile points were discovered along with prehistoric ceramics, bone, and shell items. As predicted, Paleo-Indian period through Woodland period archaeological components were documented. Aside from the limited amount of historic storm debris, no evidence was discovered of historic intrusion onto this landscape. Prior to October 13 2000, I believe that these three localities were "virgin" archaeological sites that had not been surface collected. These may have been the last "virgin" prehistoric sites on the Delmarva Peninsula. It was my pleasure to take the "virginity" of these three sites. For a brief moment, I got into the minds of these long deceased prehistoric peoples and understood them. I feel they have rewarded me with a great experience. I had the experience to study them first hand by way of the items they left behind along an isolated ridge facing the Atlantic Ocean.

Figure 66. *Ilex vomitoria* or Yaupon.

Management Recommendations

The results of this study indicate that 44NH440 has an amazing archaeological record. The results also suggest that Mockhorn Island, as a whole, encompasses a significant complex of archaeological sites that span the entire gamut of prehistory. An unknown percentage of these sites are inundated, partially inundated, or terrestrial. 44NH440 represents a site that is both inundated and partially inundated.

Blanton and Margolin (1994) in a management plan developed to address Virginia's underwater cultural resources defined some of the parameters for submerged prehistoric archaeological sites. They (Ibid: 93) note that not all underwater prehistoric sites will retain appreciable integrity and comment that well-preserved sites may be the exception rather than the rule. 44NH440 has amazing archaeological integrity and is well-preserved even under the parameters of very slow rates of sea level rise over the past 2,000 years. The situation observed at 44NH440 hints towards some amazingly well-preserved sites off the Atlantic Coast associated with intervals of time that had very high rates of sea level rise. Blanton and Margolin (Ibid.) note the underwater filled stream valleys and low-energy marine environments will have better preservation potential. I do not doubt this suggested observation. But, 44NH440 represents a former upland, not a former stream valley. Currently, the setting associated with 44NH440 is on average a low-energy marine environment. If sea levels were to continue to rise, a thick blanket of peat along with transgressive barrier island sands would cover the site and the area would eventually be in a higher energy environment under the ocean (see Figure 30). Would the site survive? It depends on the rate of sea level rise. Higher rates of sea level rise offer better site preservation potential in marine settings.

Blanton and Margolin (Ibid.) suggest that remote sensing and sub-bottom profiling devices would be an adequate means to locate underwater sites. What would you really locate if you conducted some remote sensing or sub-bottom profiling off of 44NH440? You would probably define the former upland landsurface and the former upland topographic relief (see Figure 4). I doubt that you would notice any distinctive evidence of prehistoric use along this former upland area landscape. With respect to features, the archaeological record for the area clearly indicates that shell middens are uncommon along Virginia's Atlantic seashore (Lowery 2003a). Also, the offshore sediments that blanket the upland landscape offshore of 44NH440 include a mix of shell and coastal sediments. How would you determine the difference between a former shellfish bed, a mix of coastal sediments and shell lag, and a culturally derived shell midden or pit? Presently, this question cannot be addressed or answered.

Unlike areas of the Chesapeake Bay, the waters within the barrier island bays and the lagoon areas are fairly clear. The barrier island bay areas are flushed regularly by the Atlantic Ocean. Plus, they are fairly shallow. As such, South Bay offers some amazing potential to test for inundated archaeological components within the sub-tidal zone off of 44NH440, 44NH441, and 44NH442. How would you survey the areas offshore of 44NH440 for inundated prehistoric sites in a cost efficient manner? One technique is already available that would allow for a very quick underwater survey for inundated prehistoric archaeological sites. In Maryland, waterman have employed a technology that allows them to locate, document, record, and harvest clam beds (see Figure 67). With this technology, pressurized water is used to sieve the bottom and a conveyor belt extracts all of the large objects from the bottom. Unlike a backhoe cut, the clam dredge would screen the bottom for cultural artifacts. The artifacts plus samples of the bottom sediment would be available for inspection and documentation. The rate of forward boat movement is roughly equal to the section of the bottom that has been dredged. Plus the depth below the water can be easily monitored and controlled. As such, an artifact or collection of artifacts brought up from the bottom can be marked by a floatation buoy or with a GPS receiver. The artifacts can also be bagged and labeled to specific GPS locations or coordinates. This would allow divers to check specific dredge cut locations for intact archaeological landsurfaces or features. Having no mechanical gears or parts that would directly come in touch with artifacts, the technology is artifact friendly. A series of linear clam dredge transects across the bottom of South Bay (see Figure 68) or similar areas along the coast or within the Chesapeake Bay could easily locate numerous inundated prehistoric sites in a very cost effective manner. The only limitation would be the depth of water capable of being tested with the dredge. Currently, only a few of these clam dredges are capable of excavating areas of the bottom that are 25 feet below the water surface. The majority of the clam dredges work in water depths less than 15 feet. With respect to the inundated archaeological record, the clam dredge would negatively impact some portion of each site discovered. The impact would, however, be no worse than the use of a backhoe to assess a terrestrial site. Continued dredging in an area for the sole purpose of acquiring cultural items without context would represent blatant disregard for the archaeological record. So would the continued use of a backhoe on a terrestrial site. The point being, "to bake a cake, you may have to break a few eggs." As such, I would suggest the hydraulic clam dredge could be an asset if used properly and it could be used for systematically surveying the bottom for prehistoric sites in shallow water environments.

