Abstract

The Chesapeake Watershed Archaeological Research Foundation conducted a shoreline survey of the Atlantic seashore of Virginia in 2001 (see Lowery 2003a) and limited archaeological testing at site 44NH440 in 2003. These projects involved the Mockhorn Island area along the coast of Northampton County, Virginia. The present work was initiated because in 2003 we recognized that 44NH440, a low inundated former upland ridge, does not seem to have any Late Woodland archaeological components. The working hypothesis being that sea level rise over the last 1,000 years required the Late Woodland-era occupants of the area to focus their settlements on or near the forested hummocks located near the central and western sides of Mockhorn Island. As such, 44NH440 was abandoned because tidal processes linked to slightly higher regional sea levels were more regularly inundating the landform, which encompasses the site. To test this hypothesis shell refuse surface exposures located near or adjacent to the forested hummocks were selected for testing. It was assumed that some of these shell refuse areas might indeed represent the Late Woodland use of Mockhorn Island and its surrounding coastal environment. The investigation to test the working hypothesis was conducted from February 1, 2004 through June 31, 2004 in accordance with an agreement with the Virginia Department of Historic Resources. Our investigations concluded that sea level rise did impact human settlement locations on Mockhorn Island and that the Late Woodland occupants did relocate their settlements near the forested hummocks. The results of our work have ramifications relative to the reconstruction of regional sea level rise histories, as well as, human subsistence and settlement patterns.

1: Project Background

Introduction

The test excavations and surface collection data at 44NH440 (see Lowery 2003b: Figure 35) conducted in 2003 failed to locate any definitive evidence for Late Woodland use of this landscape. Even the large assemblage of prehistoric ceramics collected and excavated at the site indicated that the site ceased to be occupied during the late Middle Woodland period or about 1,200 years ago. Keith Egloff (personal communication 7/16/02) of the Virginia Department of Historic Resources examined the ceramic assemblage collected from the site and made this observation based on the ceramics found along the shoreline. Our excavations reinforced this observation.

During the 2003 field season, we made preliminary attempts to survey the hummocks along the central ridge of Mockhorn Island (see Figure 1) to see if we could locate any evidence of prehistoric occupation or utilization. Our work indicated some level of prehistoric use along the central ridge of Mockhorn Island. Figure 2 illustrates a pitted hammerstone or anvilstone found embedded on the ground surface near a shell cluster. Figure 3 illustrates an embedded shell cluster found on the surface near the

central ridge of Mockhorn Island. At that time, the undiagnostic pitted hammerstone or anvilstone provided the only definitive evidence for prehistoric utilization of the central hummock area. Even so, it was not known if the artifact was 300 years old or 5,000 years old. Further work would be required to address the question relative to the Late Woodland use of the area.

After the completion of the investigations at 44NH440 and the submittal of the final report, the Virginia Department of Historic Resources Threatened Sites Program awarded the Chesapeake Watershed Archaeological Research Foundation a grant. The grant was to investigate the enigmatic shell clusters noted on the island and look for evidence of Late Woodland era settlements.

In the late summer of 2003, Hurricane Isabel impacted the coast of the Delmarva Peninsula and the Chesapeake Bay area. Coastal flooding (Figure 4), shoreline erosion, and property damage (Figure 5) occurred in the impact area. With respect to Mockhorn Island, some of the trees along the margins of the forested hummocks were uprooted and the damage exposed additional shell features (Figure 6). These newly exposed features provided areas to archaeologically test during the current fieldwork.

Figure 1. Forested Hummock Along the Central Ridge of Mockhorn Island.

Figure 2. Pitted Hammerstone or Anvilstone found on the Surface near the Central Ridge of Mockhorn Island adjacent to a Shell Cluster.

Figure 3. A Shell Cluster Exposed on the Surface near the Central Ridge of Mockhorn Island.

Figure 4. Coastal Flooding caused by Hurricane Isabel.

Figure 5. Granite “Rip-Rap” Boulder Movement caused by Hurricane Isabel.

Figure 6. Uprooted Tree along the West Side of Mockhorn Island that Exposed a Shell-Filled Cultural Feature.

The work in 2003 at 44NH440 made two observations that provided the foundation for the 2004 fieldwork. It was noted that:

- Numerous forested hummocks and slightly elevated knolls are located on Mockhorn Island that currently these areas do not have recorded or documented archaeological sites associated with them. Given the data known for the region, 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.

- The archaeological investigations at 44NH440 suggest that the site does not have Late Woodland-era 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 central linear ridge, which extends the length of the island. Simply excavating some units along the forested hummocks could test this hypothesis.

As such, the goals set forth for 2004 were to locate, document, and record any additional cultural evidence or sites within the Mockhorn Island area and to delineate whether the area was used during the Late Woodland period.

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

The purpose of this project was to explore the archaeological potential of buried Late Woodland inland deposits or features on Mockhorn Island. The focus of these efforts centered on a series of presumed culturally derived shell features and surface exposures of shell noted near and adjacent to the various forested hummocks (Figure 7).

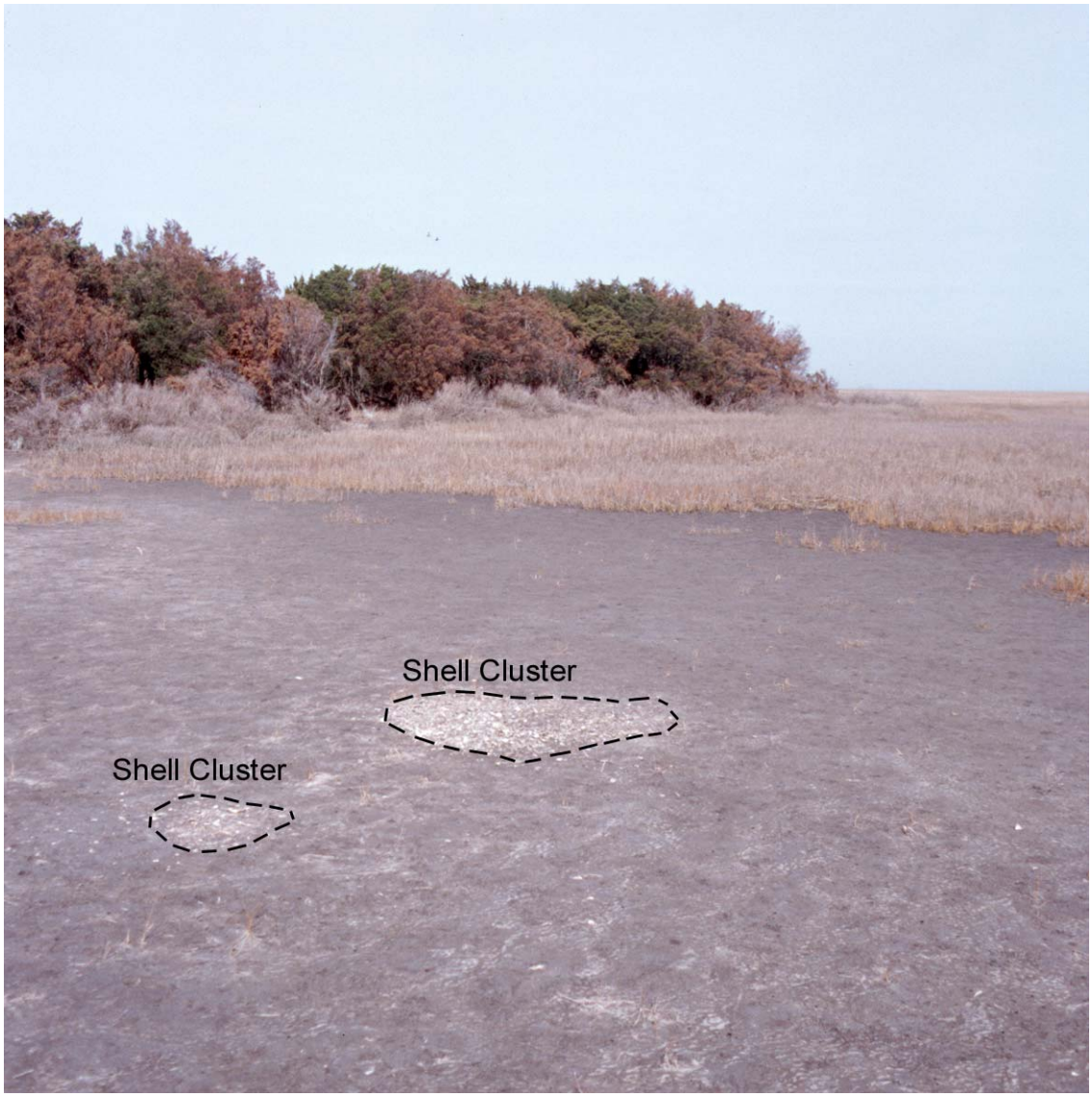

Figure 7. Surface Shell Cluster Exposures Noted on the West Side of Mockhorn Island.

Project Goals

Several basic questions organized the undertaking associated with the follow-up research on Mockhorn Island. On the whole the goals were simple, aimed mainly toward evaluating the cultural use of the forested hummock areas on the island. A basic method of locating potential cultural feature areas and systematic archaeological testing were employed. The research topics addressed are as follows:

1. Identify any cultural use of the forested hummock areas;
2. Assess the chronological evidence for a Late Woodland-era presence or use of the Mockhorn Island landscape;
3. If Late Woodland features are located, define what subsistence and trade or exchange data are indicated by the remains;
4. Compare and contrast the archaeological or geoarchaeological data discovered at 44NH440 with the information gleaned during the current fieldwork; and
5. Make suggestions for management and future research in the area.

Field Methods

Overview of Previous Fieldwork

The previous fieldwork on Mockhorn Island consisted of a shoreline survey to assess eroded archaeological resources (Lowery 2003a). The shoreline survey located several archaeological sites that span the entire prehistory. During this survey, three sites (i.e., 44NH440, 44NH441, and 44NH442) were discovered along the east side of Mockhorn Island. These sites seem to be "virgin" sites that have escaped being collected over the past 300 years.

As a result of the discoveries made at 44NH440, 44NH441, and 44NH442, the Virginia Department of Historic Resources funded limited test excavations at one of the sites. The Upper Ridge site (i.e., 44NH440) was selected for testing because it had an organic midden feature, revealed the largest shoreline artifact assemblage, and had the best potential for understanding coastal site formation processes. The results of the excavations are summarized in the previous report.

Interestingly, the shoreline survey and the testing at 44NH440 failed to reveal or locate clear-cut evidence for a Late Woodland-era use of Mockhorn Island (Lowery 2003b). However, casual walkover surveys near the interior forested hummocks and along the forested hummocks situated along the west side of the island (see Figures 2, 3, 6, 7, 8, and 9) revealed settings with the potential for producing Late Woodland-era settlements. More importantly, several shell features were observed and the work at 44NH440 did not reveal any similar features. As such, it was assumed that these features might provide important clues about the Late Woodland occupation of Mockhorn Island.

Figure 8. West Shore of Mockhorn Island with Eroded Forested Hummocks.

Overview of Field Methodology

With respect to the previous fieldwork conducted on Mockhorn Island, the fieldwork for 2004 focused around the cultural identity of the shell features situated near the central forested hummocks of the island and the forested hummocks located on the western side of the island.

During the winter months, the vegetation cover along the edges and within the hummocks of Mockhorn Island is very limited and, as a result, the surface visibility is at its best. As such, the hummocks along the central and lower end of Mockhorn Island were surveyed during the winter of 2003 and 2004. Shell features were noted and any additional cultural materials on the surface and shoreline were plotted and collected. It should be noted that the colder winter experienced during 2003-2004 season caused coastal ice to form, which limited the number of field days. The field season was delayed and extended into the early summer of 2004.

The surface shell features discovered on the island in 2003 and 2004 were excavated in a traditional manner. Because the features were scattered over many geographically isolated parts the island, a grid system was not possible. As such, the exposed surface features helped define the placement of one-by-one meter units across the landscape. All of the excavation units were oriented towards true north.

As observed, the surface of the Mockhorn Island's landscape is heavily bioturbated via fiddler crab activities. As a result of the bioturbated landscape, the excavation strategy utilized the natural and cultural stratigraphy to define the excavation levels. Overwash strata were removed as one or multiple levels and the cultural stratum (i.e., shell-organic midden debris) was removed as a single level. All strata were screened separately and any diagnostic artifacts related with each stratum were noted and or bagged to the associated unit and the appropriate excavation level. Notes and any field observations were recorded on the appropriate unit-level sheets.

Figure 9. Interior View of a Forested Hummock on Mockhorn Island.

3: Research Results

Test Unit Results and Discussion

Five one-by-one meter test units were established within two broad study areas situated on Mockhorn Island. One study area was located on the southern end of the region defined in Figure 10. The "Southern" study area is situated along the western and southern end of the island. Three test units were established along the south and eastern flanks of a partially eroded hummock (see Figure 11). The western eroded section of this hummock was recorded by Lowery (2003a: 185) as 44NH445 in 2001. A second study area was located on the northern end of the area defined in Figure 10. The "Northern" study area is actually located along the central and eastern side of the island. The two test units were established in the area where shell scatters were observed in 2003 (see Figures 2 and 3). These units are located on the hummock ridge that runs down the center of the island and west of the ridge where 44NH440, 44NH441, and 44NH442 were recorded in 2001 (see Lowery 2003a: 182-185 and 204-207).

