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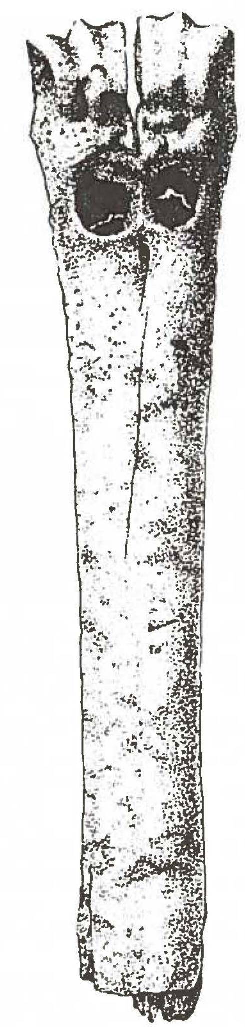

Recent Archaeological Survey and Testing in the the Atlantic Coast Zone of Delaware

Jay F. Custer and Glen S. Mellin

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RECENT ARCHAEOLOGICAL SURVEY AND TESTING IN THE ATLANTIC COAST ZONE OF DELAWARE

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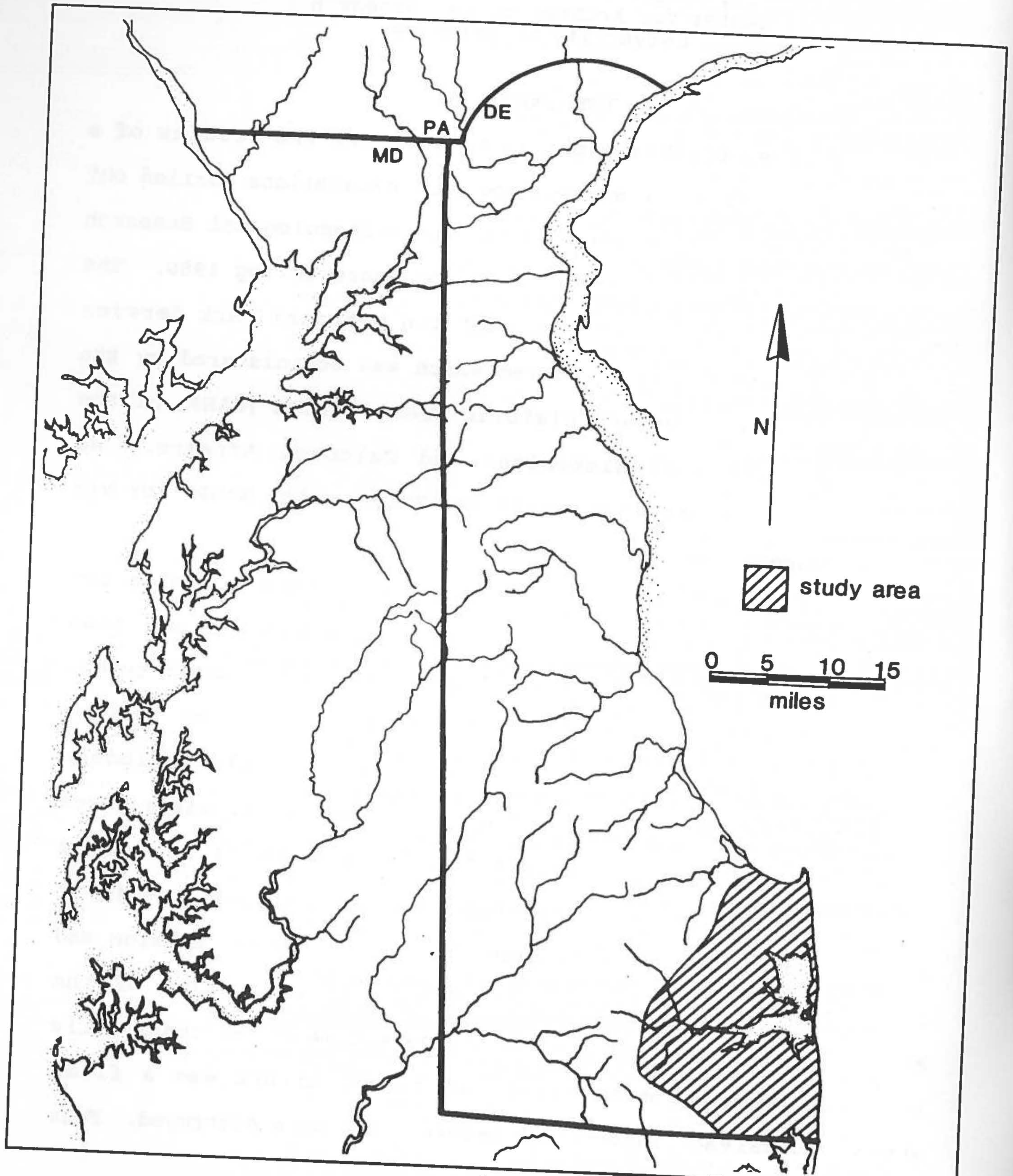
INTRODUCTION

The purpose of this paper is to describe the results of a series of archaeological surveys and test excavations carried out by the University of Delaware Center for Archaeological Research (UDCAR) in the Atlantic Coast Zone of Delaware during 1986. The research program was funded through the National Park Service Survey and Planning Grant Program which was administered by the Bureau of Archaeology and Historic Preservation (BAHP) of the Delaware Division of Historical and Cultural Affairs. We especially thank Daniel R. Griffith, Chief of the BAHP, for his help and support.