Given the current data generated as a result of this project, it is believed that 44NH440 would be eligible for nomination to the National Register of Historic Places. It is also believed that further archaeological testing on Mockhorn Island would help determine if the entire complex of sites (see Figure 5) are eligible for the National Register of Historic Places. Recommendations for further archaeological study on Mockhorn Island include the following:

- The offshore area within South Bay provides an ideal place to test for inundated sub-tidal archaeological sites. The area provides a testing ground for different underwater technologies relative to locating inundated prehistoric sites. I would suggest that linear transects using side-scan sonar and the sub-bottom profiler be performed. As a follow-up, I believe that the clam dredge be used and trace the same linear transect pattern used by the side-scan sonar and the sub-bottom profiler. A comparison between the data generated by these technologies should help resolve the problems of dealing with inundated prehistoric sites. Plus the data could serve as the first systematic underwater search for prehistoric sites off the Atlantic coast of Virginia.

- A multi-year archaeological testing program should be developed for the known sites on Mockhorn Island. The program could continue testing the linear ridge associated with 44NH440 southward to 44NH441 and 44NH442. These data would only expand upon the initial observations generated as a result of this work.

- Numerous forested hummocks and slightly elevated knolls are located on Mockhorn Island that currently do not have recorded or documented archaeological sites associated with them. Given the data known for the area, all of these knoll or hummocks should have archaeological remains. As such, these areas should be tested to increase the inventory of known sites on the island and better understand the region's prehistory and history.

- It is noted that 44NH440 does not seem to have any Late Woodland archaeological components. It is assumed that sea level rise required the Late Woodland occupants of the island to focus their settlements on or near the forested linear ridge, which extends the length of the island. Simply excavating some units along the forested ridge could test this hypothesis.

- The current work indicates that the Middle Woodland midden at 44NH440 is largely intact and has not been impacted by current fiddler crab bioturbation along the western flanks of the ridge. This portion of the midden could be tested for preserved floral and faunal remains that would help reconstruct coastal subsistence patterns, environmental conditions along the ridge during the Middle Woodland period. Carbonized plant remains and charcoal could also date the Middle Woodland component.

- It has been suggested that *Ilex vomitoria* may have been a viable local Mockhorn Island commodity used in prehistoric and early historic trade and exchange. Organic debris encrusted on the ceramics within the midden could be tested for specific enzymes or coatings to determine what was being processed in these prehistoric vessels.

- The soils associated with the organic midden could be tested for indications of intensified fishing when 44NH440 was occupied. In the field, it was noted that these soils had a "greasy" feel. The few macro fish remains provide some clues.

- A large individual rock "feature" was noted east of the mouth of the tidal creek that defines the northern boundary of 44NH440. It is suggested that this rock may have been a weight for a net. The net may have been similar to the modern pound net. If so, the weight may have been used to hold the head or crib area of pound net on the bottom. Given the nature of the offshore conditions, the wooden stakes used to create the weir or pound net may be present. These stakes would be situated under the bottom between the shore and the presumed rock net weight.