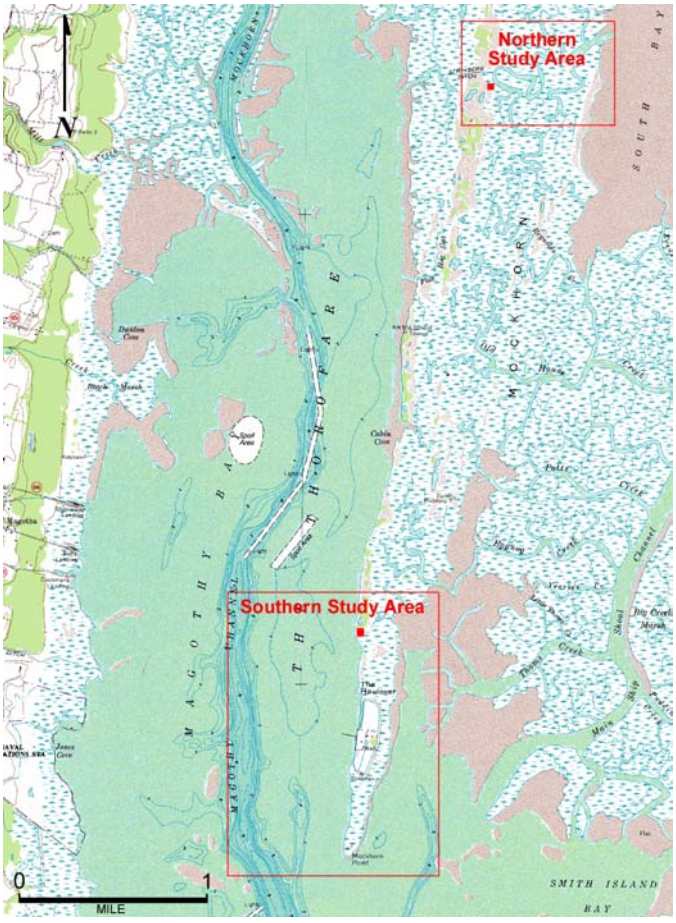

Figure 10. Study Areas on Mockhorn Island.

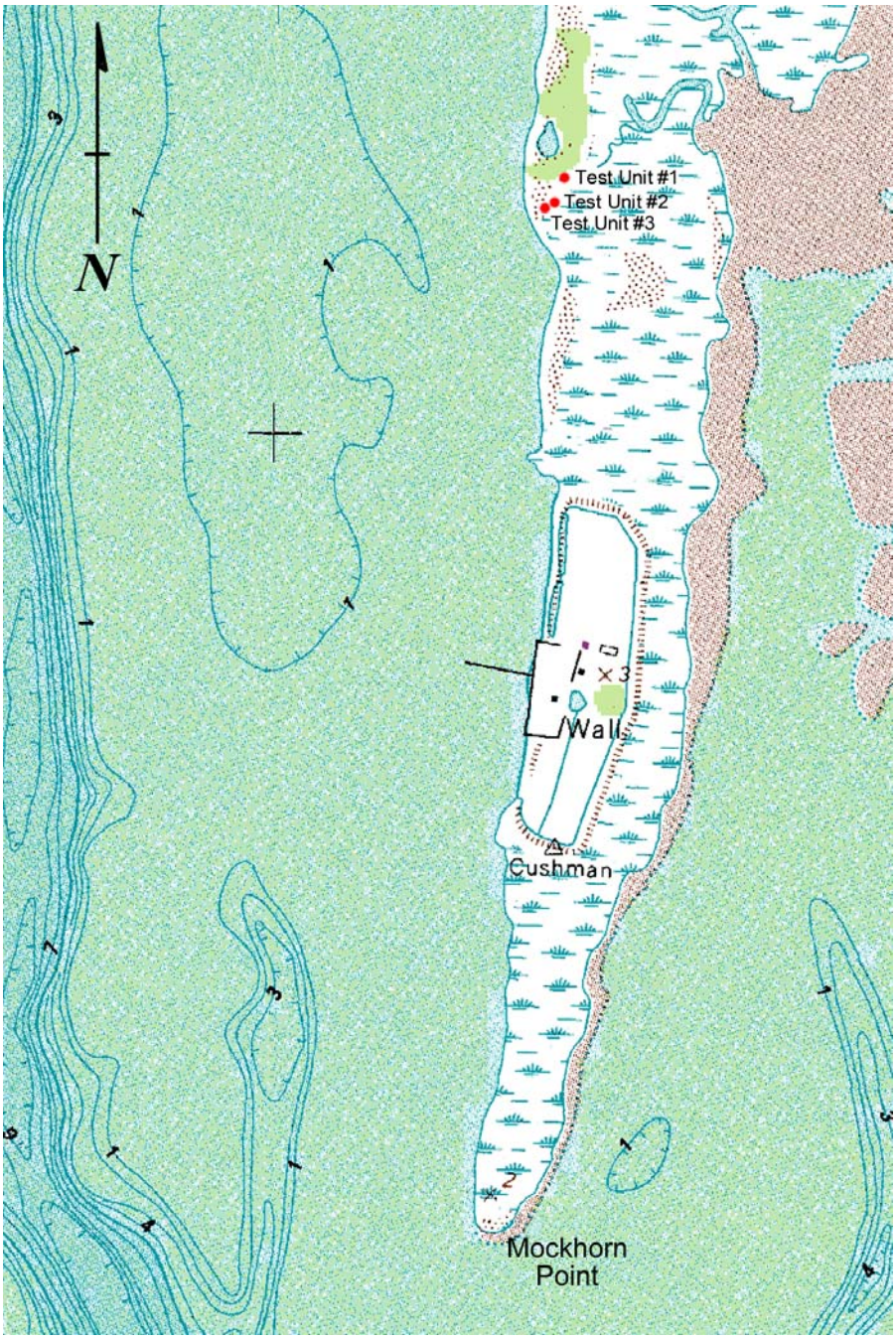

Figure 11. Location of the Test Units Excavated within the Southern Study Area on Mockhorn Island.

Test Unit #1:

Test Unit #1 (see Figures 12, 13, and 14) was established underneath a tree that had been uprooted during Hurricane Isabel. Aside from the upper 10 to 20 centimeters that were trapped in the root mass of the tree, the area was relatively intact and showed

no evidence of plow disturbance. The exposure also suggested that the area defined as Test Unit #1 was part of a cultural feature or lens of shell refuse.

Figure 12. Test Unit #1 Mockhorn Island.

Figure 13. Test Unit #1 Looking Northeast.

Figure 14. Test Unit #1 Looking Southwest.

Like all the test units excavated during the 2004 fieldwork, the material removed from Unit #1 was screened through quarter-inch wire mesh and all materials were collected (see Figure 15). Both whole and fragmentary hard-clam shells, oyster shells, and a limited number of ribbed mussel shells dominated the shellfish portion of the refuse. Four fragments of deer bone and one deer tooth were discovered along with two small slivers of bird bone. Given the diameter, the hollow bird bones probably originated from a large waterfowl bird species, such as a goose, swan, heron, or egret. Interestingly, three fragments from a sea turtle's carapace were also recovered in unit #1. A fairly dense number of cultural items were included within the refuse of Test Unit #1. Eight whole or fragmentary triangular points or bifaces were discovered (see Figure 16 A-H). These projectile points include four quartz specimens (Figure 16 A, D-E, and G), three chert specimens (Figure 16 B-C, and F), and one jasper specimen (Figure 16 H). All of the triangular points could have been manufactured from locally available cobbles or pebbles. Two of the examples (see Figure 16 E-F) are basal fragments and two of the examples include only the distal portions (see Figure 16 G-H) of projectile points. The remaining examples are whole or relatively complete specimens. However, all of the triangular points show impact damage. Six fragments of shell-tempered Townsend-Rappahannock ware (see Figure 16 I-P) were also discovered. These ceramics clearly indicate the refuse in Test Unit #1 is associated with a Late Woodland-era occupation. A hammerstone (Figure 17 A), a bi-polar wedge (Figure 17 B), and a battered anvil (Figure 17 C) were also discovered in Test Unit #1. Later in this report, it is suggested that the hammerstone, wedge, and anvil were part of a single tool kit.

Figure 15. Test Unit #1 Under Excavation Looking Southwest.

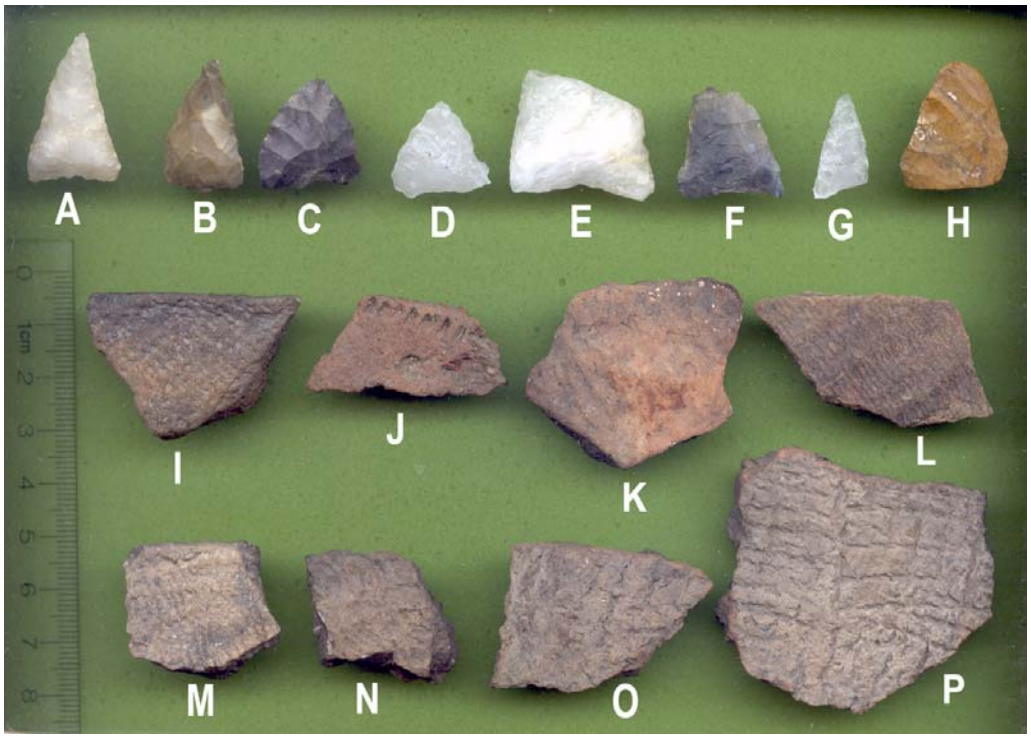

Figure 16. Late Woodland-Era Diagnostic Artifacts Excavated from Test Unit #1.

Figure 17. Late Woodland-Era Hammerstone, Wedge, and Anvil Excavated from Test Unit #1.

A general idealized image of the strata encountered within Test Unit #1 is shown in Figure 18. The surface stratum included a 15 to 19 centimeter thick shell refuse lens or midden. The surface refuse stratum would have been at least another 10 centimeters thick given the amount of material removed by the uprooted tree. Beneath the refuse stratum was a former upland organic stratum. The deepest stratum included the same well-developed Late Pleistocene age "Bt" soil horizon observed during the excavations at 44NH440. It is assumed that this well-developed soil horizon may have been the source for the Paleo-Indian point found in 2001 along the eroded shoreline at 44NH445 (Lowery 2003a: 185). It is evident that the strata had been bioturbated by fiddler crab activities (see Figure 19). Note the lighter circular soil patches evident on the surface of the former upland stratum exposed in the excavation. These circular patches represent overwash sediments that have worked their way down into the former burrows and tunnels of fiddler crabs.

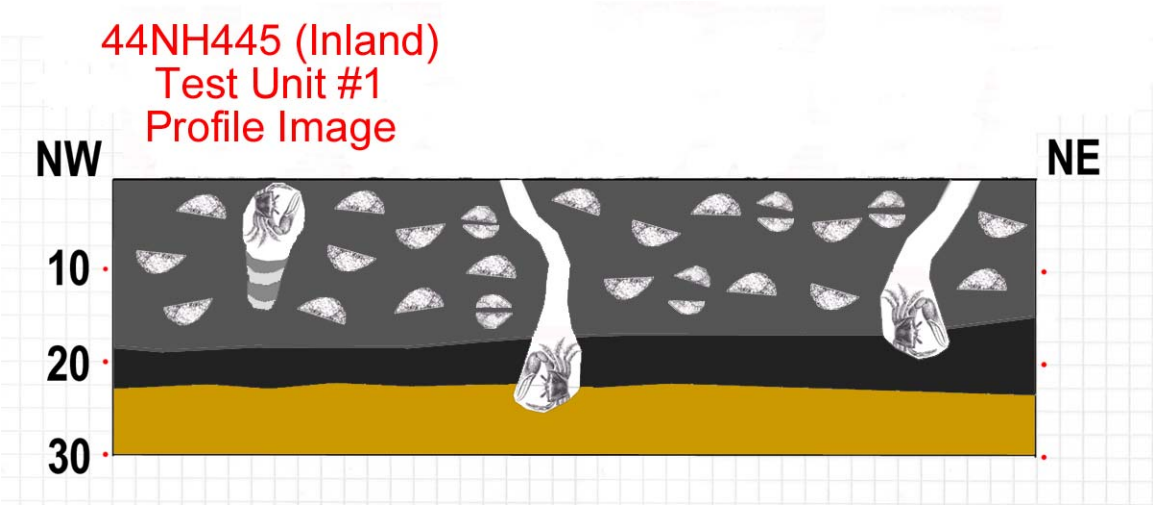

Figure 18. Idealized Profile of Test Unit #1.

Figure 19. Close Up Image of Profile Associated with Test Unit #1.