The Atlantic Coast Zone of Delaware (Figure 1) was chosen for a program of archaeological survey because it has been identified as an area with a high priority for research by the state plan for the management of cultural resources (Custer 1983). The reasons for this high research priority include a high potential for the occurrence of archaeological sites which may contain significant information, a low level of survey coverage in some parts of the region, and significant levels of destruction of the archaeological record by natural erosion and development. Over the past five years, destruction of the archaeological record by expanding development has continually increased, and in many cases our survey effort was a final attempt to salvage information before sites were destroyed. Four

FIGURE 1
Study Area Location

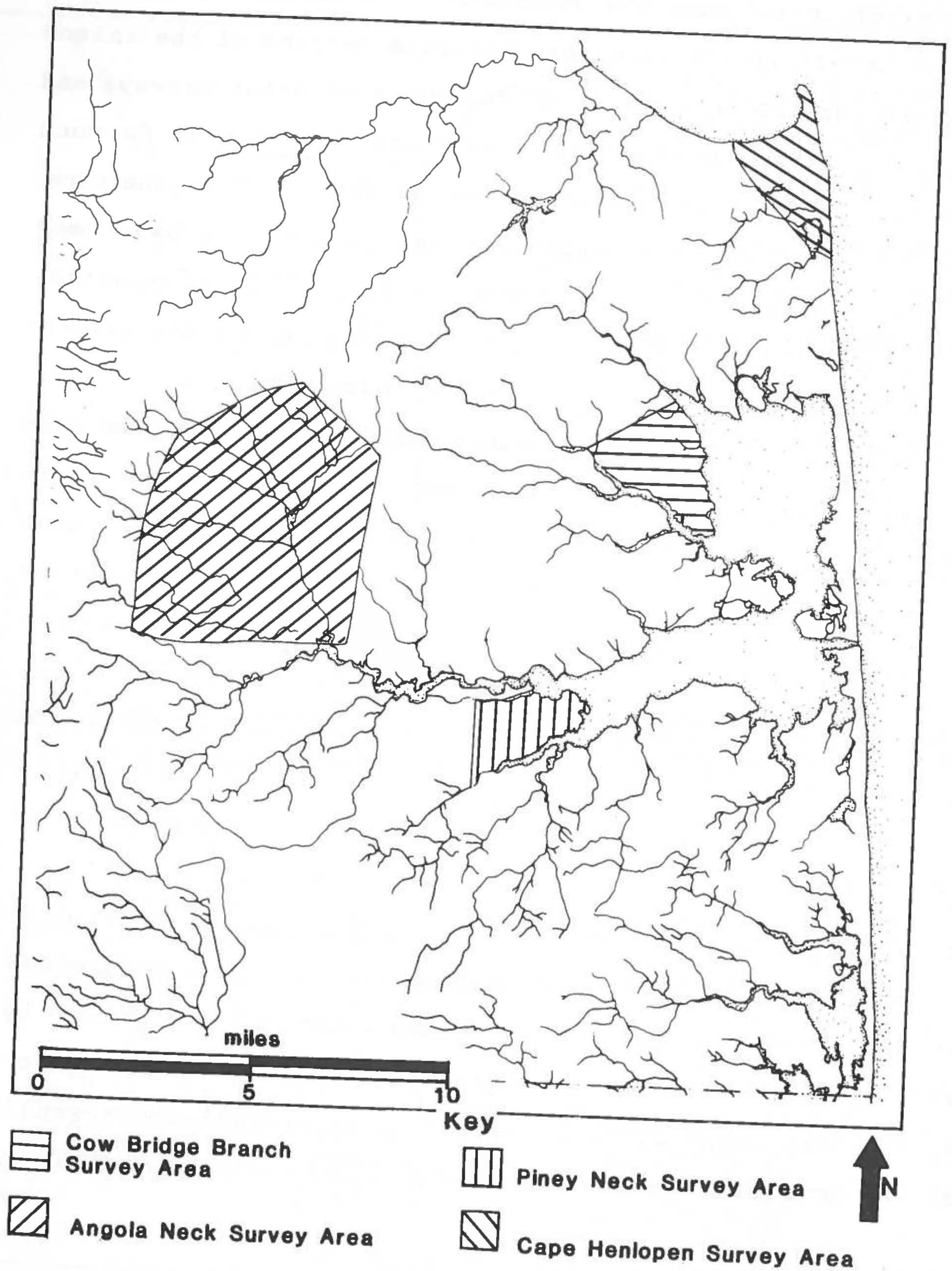


specific areas were chosen for survey and testing (Figure 2). Three of these areas (Piney Neck, Angola Neck, and the upper Cow Bridge Branch drainage) are within the Indian River-Rehoboth Bay complex of inland bays and associated tributaries. These three areas are all on the interior, upstream margins of the inland bays and were chosen for survey because most prior surveys and excavations in the Atlantic Coast Zone do not provide much coverage of these types of environmental settings. Furthermore, the interior, upstream margins of the inland bays have been identified as priority areas for prehistoric archaeological research in the newly completed management plan for prehistoric archaeology of the Delaware Atlantic Coast Zone (Custer 1987). In fact, the surveys and excavations described here provided data used in the development of the Atlantic Coast management plan. The fourth study area described here is the Cape Henlopen Dunes complex (Delaware Division of Historical and Cultural Affairs 1976) which is located south of the present Cape Henlopen in an area where portions of the geological ancestors of the modern cape are preserved. Testing in this area was undertaken because the inland advance of the Great Dune was burying and destroying a shell midden site (7S-D-9), which was part of the Cape Henlopen National Register District.

Environmental Setting

The Atlantic Coast study area is located in the Low Coastal Plain physiographic province of Delaware and is characterized by a relatively flat and featureless landscape. Elevation differences range up to 10 meters (30 feet) and these small differences are further moderated by long and gradual slopes.