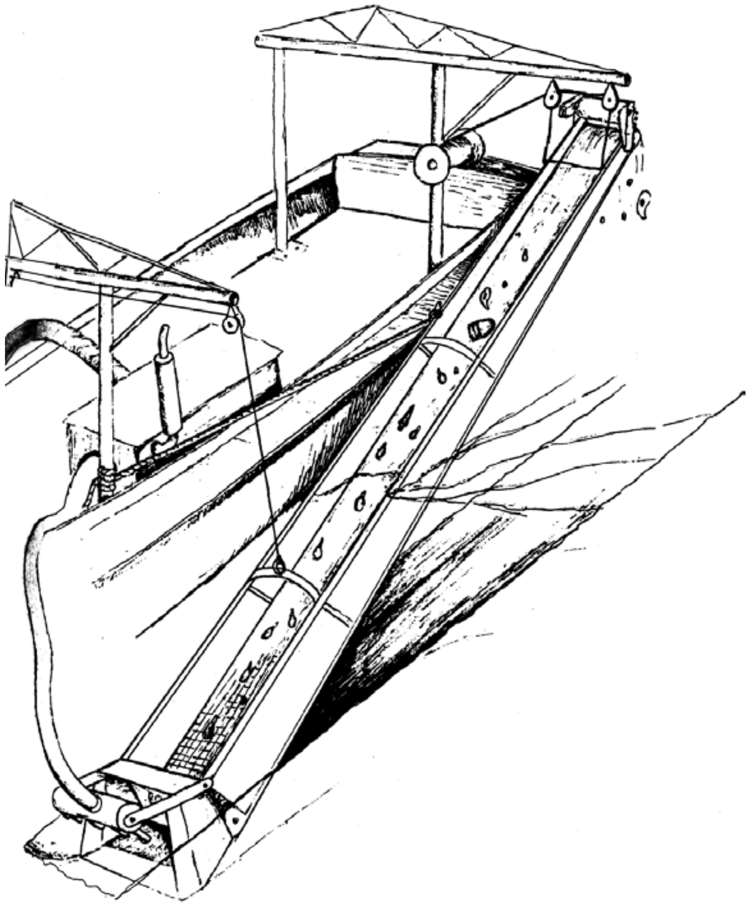


Figure 67.   Hydraulic Clam Dredge.

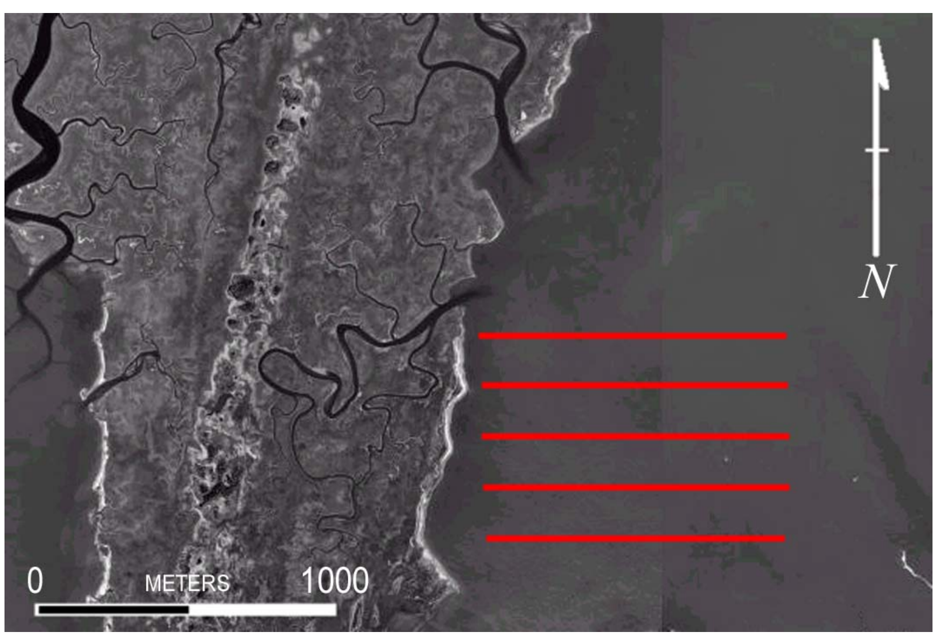


Figure 68.   Suggested Linear Clam Dredge Transects.

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APPENDIX I:

Soils Data Associated with Mockhorn Island