Test Unit #2:

Test Unit #2 was established within an exposed shell cluster area located southwest of Test Unit #1 (see Figure 20). The area was formerly forested, as indicated by an isolated tree stump. Sea level rise combined with storm surge overwash has created an ecological setting that represents an upland being transformed into a tidal salt

marsh wetland. Test Unit #2 was established along the northwest edge of what was presumed to be a shell-filled pit feature.

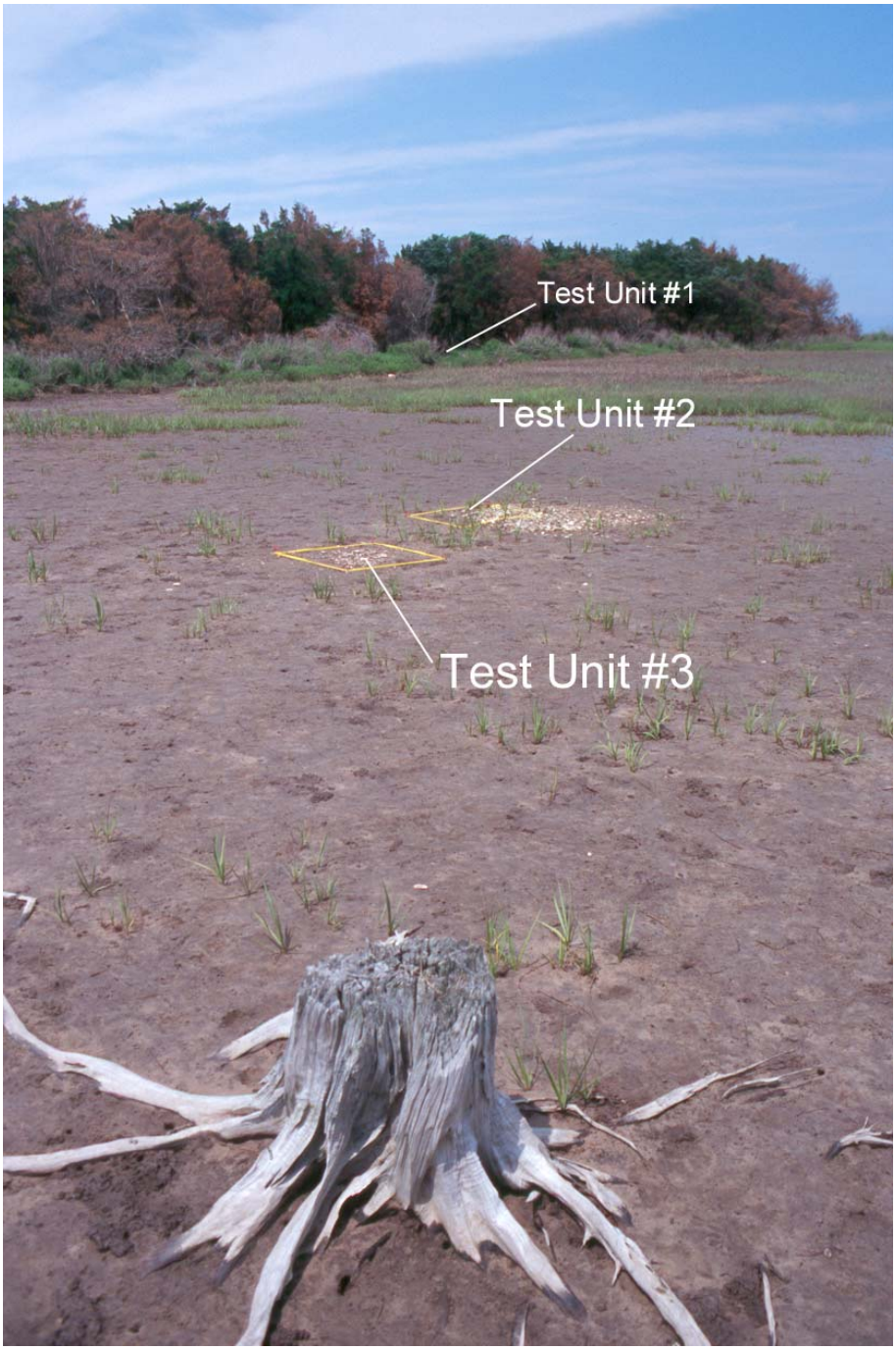

Figure 20. Location of Test Units #2 and #3 in Relation to Test Unit #1.

As expected, the excavation of Test Unit #2 revealed a shallow refuse-filled pit feature that was approximately 20 centimeters thick (see Figure 21). Given the surface exposure, the feature is approximately 1.75 meters in diameter. Figures 21 and 22 show the feature under excavation. The feature-fill included a mix of oyster shell and hard-clam shell. In comparison to the shells found in Test Unit #1, a higher proportion of the shells in unit #2 were fragmented. The cultural material found within in the feature were also more limited. Figure 23 illustrates the entire artifact assemblage found in unit #2. The lithic assemblage included a large quartzite flake (Figure 23A), a fine-grained quartzite bi-polar wedge (Figure 23B), and a crudely made triangular jasper biface (Figure 23C). Because of the thick base and the damage to the distal end of the biface, it may have served as a hand-held drill. Two incised fragments of Townsend-Rappahannock ware (Figure 23 D-E) were also found in the excavated feature fill. The diagnostic artifacts suggest that the chronological cultural affinity of the feature is Late Woodland.

An idealized image of the strata encountered within Test Unit #2 is shown in Figure 24. Unlike Test Unit #1, a thin stratum of storm surge overwash sediments covered the northeast corner of unit #2. In the far northeast section of the unit, a thin stratum of former upland sediments was observed below the overwash material. The upland sediment stratum was also observed within the northwest and southwest section of the unit, which was outside the feature area. As already mentioned, the feature fill included a mix of shell and organic sediments. The feature refuse stratum was situated directly on the well-developed "Bt" soil stratum. As such, it is assumed that the shallow pit feature could have been culturally excavated. The feature may have been a small "tree-throw", which served as a Late Woodland-era refuse basin. Bioturbation within the unit area was indicated by the occasional intrusion of a live fiddler crab into the unit via the open burrows noted within the walls of the unit.

Test Unit #3:

Test Unit #3 was established over a small exposed shell cluster located west of Test Unit #2 (see Figure 25). Like the shell area noted within Test Unit #2, it was presumed that the shell exposed on the surface of unit #3 indicated the presence of a sub-surface pit feature.

Unexpectedly, the excavation of Test Unit #3 revealed a very thin lens of shell that was less than 10 centimeters thick (see Figures 26, 27, and 29). The overwash sediments covered the landscape in a pattern that falsely suggested a sub-surface feature was present. The shell lens included a mix of hard-clam and oyster shell material. The shell was highly fragmented. The fragmentation suggested that the refuse had been highly weathered and it may have also been subjected to post-depositional crushing. Only three cultural artifacts were found within the refuse and these are illustrated in Figure 28. The artifacts include a complete chert triangular projectile point, a thermally altered chert flake, and a single fragment of Townsend ware. Like the cultural material excavated from units #1 and #2, the items from unit #3 indicated a Late Woodland-era affiliation for the shell refuse

Figure 21. Test Unit #2 Under Excavation.

Figure 22. Close Up Image of Test Unit #2 Looking Southeast.

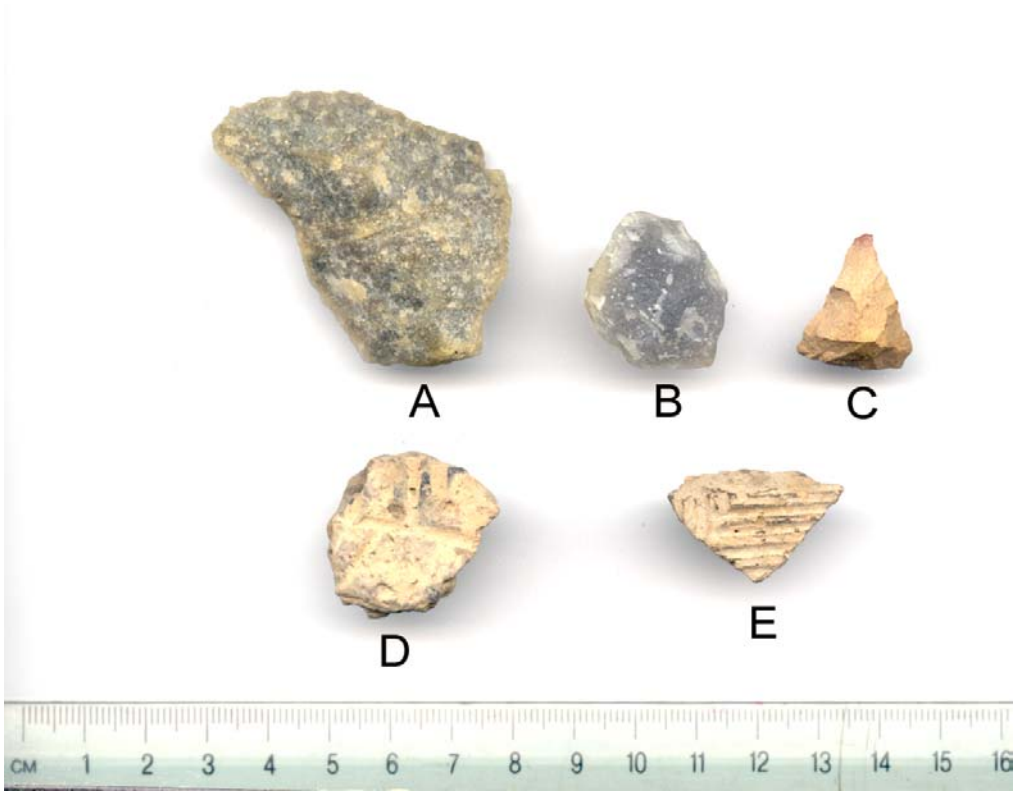

Figure 23. Artifacts Recovered from Test Unit #2.

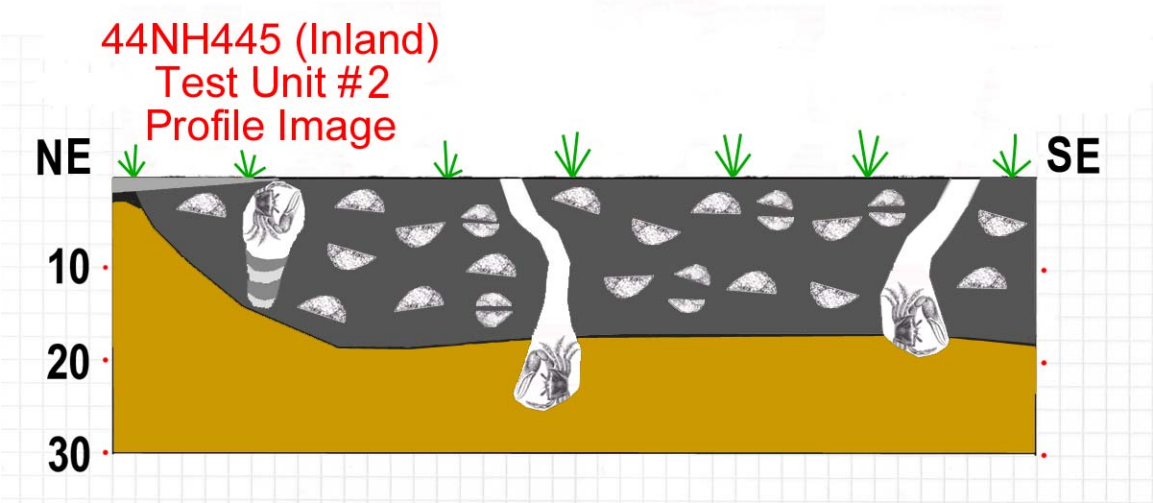

Figure 24. Idealized Profile of Test Unit #2.

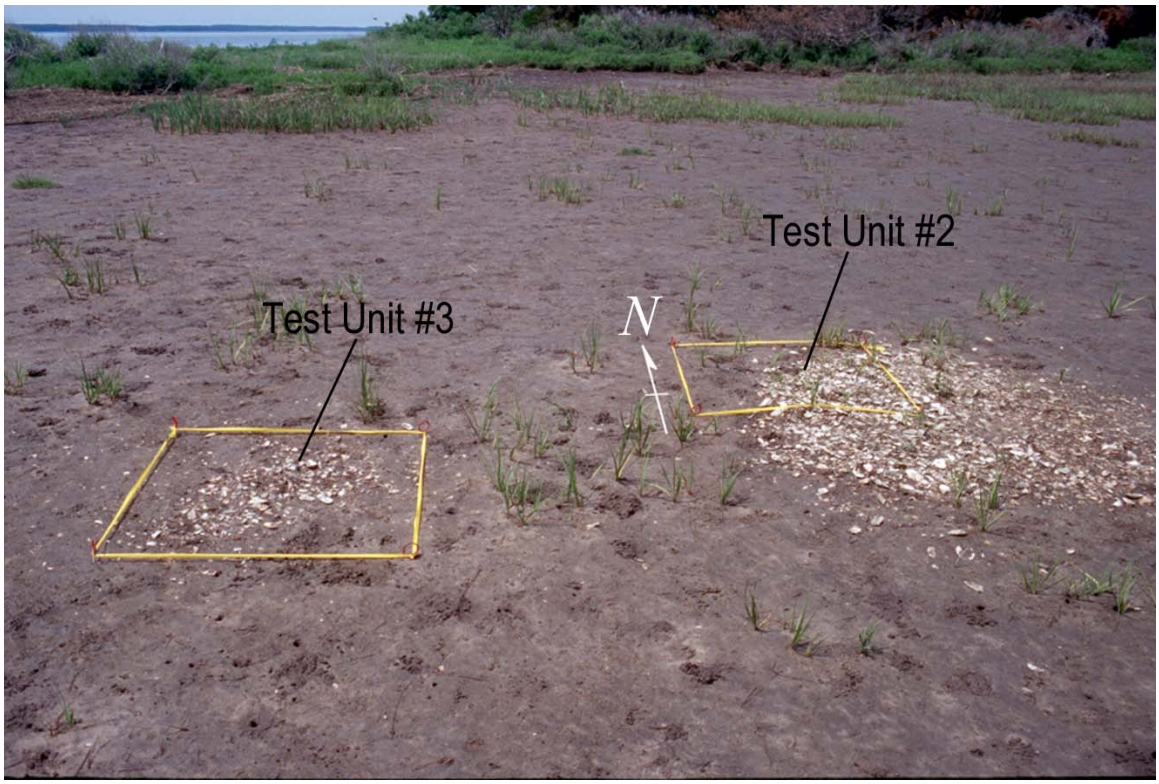

Figure 25. Close Up Image of Test Units #2 and #3.