FIGURE 2
Survey and Test Locations



streams and rivers in the area have been greatly altered by rising sea level and most river systems, including Indian River, are tidal in their middle and lower reaches with extensive salt marshes found in the estuarine areas (Kraft et al. 1976; Daiber et al. 1976). Inland bays, such as Indian River Bay and Rehoboth Bay, provide rich environmental settings for prehistoric hunters and gatherers because of their combinations of fresh and brackish water resources. The existing archaeological record for the Atlantic Coast area (Custer 1987) documents the prehistoric use of these rich environmental zones.

The configuration of landforms and drainages within the Atlantic Coast region has changed markedly over the past 15,000 years due to post-Pleistocene sea level rise. Belknap and Kraft (1977) have developed a sea level rise curve for the local areas and many other studies by Kraft and his associates (eg. Kraft et al. 1976) allow the reconstruction of past coast lines and environments. Figure 3 shows a series of reconstructions of past coastlines for the time periods of 12,000, 7,500, 4,000, and 1,500 years ago. It can be seen that the Indian River/Rehoboth Bay area is slowly transformed from an interior freshwater drainage into a coastal estuarine marsh complex.

Paleoenvironmental data, such as pollen, can be combined with the coastal reconstructions to develop descriptions of the range of resources and environments available to prehistoric groups. Detailed descriptions of the pollen data are provided by Custer (1983; 1984; 1987). Table 1 summarizes the changing environments through time and notes their distributions in the Atlantic Coastal zone. The distribution of environments shown in