Figure 26. Test Unit #3 Looking Southwest.

Figure 27. Test Unit #3 Looking West at the Exposed Wall Profile.

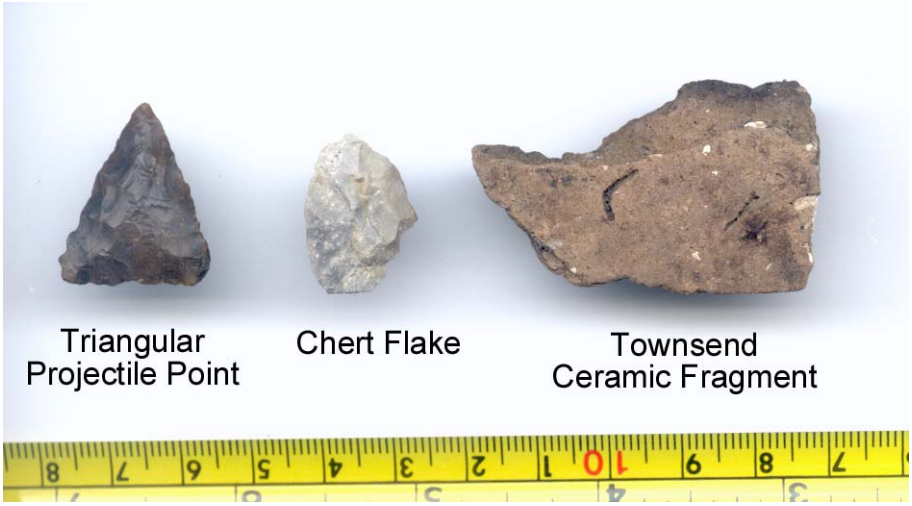

Figure 28. Artifacts found within Test Unit #3.

An idealized image of the strata encountered within Test Unit #3 is shown in Figure 29. A thin stratum of overwash sediments partially covered the surface of the unit area. The refuse stratum occurred immediately below the overwash sediments and within the center of the unit the refuse stratum was on the surface. The refuse stratum was only eight centimeters thick and the stratum was also heavily bioturbated by fiddler crabs. The stratum below the refuse midden included a thin layer of organic-rich upland forest sediments. The upland stratum was deposited on the landscape before sea-level rise and

coastal saltwater intrusion impacted the area. Finally, below the upland stratum occurred the well-developed "Bt" soil stratum typical to the Mockhorn Island area.

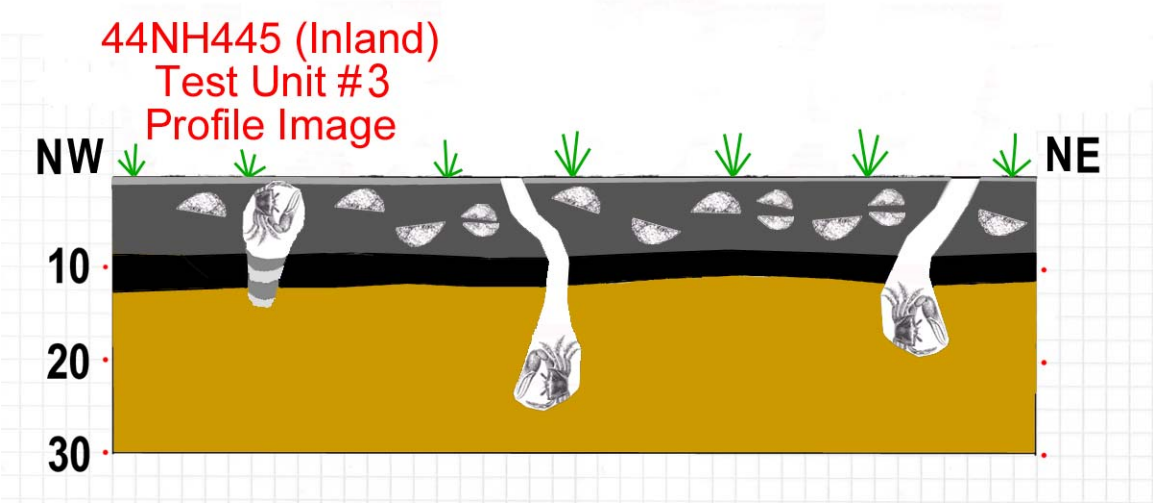

Figure 29. Idealized Profile of Test Unit #3.

After completing the test excavations at units #1, #2, and #3 along the west side of Mockhorn Island, the "Northern" study area became the focus of the 2004 archaeological testing on the island (see Figure 30). Two test units (i.e., Test Unit #4 and Test Unit #5) were established on the ridge that runs down the center of the island. These two units were located adjacent to a deep tidal creek that drains into South Bay and west of the low ridge where 44NH440, 44NH441, and 44NH442 were recorded in 2001 (see Lowery 2003a: 182-185 and 204-207). From the center of Mockhorn Island, 44NH440 and South Bay are easily accessible via the water using a boat, canoe, or kayak. A powerboat was used (see Figure 31) to gain access to Mockhorn Island's central ridge and excavate the test units within the "Northern" study area. Because of the depth of the creek, tidal fluctuations within South Bay were not a boating problem while the powerboat was moored. However, gaining access to the creek and departing the area could only occur at high tide. As such, the area could only be accessed when the tide was high during the early morning and departure could only occur when the following high tide was in the late afternoon or early evening. During the mid-day, we were in essence trapped within the creek area. Like the western side of Mockhorn Island, the area where the test units were located was clearly forested in the recent past (see Figure 32). Immediately inland of test units #4 and #5 was a small-forested hummock whose live trees have escaped the destructive effects of prolonged saltwater intrusion and sea level rise (see Figure 1).

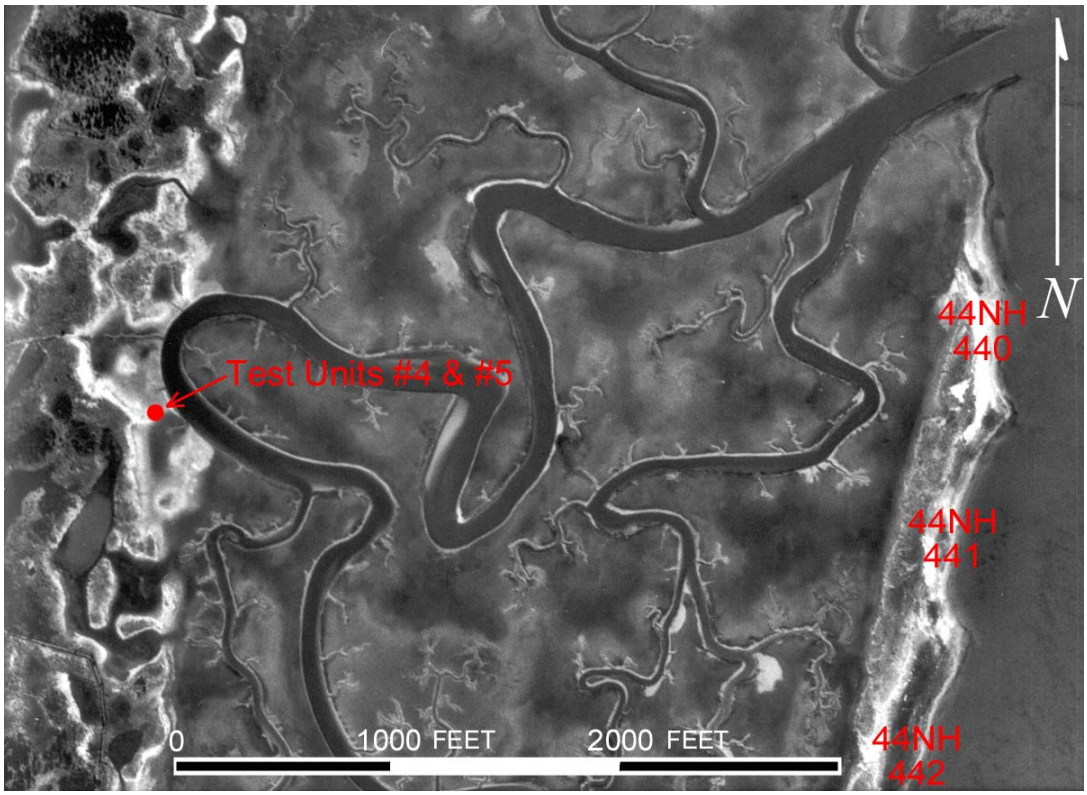

Figure 30. Location of the Test Units Excavated within the Northern Study Area on Mockhorn Island.

Figure 31. Mooring along the Creek near the Central Hummock Ridge.

Figure 32. Evidence of a Former Forest near the Excavation Units.

Test Unit #4:

Test Unit #4 was situated over an area with a limited scatter of hard-clam shell (see Figure 33). Like Test Unit #5, unit #4 was located in the approximate area where in 2003 a pitted hammerstone-anvil was discovered on the surface (see Figure 2). Because of the limited scatter of shell on the surface and the covering of overwash sediments, it was not apparent what may be buried at this locality.

The excavations quickly revealed modern cultural material. A shotgun shell and a fragment of glass were located within the overwash sediments just below the surface. Discovered below the overwash debris was a very thin stratum of highly fragmented hard-clam shell. The fragmented nature of the shell indicated the surface with the refuse might have been exposed to many years of weathering and crushing. A jasper triangular point and two fragments of Townsend ware (see Figure 34) were found within the thin refuse stratum. An upland organic stratum was discovered below the refuse stratum and a well-developed "Bt" soil stratum was found below the upland soil layer. Given the very shallow nature of cultural deposit, mixing of modern material with the Late Woodland-era deposits seems to have occurred. Fiddler crab bioturbation, which was evident, would only increase the degree of mixing. An idealized profile image for Test Unit #4 is illustrated in Figure 35.

Test Unit #5:

In Test Unit #5, the observations made within unit #4 were only accentuated. Test Unit #5 was located northwest of unit #4 (see Figure 33). A generalized profile of unit #5 is presented in Figure 37. The surface of the unit was covered with overwash sediments. Within the overwash debris a single fragment of black plastic was recovered. The hard-clam refuse stratum was thinner in unit #5 than same stratum located to the southeast in unit #4. A single small black chert triangular point was found unit #5 within the refuse stratum (see Figure 36). The same former upland stratum was noted below the refuse stratum. But unlike all the previous units excavated, diagnostic artifacts were discovered within the upland soil stratum. Five fragments of a shell-tempered cord-marked vessel were discovered at the bottom of the upland soil stratum only eight centimeters below the ground surface (see Figure 36). Four of the fragments could be mended. All of the fragments are the same thickness and have the same general surface decoration, which may indicate they are from one single vessel. Though not as thin as typical Townsend vessel fragments, the ceramics found in unit #5 have relatively thin walls. The fragments seem to correspond to the very late Middle Woodland Mockley type vessels noted by Custer (1989: 174), which are referred to as Clagget ware. As such, the data from Test Unit #5 indicate that the central hummock of Mockhorn Island began to be utilized by prehistoric people by at least the late Middle Woodland period. Interestingly, this is about the same time 44NH440 was abandoned.

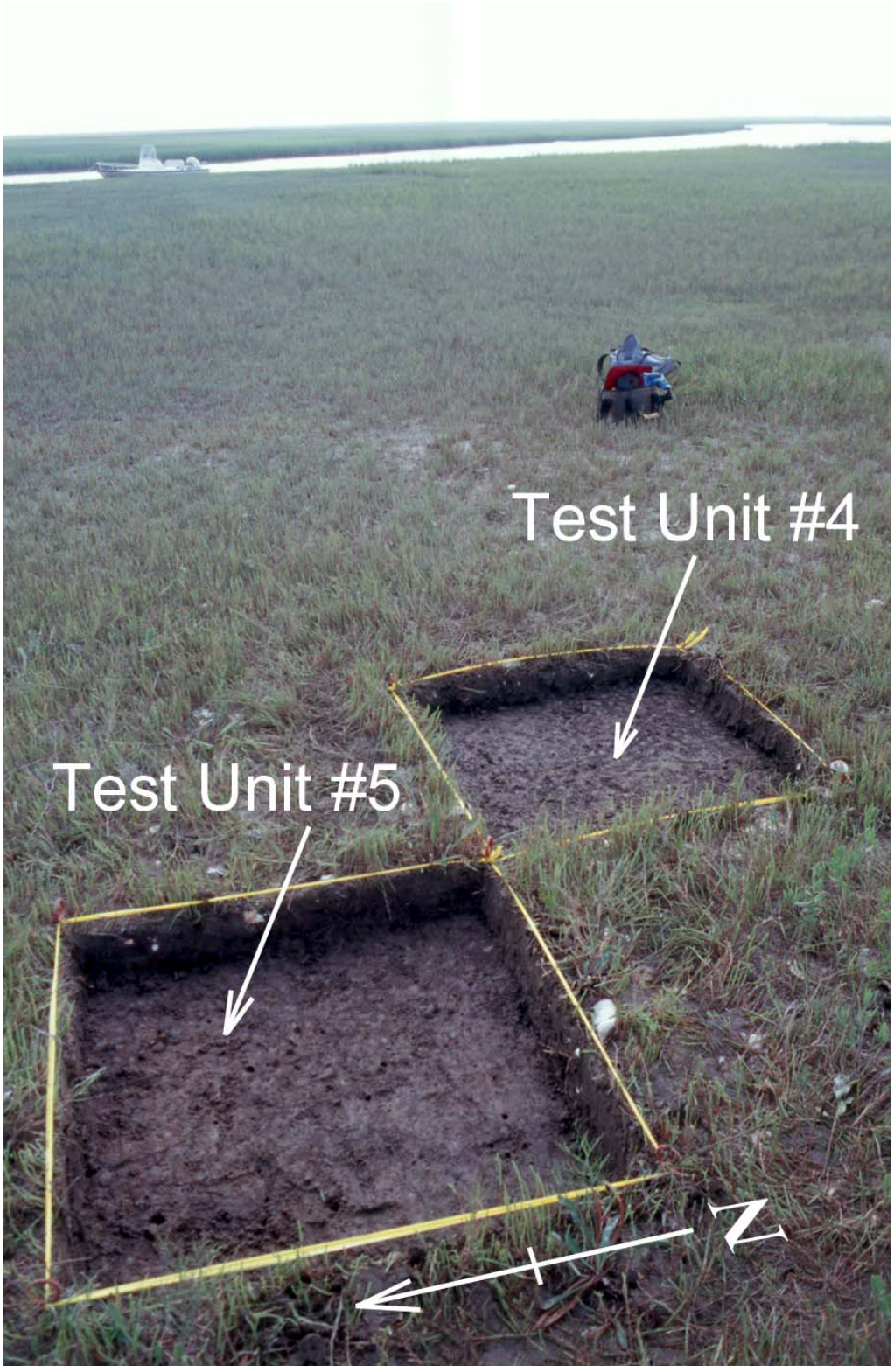

Figure 33. Close-up Excavation Images of Test Units #4 and #5 Looking Southeast.

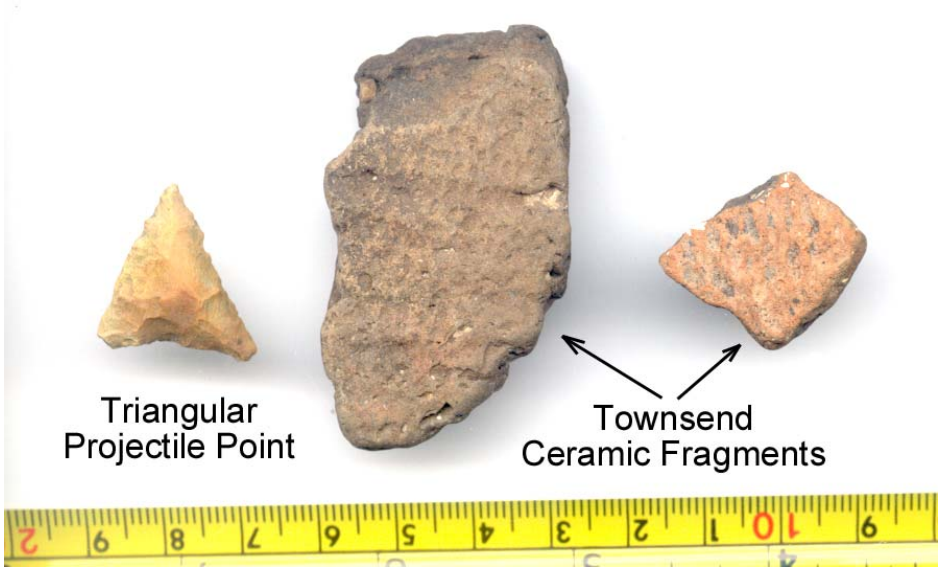

Figure 34. Diagnostic Artifacts Within Test Unit #4.

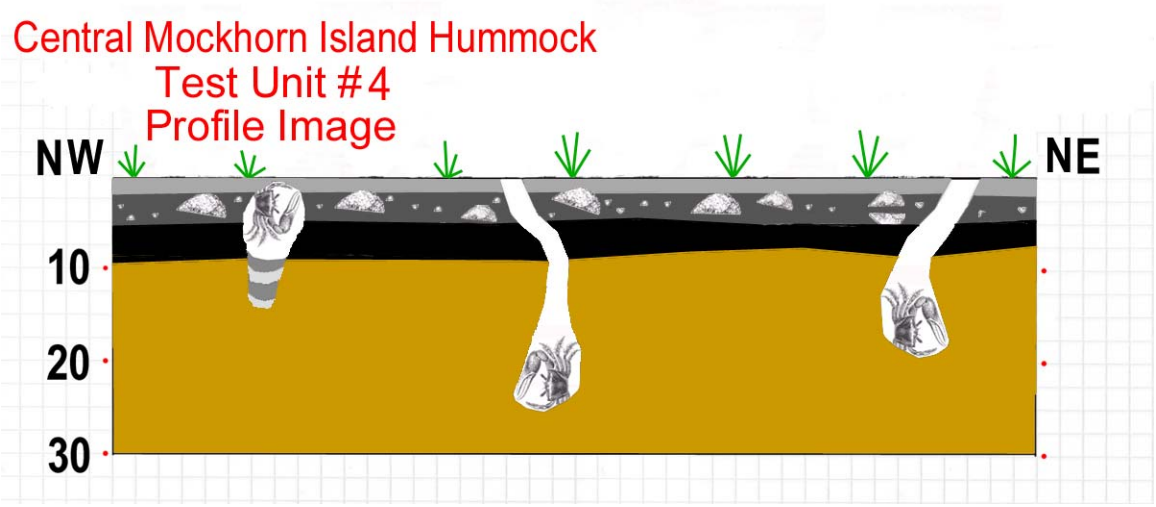

Figure 35. Idealized Profile of Test Unit #4.

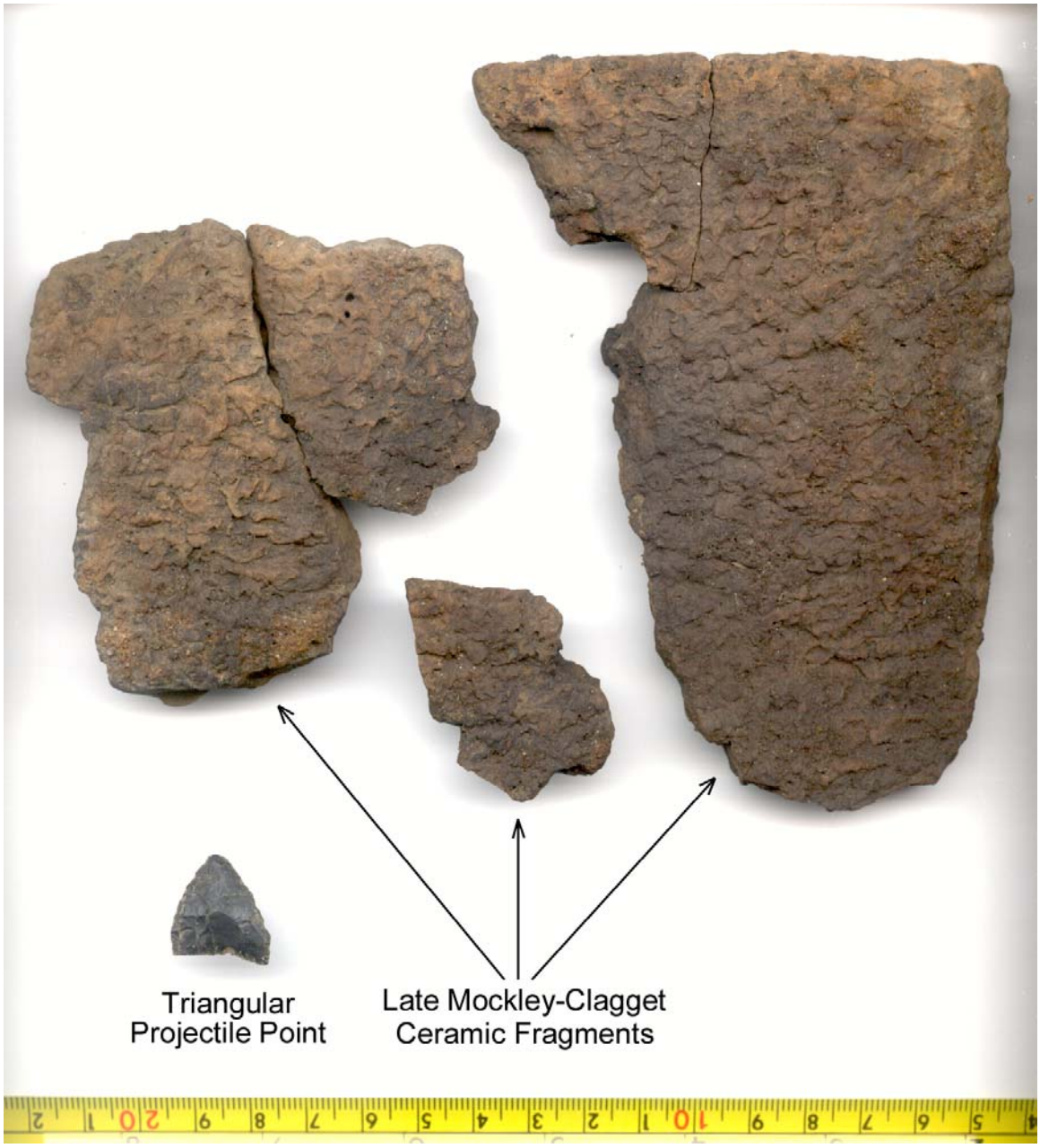

Figure 36. Diagnostic Artifacts Within Test Unit #5.

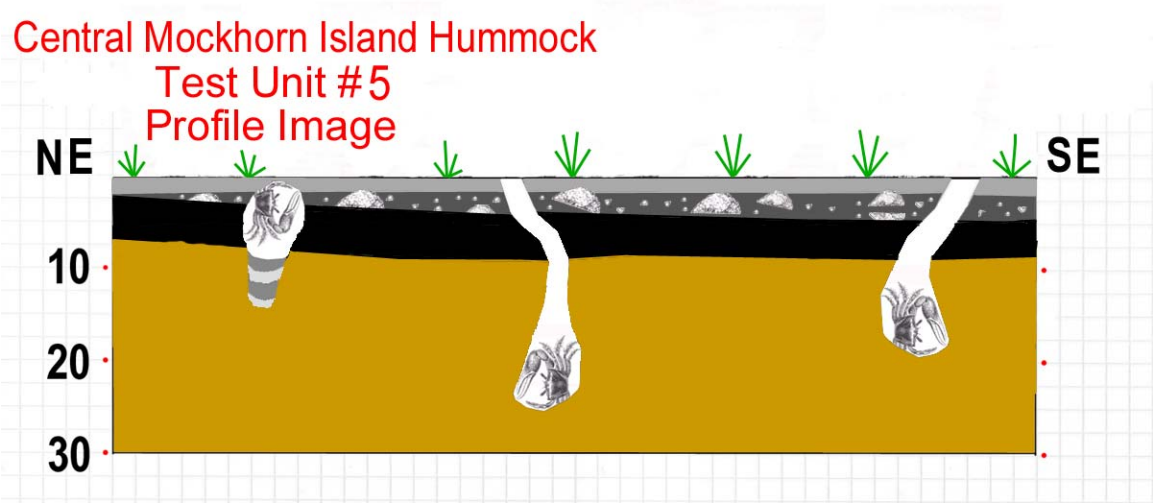

Figure 37. Idealized Profile of Test Unit #5.

4: Research Summary and Management Recommendations

Research Summary

The current work has addressed the origin of the shell refuse features located within the Mockhorn Island landscape. All the shell features tested within and adjacent to the forested hummocks did indeed reveal evidence that they were 1,000 to 400 years old or Late Woodland in age. Aside from the chronological data, the work provided us with several additional types of information relative to landscape changes, human reactions to sea level rise, cultural subsistence patterns, and the uniqueness of the Mockhorn Island area. Our work also touched upon an additional type of bioturbation impact to inundated coastal archaeological sites.

The current work on Mockhorn Island has addressed additional research topics aside from the aspects of prehistoric human land use patterns. It was noted in 2003 that 44NH440, which is located on a slightly elevated ridge, was abandoned as a human occupation site circa 1,200 years ago (see Figure 38). The current research indicates that the forested ridges on the interior and western side of the island became the focus of human settlement after 1,200 years ago (see Figure 38). What would be the principle reason for the relocation of human settlements away from the coast to the interior? Kearney (1996) may have provided pertinent data to answer this question. His research (Ibid.) addresses the sea level changes in the Chesapeake Bay over the past 1,000 years based on a series of radiometrically-dated former upland peat deposits and forest stumps

buried below tidal marsh stratum near Deal Island, Maryland. His research suggests the regional sea levels were .5 meters or 1.63 feet lower 1,000 years ago.