FIGURE 3
Shoreline Reconstructions

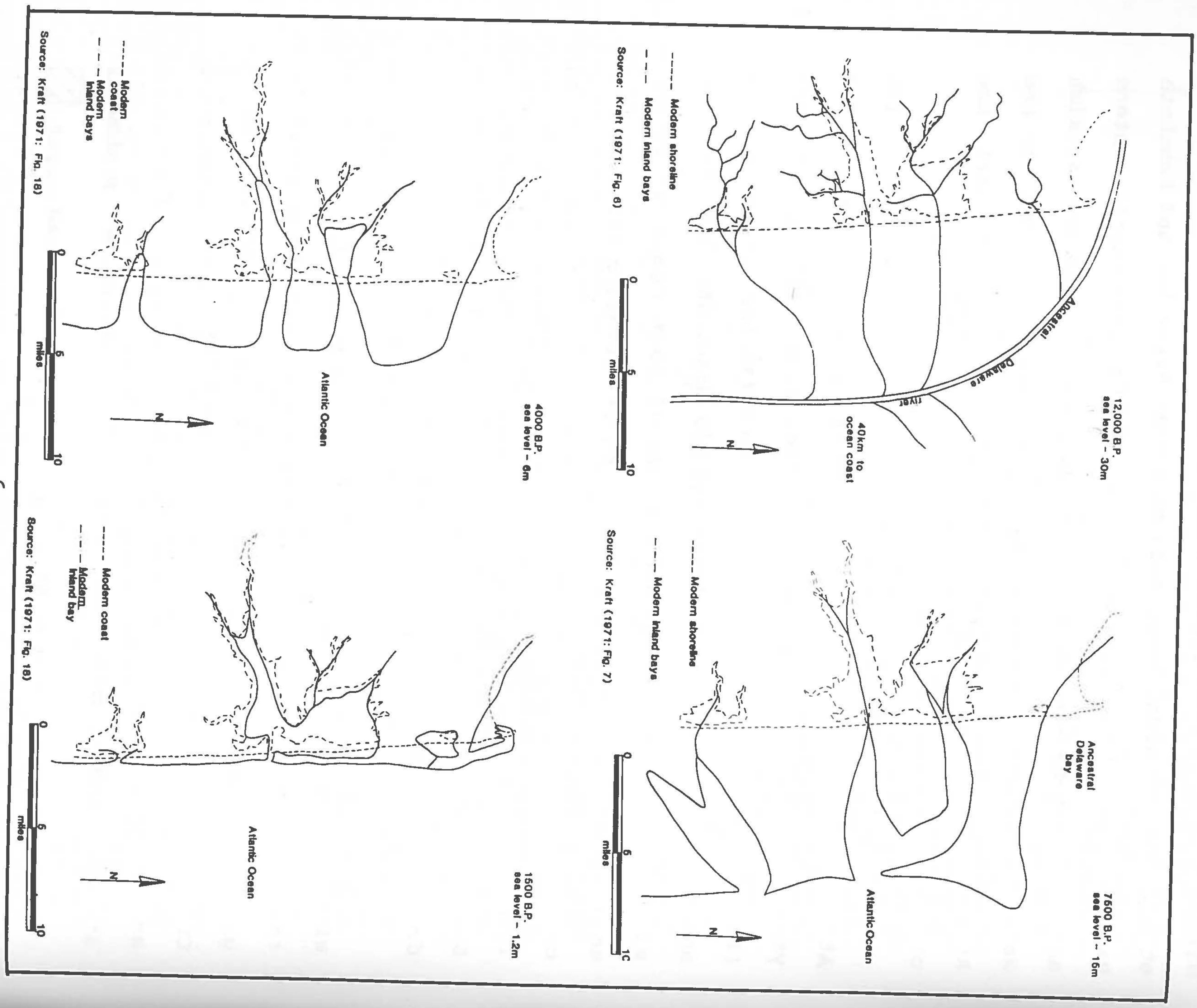


TABLE 1

SUMMARY OF ENVIRONMENTAL CHANGES

Episode	Interior Well-Drained	Poorly-drained	Major Drainages	Coastal Zone
Late Glacial (12,000 B.C.- 8,000 B.C.)	Boreal forest limited grass-lands	Bogs and swamps with deciduous gallery forest	Deciduous gallery forest with some grasslands in floodplains	Few estuarine settings, scrubby boreal woodlands low productivity
Pre-Boreal/ Boreal (8,000 B.C. -6,500 B.C.)	Boreal forest	Bogs and swamps with deciduous gallery forest	Deciduous gallery forest and boreal forest	Boreal forest, few estuarine settings, low productivity
Atlantic (6,500 B.C. -3,000 B.C.)	Oak-Hemlock mesic deciduous forests	Extensive bogs and swamps with deciduous gallery forest	Mesic deciduous forests	Mesic deciduous forests, some estuarine settings, low productivity
Sub-Boreal (3,000 B.C. -800 B.C.)	Oak-Hickory xeric forests and grasslands	Few bogs and swamps	Deciduous gallery forests with some fringing salt marshes, xeric forests and grass-lands in flood-plains	Extensive salt marshes with scrubby xeric vegetation and fringing xeric deciduous forests, high productivity
Sub-Atlantic - Recent (800 B.C.- Recent)	Oak - Pine - Hickory forest with mixed mesophytic communities	Bogs and swamps with deciduous gallery forests	Deciduous gallery forests (Oak - Chestnut) with extensive fringing salt marshes	Extensive salt marsh, Oak - Pine woodlands with some scrubby xeric vegetation high productivity

Table 1 highlights the diversity of the Delaware Low Coastal Plain, a feature described earlier by Brush, Lenk, and Smith (1980).

ANGOLA NECK SURVEY AREA

The Angola Neck survey area is located on the northwest side of Rehoboth Bay and is bounded by Love Creek, Rehoboth Bay, Herring Creek, and Delaware Route 24. The juxtaposition of numerous tidal creeks makes Angola Neck a likely location for prehistoric sites post-dating ca. 3000 B.C., which is the date at which lower Herring and Love Creeks were innundated by Holocene sea level rise. During earlier times, Angola Neck would have been an interior woodland with a relatively low site potential. Prior to our survey, there were 5 known sites in the survey area (7S-G-6, 12, 15, 64, and 73). Only one site (7S-G-64) produced diagnostic artifacts which were Woodland I ceramics and projectile points. The presence of Coulbourn and Mockley ceramics at 7S-G-64 indicate Delmarva Adena and Carey Complex occupations.

The UDCAR survey of Angola Neck revealed that extensive development of the survey area has destroyed most of the archaeological resources of the south side of the neck. Plantings of cover crops reduced ground visibility and limited surface survey areas. Nonetheless, two sites were identified and are described below:

7S-G-86. This site consists of a surface exposure of fire-cracked rock and quartz debitage on a low knoll overlooking the confluence of Love Creek and an unnamed ephemeral stream. No

diagnostic artifacts were recovered and the site probably represents a small procurement site of unknown age.

7S-G-85. Located along Sarah Run near its confluence with Burton Prong, a tributary of Herring Creek, this site consists of 3 separate loci. Locus A, which is located on the upstream limits of the site, consisted exclusively of a scatter of fire-cracked rock. Locus B produced two jasper non-diagnostic bifaces and a Woodland II Townsend shell-tempered ceramic sherd. Locus C produced a hammerstone, quartz and argillite debitage, a quartz tool and a late stage quartz biface. The separate loci and the range of artifacts suggest that the site is a series of re-occupied procurement sites or small base camps. The Townsend ceramic sherd is evidence of a Woodland II presence and a Woodland I occupation is also possible.

COW BRIDGE BRANCH SURVEY AREA

The Cow Bridge Branch survey area covers a series of low order tributaries of Indian River upstream of Millsboro Pond including Cow Bridge Branch, Deep Branch, White Oak Swamp Ditch, Peterkins Branch, Morris Millpond, Eli Walls Ditch, McGee Ditch, Gills Branch, Alms House Ditch, Horse Pound Swamp Ditch, Stockley Branch, Mirey Branch, Narrow Ditch, and Sheep Pen Ditch. Although the lower ends of the higher order drainages are the locations of tidal marshes, these streams would have been flowing through low-lying poorly drained woodlands with fresh water swamps through much of prehistory. Nonetheless, there are numerous areas of well-drained soils which are suitable habitation locales from which the rich resources of the poorly drained woodlands could be exploited during prehistoric times.

Survey in this area focused on plowed fields; however, some wooded areas were surveyed as well. A total of 22 individual sites were identified and are described below:

7S-F-29. This site is located on a low bluff overlooking the poorly drained floodplain swamp of Deep Branch. Jasper debitage, fire-cracked rock, a chert core, a Coulbourn cord-marked body sherd, and a Mockley cord-marked body sherd were found at the site indicating a Woodland I occupation.

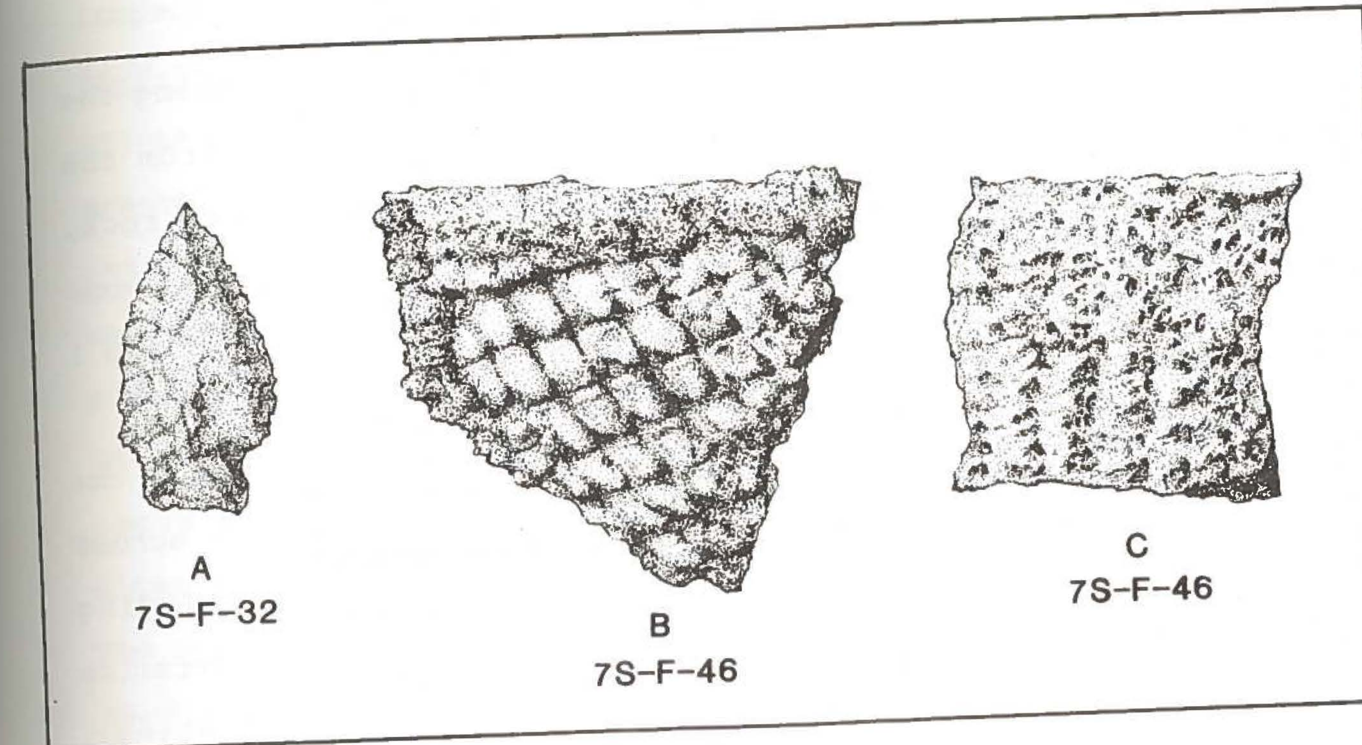
7S-F-30. Consisting of two separate loci, this site is located on a low knoll overlooking the poorly drained floodplain of Walls Ditch. Locus A of site 7S-F-30 produced quartzite debitage, a Jacks Reef projectile point, and a Townsend body sherd. Locus B produced fire-cracked rock, a jasper projectile point tip and a Mockley/Claggett body sherd. The artifact assemblage indicates a Woodland I - Woodland II occupation and the site is thought to be two base camps occupied at varied time periods.

7S-F-31. Two separate loci comprise this site which is located on a low bluff overlooking the poorly drained floodplains of Walls Ditch. Locus A produced jasper debitage and fire-cracked rock and Locus B produced a bi-pitted hammerstone and fire-cracked rock. The site probably represents at least two procurement sites of unknown age.

7S-F-32. This site is located on the edge of the floodplain of Gills Branch and surface collection produced fire-cracked rock, quartz and quartzite debitage, a pitted stone, a jasper flake tool, and a stemmed projectile point (Figure 4). A Woodland I occupation is inferred and the site is thought to be a base camp.

FIGURE 4

Artifacts from Cow Bridge Branch Survey Area



7S-F-33. Three loci comprise 7S-F-33 and all are located along the floodplain of Stockley Branch. Locus A produced fire-cracked rock, a jasper core tool and a Wolfe Neck cord-marked body sherd. Locus B produced a quartz core and a Nassawango cord-marked body sherd. Locus C produced a large number of artifacts which were collected by a local amateur archaeologist. The collection was not available for inspection at this time. A Woodland I occupation of the area is indicated by our research and the site is probably the location of at least two base camps.

7S-F-34. Site 7S-F-34 is located adjacent to the poorly drained floodplain of Stockley Branch and much of the site has been destroyed by a gravel pit. A bi-pitted hammerstone, fire-cracked rock, a jasper utilized flake, debitage of quartz and jasper, a jasper cobble core, and two Mockley cord-marked body sherds were recovered from the site. A Woodland I occupation is indicated and the site probably represents a base camp.

7S-F-35. This site is located on a high knoll overlooking the poorly drained floodplain of Walls Ditch. Recovered from the site were jasper and argillite debitage, fire-cracked rock, utilized flakes, a late stage biface fragment, and a grooved axe. The presence of argillite debitage could indicate a Woodland I occupation and the site may be a small base camp.

7S-F-36. The owner of this site has a large collection from the site which is located on a knoll overlooking Walls Ditch across from 7S-F-35. A wide range of artifacts are present including ground stone tools (grinding stones and hammerstones), ceramics (Townsend, Mockley, Coulbourn, and Dames Quarter varieties), projectile points (stemmed, notched, bifurcate, and triangular varieties) and bifaces in various stages of reduction. Lithic raw materials at the site include local chert, jasper, quartz, and quartzite as well as non-local argillite, rhyolite, and steatite. The range of artifacts indicates that the site is a base camp inhabited during Archaic - Woodland II times.

7S-F-37. This site consists of two discrete loci which are located on a low knoll overlooking the poorly drained floodplain of Cow Bridge Branch. Locus A produced fire-cracked rock and a Wolfe Neck cord-marked body sherd. The property owner also noted that he had found between five or ten projectile points at Locus A and at Locus B as well. A Woodland I occupation is indicated.

7S-F-38. Located on a knoll in a poorly drained woodland, this site is the source of a collection of projectile points owned by the property owner. The collection was not available for inspection.

7S-F-39. This site is located on a small peninsula of land which sticks out into the poorly drained floodplain swamp of Cow Bridge Branch. An adjacent gravel pit operation has probably intruded into the site. Quartz debitage, fire-cracked rock, and a Wolfe Neck ceramic sherd were found at the site, which is thought to be a Woodland I base camp.