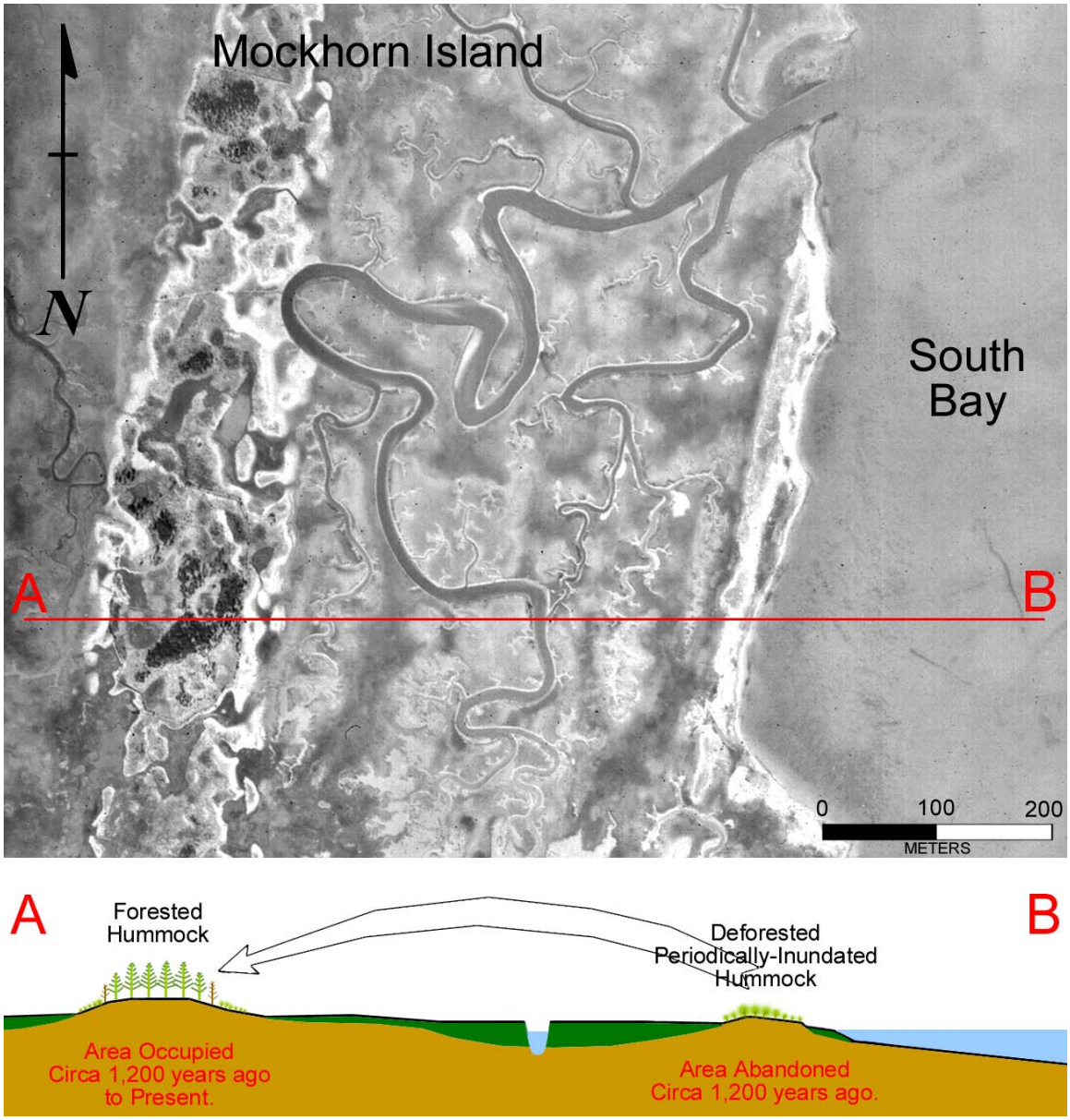

Figure 38. Sea Level Rise Induced Relocation of Human Settlements.

Part of Figure 38 (compare to Figure 30) illustrates an aerial view of a section of Mockhorn Island encompassing 44NH440, which is recognized in the image as the deforested and periodically inundated hummock. The image also provides an idealized cross section through the area showing the relative sea level, the relative topographic relief, the current distribution of tidal marsh peat, the former upland landscape, and the general distribution of modern forest-plant types. Kearney's (1996) study on sea level rise in the Chesapeake Bay has some ramifications relative to the information addressing

the cultural use of Mockhorn Island landscape shown in Figure 38. If the regional sea levels were 1.6 feet lower or greater circa 1,000 years ago, the deforested and periodically inundated hummock shown in Figure 38 should have sustained a marginal coastal forest, which may have been stressed by saltwater tidal storm surges. Because prehistoric peoples seem to have avoided the use of wet landscapes for the establishment of domestic settlements, 1,000 years ago 44NH440 would have been largely abandoned, as a landscape deemed useful for the construction of semi-permanent houses. With respect to Kearney's (Ibid.) work, his assessment about the sea level regional changes was based largely on a series of dated tree stumps buried below tidal marsh peat. Even though Kearney incorporated regional subsidence as a variable in his sea level rise equation, a determination that the area been subjected to only 1.6 feet of sea level rise over the past 1,000 years could be challenged. How could Kearney's regional sea level rise data be challenged? Figure 39 illustrates an eroded bank profile along the Chesapeake Bay, which shows a tidal marsh peat deposit covering a several ancient tree stumps. There is no doubt that the formation and thickness of the tidal marsh peat stratum is directly correlated to sea level rise (see Darmody and Foss 1978). However would radiometric dates on the ancient tree stumps in Figure 39 actually correlate to the last actual moment in time when the area was an upland forest and therefore indirectly provide a true age when the forest died by way of saltwater intrusion induced by sea level rise? The images shown in Figures 20, 26, and 32 actually help address this question. The tree stumps in the foreground of Figures 20 and 32 represent the remains of former cedar trees that lived on Mockhorn Island. In these images, the trees are no longer alive. The remains of the stumps are still evident and a stratum of tidal marsh has not yet completely covered the stump. In theory, it could take 1,000 years of accelerated sea level rise before the stumps in Figures 20 and 32 were completely covered by a tidal marsh peat deposit. Lowery (2003b: Figure 26) illustrates the transitional impact of sea level rise to a marginal forest area stressed by saltwater intrusion. In this image, some trees have died at some unknown time in the past. Meanwhile, some trees are still alive because of the species adaptation to a saltwater environmental setting. Combined with the differences in wood preservation after the death of individual trees, a radiometric date on a tree stump situated below a tidal marsh peat deposit may not provide a high-resolution accurate assessment of regional sea level rise and the timing of coastal inundation. The long-term bioturbation of an area via coastal organisms (i.e., fiddler crabs, and clams) within the former upland forest soil horizon beneath a tidal marsh peat deposit also limits the usefulness of radiometric dates on mixed macro-plant organics in assessing high-resolution sea level trends.

Archaeological data in coastal areas may help provide supportive information when trying to provide high-resolution assessments of regional sea level trends. Here on the Delmarva Peninsula, prehistoric peoples avoided the use of wet landscapes for the construction of semi-permanent houses or the establishment of domestic settlements. Evidence supporting the prehistoric domestic use of an area would include post-hole features, pit-features, and refuse areas. A combination or wide range of artifacts such as ceramics, debitage, scrapers, hammertones, fire-cracked rock, knives, and projectile points of a common age would also be supportive evidence that an area served as a prehistoric domestic site at a particular moment in time. In contrast, an inundated site

with numerous stylistically similar projectile points, a limited quantity of other artifact types, and no features would not seem to represent a prehistoric domestic use of a particular area. In this situation, the inundated area, which is currently situated below a tidal marsh deposit, may simply represent a former poorly drained upland freshwater swamp that once served as a hunting locale. In using archaeological remains to help calibrate sea level rise, an assessment of the cultural use or function of an area is very important. It is also helpful to have a long recorded cultural use of a particular landscape. In both aspects, Mockhorn Island provides these types of data.

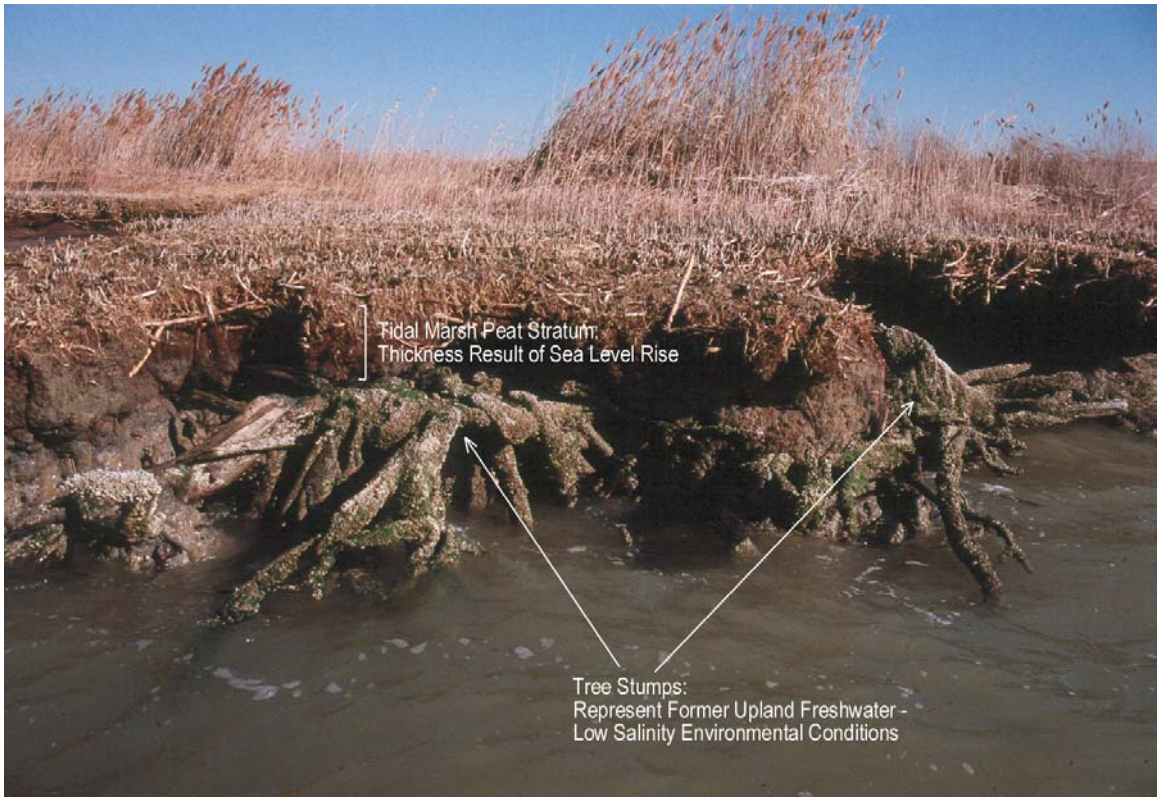

Figure 39. An Eroded Bank Profile Suggesting an Inundated Former Upland Setting.

With respect to Mockhorn Island, the current archaeological research and the previous archaeological work at 44NH440 have provided insights into the impact that sea level rise has had on the cultural use of a coastal landscape. Immediately prior to 1,200 years ago, 44NH440 was an elevated linear ridge adjacent to a coastal bay. Middle Woodland-era prehistoric cultures occupied this landscape and subsisted off the marine resources in the adjacent shallow bay (see Figure 40). As sea levels gradually rose, the former upland ridge was deforested and transformed into a slightly elevated coastal marsh. Being effected by extreme high tide events and periodic storm surge activities, the forested area including 44NH440 was greatly reduced and as a result, the area was abandoned as a culturally used domestic landscape circa 1,200 years ago. The focus of human domestic activities seems to have shifted towards the more elevated forested hummocks inland and along the western side on the island during the Late Woodland-era

(see Figure 40). The archaeological record supports this assertion. As such, Kearney's (1996) observation that regional Delmarva sea levels were .5 meters or 1.63 feet lower 1,000 years ago is in line with the regional archaeological data.