7S-F-40, 41, 42. These three sites are located on upland slopes above the poorly drained floodplain of Cow Bridge Branch. All sites were reported based on interviews with private collectors. The collections were not available for analysis.

7S-F-43. Located adjacent to the poorly drained floodplain of Sheep Pen Ditch, 7S-F-43 produced argillite and jasper debitage. The site probably represents an ephemerally utilized procurement locale.

7S-F-44. Site 7S-F-44 consists of two separate loci along the floodplain of Mirey Branch in an area of poorly drained woodlands. Locus A yielded fire-cracked rock in an area of low surface visibility and Locus B produced quartz debitage and 9 body sherds of Wolfe Neck cord-marked ceramics. A Woodland I occupation of Locus B is inferred and the site may represent a base camp.

7S-F-45. This site is located on a low knoll next to the poorly drained floodplain of Mirey Branch. Debitage and 5 Wolfe Neck cord-marked body sherds were recovered from the site. A Woodland I occupation of the site is inferred.

7S-F-46. Located at the confluence of Mirey Branch and Narrow Ditch, this site is the largest accumulation of artifacts seen in the Cow Bridge Branch study area. Hundreds of sherds were visible on the site's surface and the sample collection included Wolfe Neck, Mockley, and Coulbourn varieties including rims (Figure 4). Debitage and fire-cracked rock were also present. The large number of artifacts indicates the presence of a Woodland I macro-band base camp with multiple occupations.

7S-F-47. Located just downstream from 7S-F-46 on Mirey Branch just below its confluence with Narrow Ditch, 7S-F-47 is almost as large as 7S-F-46. Again, hundreds of ceramic sherds were visible on the site's surface and the sample collection included Nassawango, Wilgus, and Coulbourn wares. These ceramics are all associated with Delmarva Adena cultures (Custer 1984) and indicate a focused Woodland I occupation. Flakes, fire-cracked rock, and a triangular projectile point were also observed. The large number of artifacts indicates the presence of a repeatedly occupied base camp.

7S-F-48. This site is located on a low knoll within 500m of Mirey Branch. Collection yielded quartz debitage and two cores. A procurement function is assigned to the site.

7S-F-49, 50. These two sites are located along Alms House Ditch on low knolls adjacent to the poorly drained floodplain. Both sites yielded small quantitites of debitage of quartz and jasper and are interpreted as procurement sites of unknown age.

PINEY NECK SURVEY AREA

Piney Neck is located on the south side of Indian River and is bounded by Indian River on the north and Pepper Creek on the south. Prior to 3000 B.C., Piney Neck was at a mid-drainage position and would have been an attractive settlement area. Continued sea level rise after 3000 B.C. would have increased the size of the productive estuaries and enhanced the suitability of the Piney Neck region for prehistoric settlement. Before the UDCAR survey, there were four known sites on Piney Neck (7S-K-1, 24, 25, and 26). Only one of these sites produced diagnostic artifacts and 7S-K-1 is thought to be a Woodland II base camp.

Five sites were identified on Piney Neck during the UDCAR survey and are described below:

7S-K-33. This site is located on a bluff overlooking the embayed section of Pepper Creek. Surface collection of the site recovered quartz debitage, fire-cracked rock, a Mockley cord-marked body sherd, 6 Wolfe Neck cord-marked body sherds, and a Wolfe Neck net-impressed rim sherd. The site is thought to represent a potential multi-component Woodland I base camp.

7S-K-34. Located on the shore of the embayed section of Pepper Creek, this site was identified on the basis of a scattering of fire-cracked rock. No other artifacts were observed.

7S-K-35. This site is located near the tip of Piney Neck on a low knoll overlooking the tidal marshes. A large concentration of artifacts as observed at the site including quartz, jasper, argillite, and chert debitage, and Wolfe Neck, Coulbourn, Hell Island, and Townsend body sherds. The site almost certainly represents a Woodland I - Woodland II base camp. A bulldozed road cut across the site exposed some sub-surface features at the site and a description of the excavation of those features is presented later in this report.

7S-K-36. Located near the tip of Piney Neck, this site is not far from 7S-K-35. Collection of the site yielded debitage, including some argillite, and a Mockley cord-marked body sherd. A Woodland I occupation is inferred.

7S-K-37. This site is also located near the tip of Piney Neck in the vicinity of 7S-K-36 and 7S-K-37. Many Townsend body sherds were observed on the sites surface and a Woodland II occupation is inferred.

7S-K-35 Salvage Excavations

As was noted earlier, some cutting of roads had taken place at 7S-K-35 during the course of our survey. Within one section of the road, a series of dark features were identified. The soil at the base of the bulldozer cut was flat-shoveled to identify potential feature stains and these stains were then mapped (Figure 5). Although only one feature was excavated, the well-defined nature of the soil stains indicate that these are all cultural features. The density of features in the trench approaches that of the Delaware Park site (Thomas 1981). An isolated dark, greasy feature at the south end of the trench (Feature 1 - Figure 5) had been gouged by the bulldozer and was excavated to salvage before it was destroyed. Figure 6 shows a plan view of the feature and Figure 7 shows its profiles. Level 1 consists of disturbed organic soils with little integrity. Level 2 also is disturbed and is a transition zone to the

FIGURE 5

7S-K-35 Feature Map

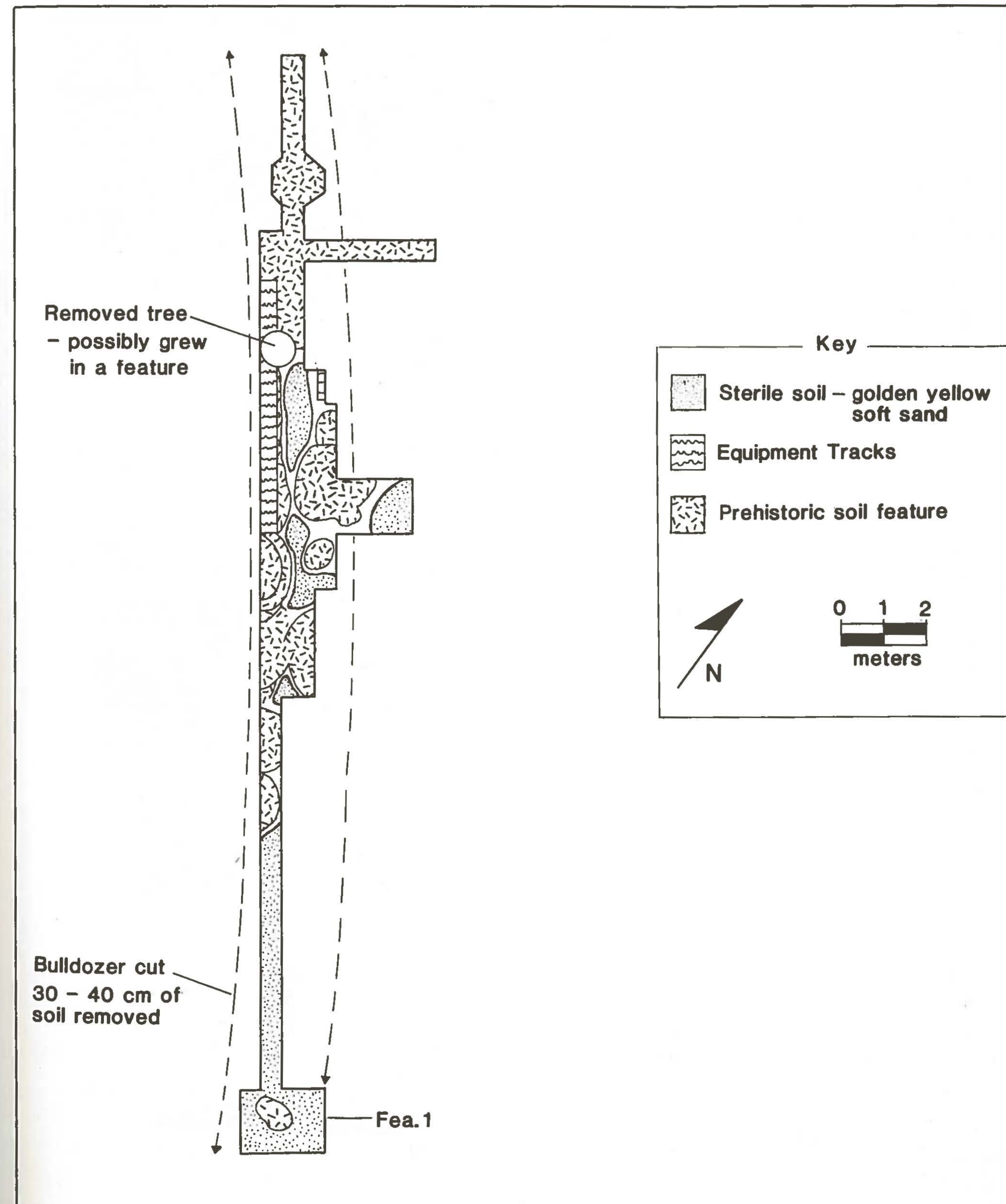


FIGURE 6

7S-K-35 Feature 1 Plan