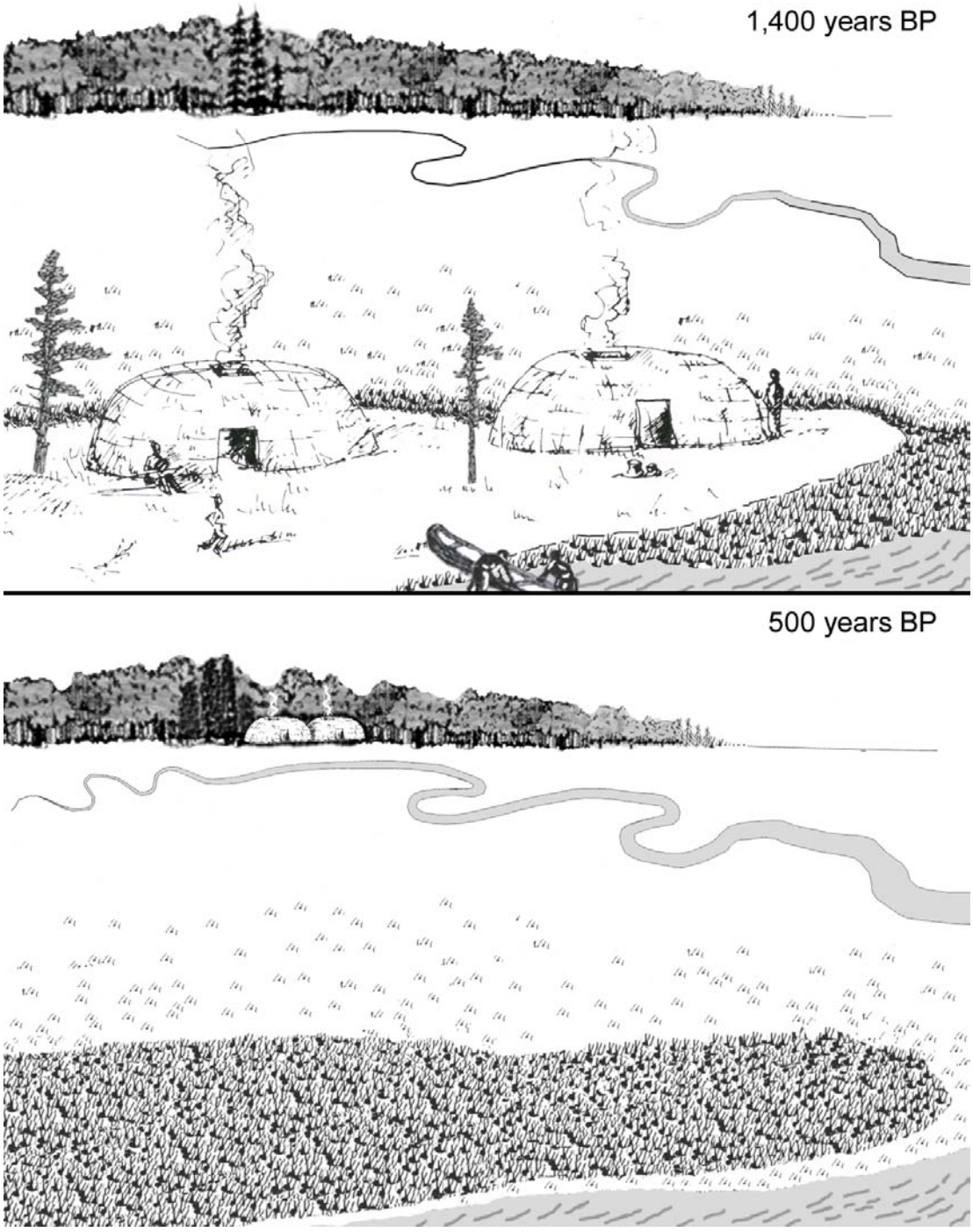

Figure 40. An Idealized View Showing the Sea Level Rise Impact to Prehistoric Settlement Locations on Mockhorn Island.

The preservation within the features provides us with some data about the Late Woodland-era human subsistence patterns in an Atlantic coastal barrier island setting. All the test units revealed evidence of similar cultural subsistence interests relative to shellfish. Hard clam (i.e., *Mercenaria mercenaria*) and American oyster (i.e., *Crassostrea virginica*) were discovered within all of the excavation units (see Figure 41). Atlantic ribbed mussel (i.e., *Geukensia demissa*) remains were found within units #1, #4, and #5 (see Figure 41). Because of the shallow nature of the cultural deposits in units #4 and #5, the ribbed mussel remains found in these units were small and highly fragmented. The long attenuated oyster shells with ridged surfaces (see Figure 41) found within the test units suggest that these oysters were gathered in shallow high-energy tidal creeks or on tidal mud-flat areas. Impressions of ribbed mussels were noted on a few of the oyster shells (see Figure 41).

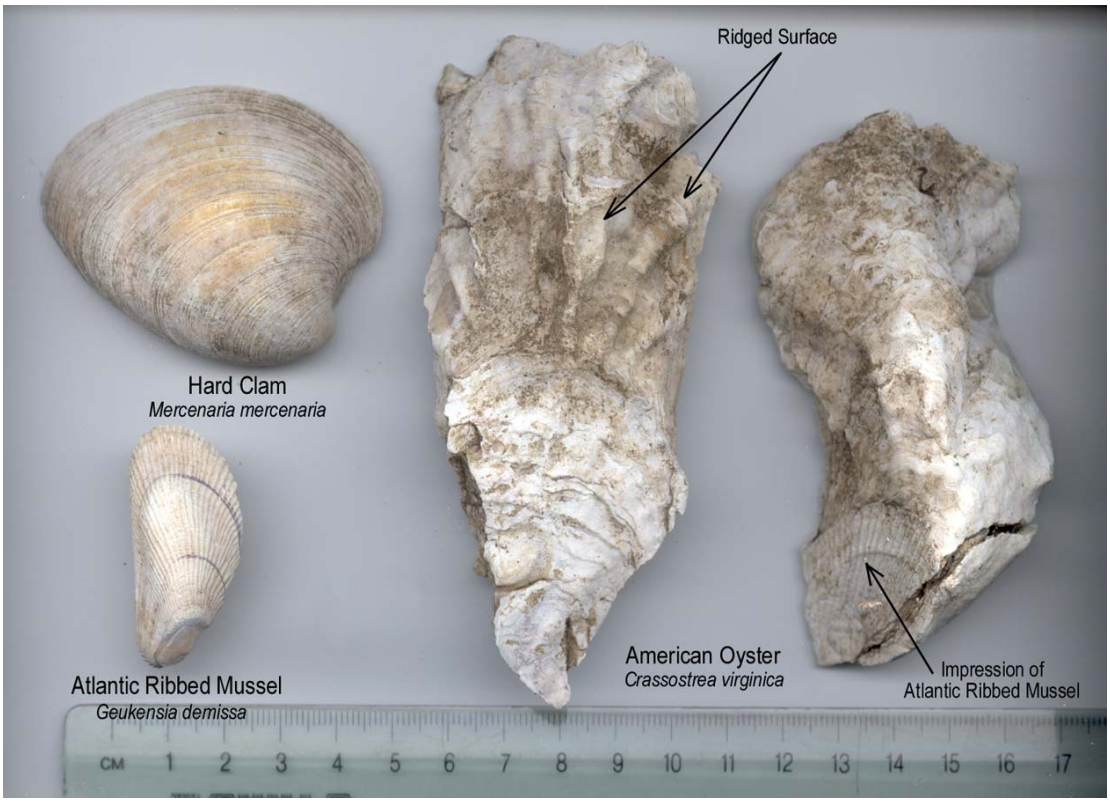

Figure 41. A Sample of the Shellfish Remains Excavated from Test Unit #1.

Only Test Unit #1 provided vertebrate remains to assess what types of animals the prehistoric Late Woodland-era occupants of Mockhorn Island utilized. The preservation of bone only within Test Unit #1 may simply be the result of the thick and intact nature of the cultural shell deposit in that area. Four fragmentary bones and one tooth belonging to whitetail deer (i.e., *Odocoileus virginianus*) suggest that Mockhorn Island supported a population of deer during the Late Woodland period (see Figure 42). At 44NH440, whitetail deer remains were also discovered, but these remains were associated with the Middle Woodland period. Two small fragments of bird bone (see Figure 42) were discovered within Test Unit #1, as well. Both bird bone fragments are hollow and the

estimated diameter suggests they originated from a large species of bird. Given the incomplete nature of the fragments, species identification was impossible. It is likely, however, that the bird bone fragments belong to some sort of waterfowl (i.e., goose, swan, or duck) or shorebird (i.e., heron, rail, crane, or egret). One of the more surprising discoveries in Test Unit #1 included the bony carapace portions of a sea turtle (see Figure 43). White and White (2002: 136-145) have reported Loggerhead, Green, Ridley, and Atlantic Hawksbill seaturtles within the Delmarva region. However, the Loggerhead seaturtle is the most common Delmarva species. Even in the area around Mockhorn Island today, the Loggerhead species is commonly seen from May to late October-early November. It would seem that seaturtles, along with deer, waterfowl, oysters, hard clams, and ribbed mussels provided the foundation for Late Woodland-era human subsistence within the Mockhorn Island area (see Figure 44).

Figure 42. Some of the Terrestrial Fauna Remains Excavated from Test Unit #1.

Figure 43. Sea Turtle Remains Excavated from Test Unit #1.

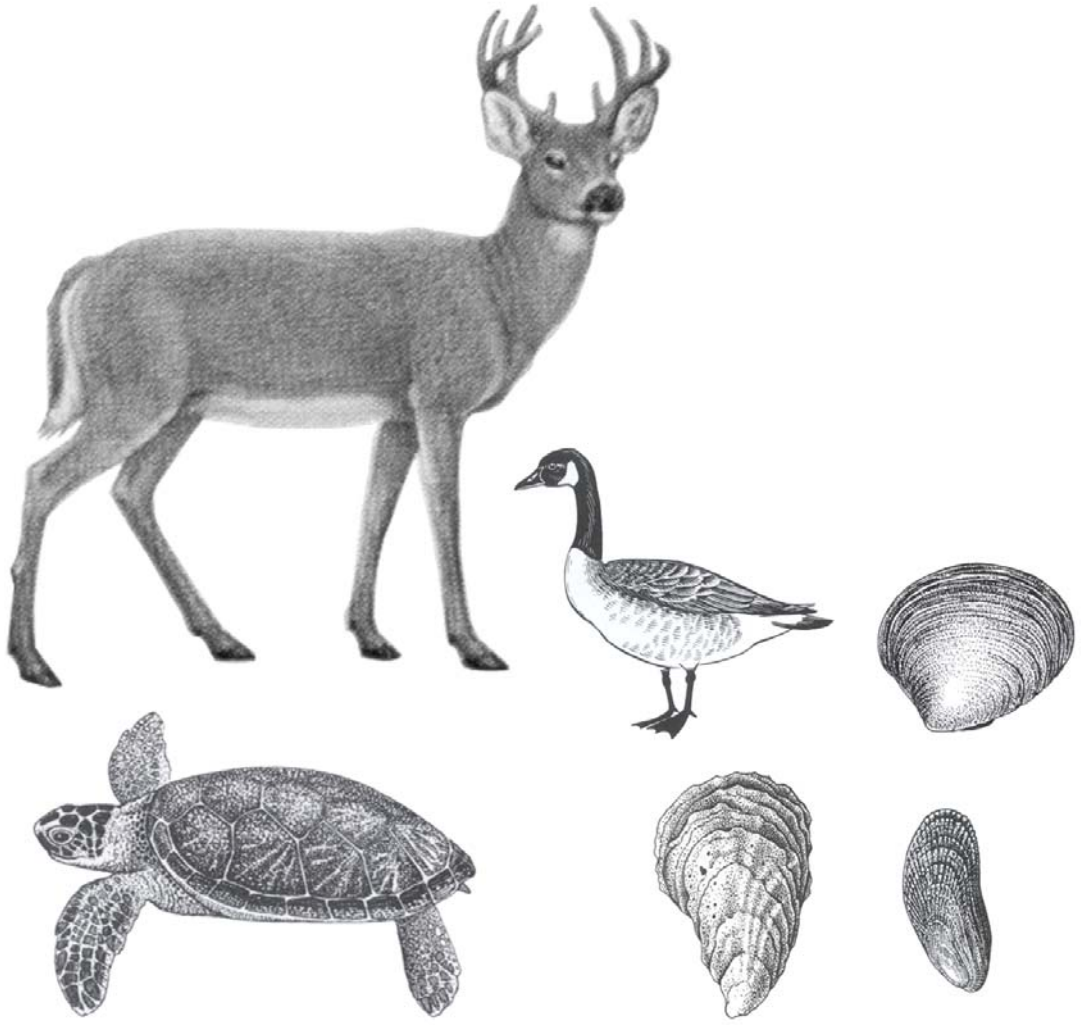

Figure 44. Late Woodland-Era Human Subsistence Species.

With respect to subsistence, the excavations at Mockhorn Island have provided us with some information about how hard clams were processed or shucked. In examining the clamshells found within the test units, a pattern of shell damage began to emerge. Of the test units excavated, the shells from Test Unit #1 provided the largest and most unaltered hard clam assemblage. Approximately forty-one percent of the hard clams (28 shells) had evidence of thermal damage. It is unclear however whether the thermal damage was the pre-depositional result of steaming or the post-depositional result of natural forest-marsh fires. The second type of damage noted on the clamshell assemblage included a combination of splintering, longitudinal splitting, crushing, and impact damage (see Figures 45 and 46). The damage would seem to be indicative of the use of an anvil, a wedge, and a hammer to split the clam for meat extraction (see Figure 47). The lithic tool kit needed to perform this type of clam processing has been found in the excavation units (see Figure 17), on the surface (see Figure 2), and along the eroded shorelines.

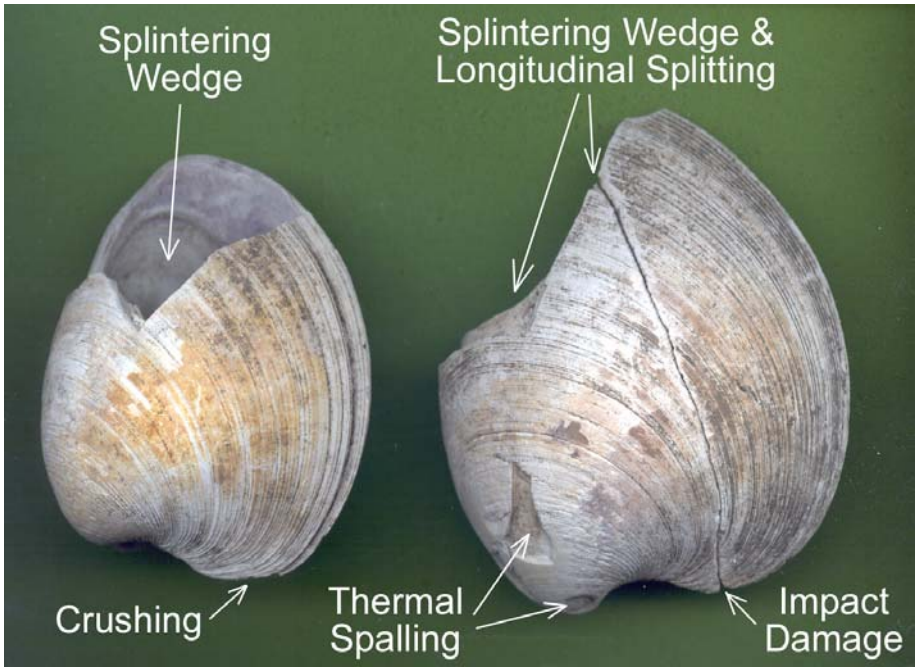

Figure 45. Hard Clam Damage Observed on Conjoined or Articulated Shells Excavated from Test Unit #1.

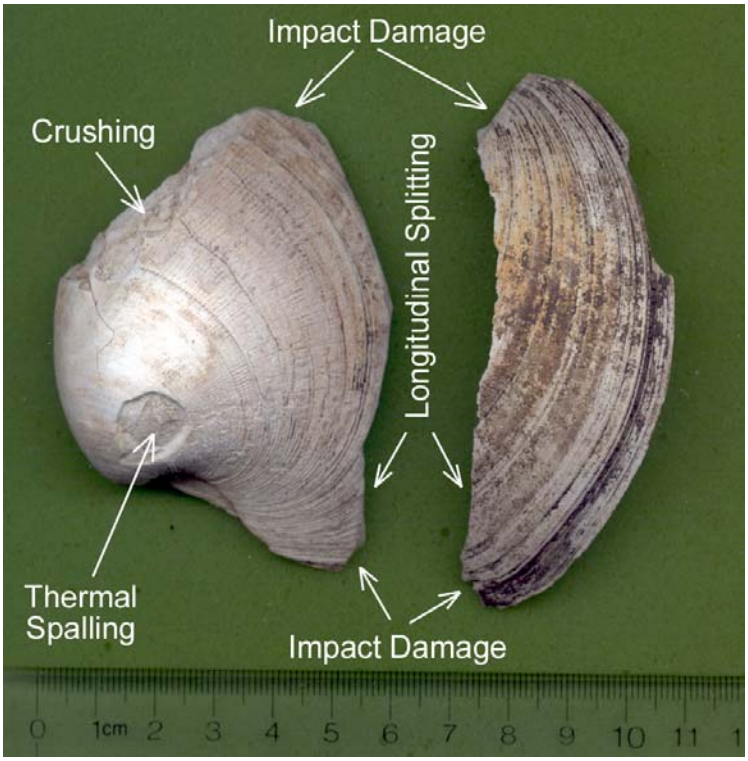

Figure 46. Hard Clam Damage Observed on Fragmentary Shells Excavated from Test Unit #1.

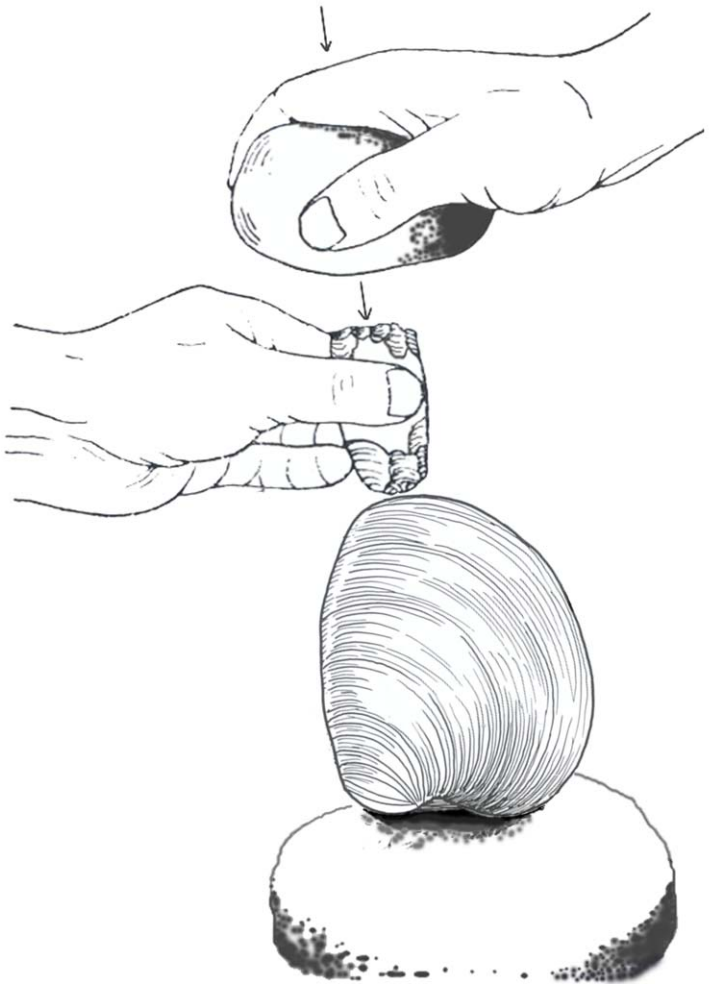

Figure 47. Late Woodland-Era Technique for Shucking Hard Shell Clams.

In trying to assess whether fire or steaming might have been involved in the prehistoric processing of the hard clams, it may be important to mention some of my personal background experience. A fair number of the smaller clamshells excavated from Test Unit #1 were complete and showed no evidence of splintering, longitudinal splitting, crushing, or impact damage. Meanwhile, "shucking" damage was commonly noted on the larger hard clams found within unit #1. From my personal observations relative to the steaming of hard clams, larger clams typically resist the effects of steaming and require added prying or shucking to open the valves for meat extraction. As such, the pattern of damage observed within the sample of shells from Test Unit #1 may indicate that some of the thermal shell alteration was pre-depositional.

The final notable observation made as a result of the fieldwork is not directly related to the shell features excavated on Mockhorn Island. The observation relates to archaeological sites adjacent to the shoreline. Within the marsh areas of Mockhorn Island, the burrows of fiddler crabs have "churned" portions of the landscape. When

excavating near 44NH445, observations were made at low tide that suggest shallow-water inundated sites may be impacted by the bioturbation of other organisms. The shoreline area west of 44NH445 is largely stable. Even so, prehistoric lithic debris is commonly found along the shoreline. At low tide, large circular depressions were evident and these were created as a result of the feeding action associated with stingrays (see Figure 48). Stingrays use their fins to excavate the bottom for the purpose of extracting mollusks. Around some of the depressions, we observed prehistoric lithic debitage and waste debris. As such, some of the cultural materials originally found along the shoreline and recorded for 44NH445 may be disturbed from their context as a result of stingray bioturbation. It is clearly evident that during periods with relatively slow rates of sea level rise bioturbation activities within the forming marshes and the adjacent drowned landscapes seem to have had a major impact on archaeological sites.

Figure 48. Stingray Bioturbation Observed Adjacent to 44NH445.

Management Recommendations

The results of this study indicate that Mockhorn Island has an amazing archaeological record. The results also suggest that area, 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. The work at 44NH440 in 2003 indicated that the site was abandoned as a potential landscape for human occupation circa 1,200 years ago. The abandonment of this landscape seems to have been due to the sea level rise and the resultant inundation of the elevated ridge.

The current work supports the fact that the interior forested hummocks and the forested hummocks along the west side of Mockhorn Island became the focus of human settlement. Not surprisingly, sea level rise seems to be a major variable that influences the displacement of human residential settlements within the topographically low sections of the coastal plain. The timing of these residential displacement episodes could eventually help calibrate rates of sea level rise. The current work on Mockhorn Island indicates relatively low or slow rates of sea level rise at the mouth of the Chesapeake Bay and along the Atlantic coast over the past 1,200 years.

Projects such as the Atlantic seashore archaeological survey (Lowery 2003a) initially generated the information about the significance of the Mockhorn Island landscape. In locating numerous sites on the island, a few localities stood out as potential areas that could easily address some interesting archaeological questions. Our earlier work at 44NH440 (Lowery 2003b) provided preliminary information about environmental change, landscape development, coastal processes, prehistoric cultural chronology, human subsistence, and regional trade and exchange. Our current work has continued to analyze these same topic areas and extend our perspectives beyond the site boundary limitations and the cultural chronologies of 44NH440. Put simply, it is truly amazing what kind of information a few one-by-one meter test units can generate. More importantly, the entire long-term Mockhorn Island management study and process initiated and funded by the Virginia Department of Historic Resources Threatened Sites Program over the past few years should serve as a model for future archaeological programs within State agencies. Prior to the Mockhorn Island investigations, this parcel of State land was an "unknown archaeological backwater". With just a minimal amount of effort and the proper expertise, the archaeological significance of this landscape has begun to emerge. Is the significance of this landscape completely understood? I think not! More importantly, will research into the hidden archaeological mysteries of Mockhorn Island continue? I would hope so!

Given the current data generated as a result of this project and our earlier investigations, it is believed that the entire complex of archaeological sites included within the Mockhorn Island area would be eligible for nomination to the National Register of Historic Places as an archaeological district. However, recommendations for further archaeological study on Mockhorn Island could include the following:

- The island includes numerous forested hummocks and slightly elevated landscapes that are not eroded and probably contain archaeological remains. To expand the documentary site inventory and assess the "relative significance" of specific parts of the island landmass, these uninvestigated hummocks and landscapes should be archaeologically tested.

- The undulating upland landscape of Mockhorn Island should provide the perfect laboratory to reconstruct the vegetation changes to the region. As sea levels rose, former forests and meadows were inundated and buried underneath a tidal marsh peat deposit. The earliest upland vegetation macro-remains should be located within the deepest troughs located between the ridge landforms. Meanwhile, the

youngest upland vegetation macro-remains should be located immediately adjacent to the current forested hummocks. Such a project would put some of the cultural use of this island into an environmental framework.

- Being a coastal setting, Mockhorn Island and the surrounding bays should provide the perfect setting to best understand how archaeological sites are impacted by sea level rise. Our work over the past two years has focused on partially inundated sites. South Bay, which is east of the island, provides the perfect setting to study how sea level rise has influenced or effected prehistoric archaeological components. Such work could provide the "stepping stones" for investigating sites in deeper water settings on the continental shelf.

- The State agencies responsible for the management of Mockhorn Island should take on a more active role in the stewardship of its archaeological resources. Unlike natural resources, cultural resources are non-renewable. It is equally, if not more important, to understand and study the non-renewable resources than those that are self-sustaining or renewable. For example, Mockhorn Island supports a population of peregrine falcons. I would be willing to bet that the State agencies know how many nesting pairs of falcons use the island, where the nests are located, their lifecycle, eating habits, and reproductive rates. Meanwhile, nobody knows how many Middle Woodland archeological sites are included within the island's landmass, where these sites are located, the intact nature of each site, and which sites are most archaeologically significant or sensitive. The point being, if the population of falcons imploded dramatically, the number of falcons using the island could be restored over time with proper management. Meanwhile, the total number of Middle Woodland archaeological sites on the island cannot increase. These archaeological sites are all that will ever be located on the island. Put simply, archaeological sites cannot breed and produce new offspring. As such, they should receive at least an equal amount of attention and concern as the island's renewable resources.

As a final note, it has been a personal pleasure to conduct follow-up work relative to the earlier archaeological shoreline survey accomplished for Virginia's Atlantic seashore. As a result of this earlier survey, the archaeological significance of Mockhorn Island became apparent. It was an amazing professional pleasure to find what was obviously a "virgin" archaeological site (i.e., 44NH440) with an overwhelming archaeological record. With respect to it's setting, it was a pioneering experience to conduct the first archaeological excavations at this site. As a summary, the current work expanded upon the efforts at 44NH440 and began to develop a broader view of Mockhorn Island. Each of these test excavation projects clearly shows the intimate diachronic relationship between the environment and ancient human societies. My whole entire Mockhorn Island experience includes a series of memorable events that will be treasured forever. Hopefully, the "powers that be" will treasure the island's archaeological resources in an equally deserved fashion. An old saying comes to mind that seems pertinent. "You can lead a horse to water, but you can't always make it drink".

References Cited

Custer, Jay F.
1989 1989 Prehistoric Cultures of the Delmarva Peninsula: An Archaeological Study. University of Delaware Press, Newark, Delaware.

Darmody, Robert G., and John E. Foss
1978 Tidal Marsh Soils of Maryland. Maryland Agricultural Experiment Station, University of Maryland. College Park, Maryland.

Egloff, Keith
2002 Archaeologist. Virginia Department of Historic Resources, Richmond, Virginia. Personal Communication: 7/16/02.

Kearney, Michael S.
1996 Sea Level Change During the Last Thousand Years in Chesapeake Bay. Journal of Coastal Research 12(4): 977-983.

Lowery, Darrin L.
2003a Archaeological Survey of the Atlantic Coast Shorelines Associated with Accomack County and Northampton County, Virginia. The Virginia Department of Historic Resources, Survey and Planning Report Series No. 7. Portsmouth, Virginia.

2003b A Landscape Sculpted by Wind and Water: Archaeological and Geomorphological Investigations at the Upper Ridge Site (44NH440) on Mockhorn Island in Northampton County, Virginia. Manuscript prepared by the Chesapeake Bay Watershed Archaeological Research Foundation for the Virginia Department of Historic Resources, Threatened Sites Program. Portsmouth, Virginia.

White, James F., and Amy W. White
2002 Amphibians and Reptiles of Delmarva. Tidewater Publishers. Centreville, Maryland.