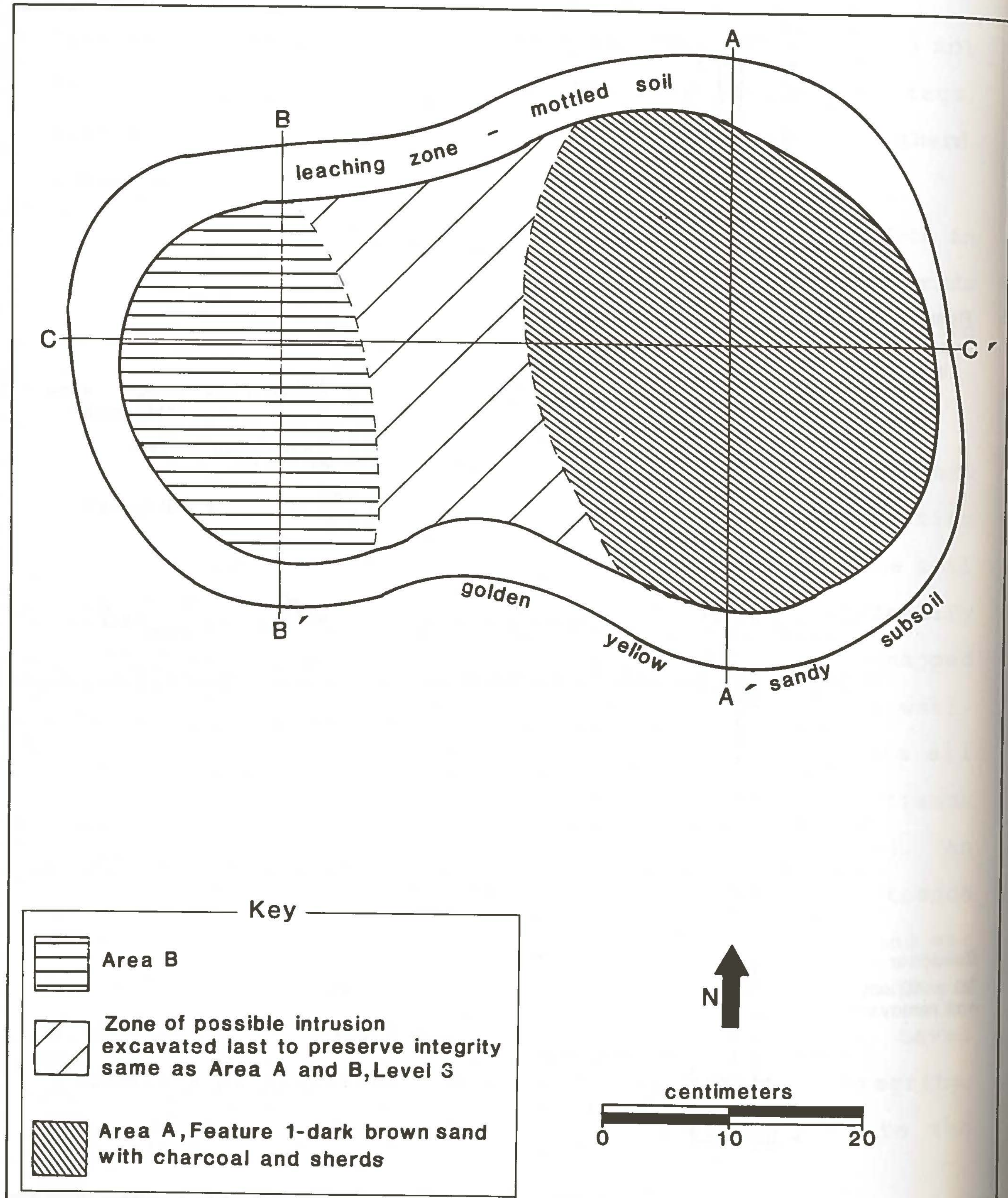
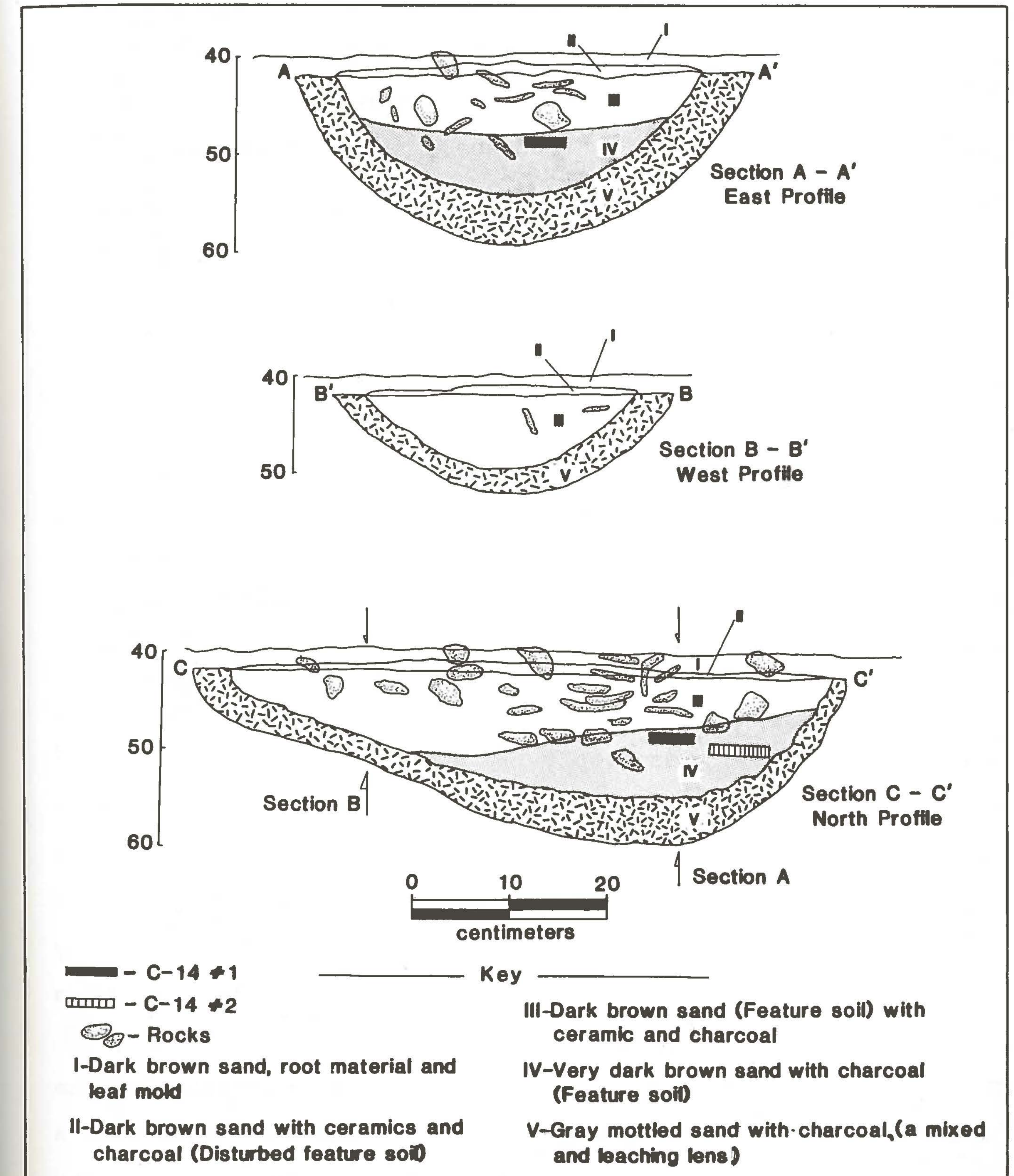


FIGURE 7

7S-K-35 Feature 1 Cross-Sections



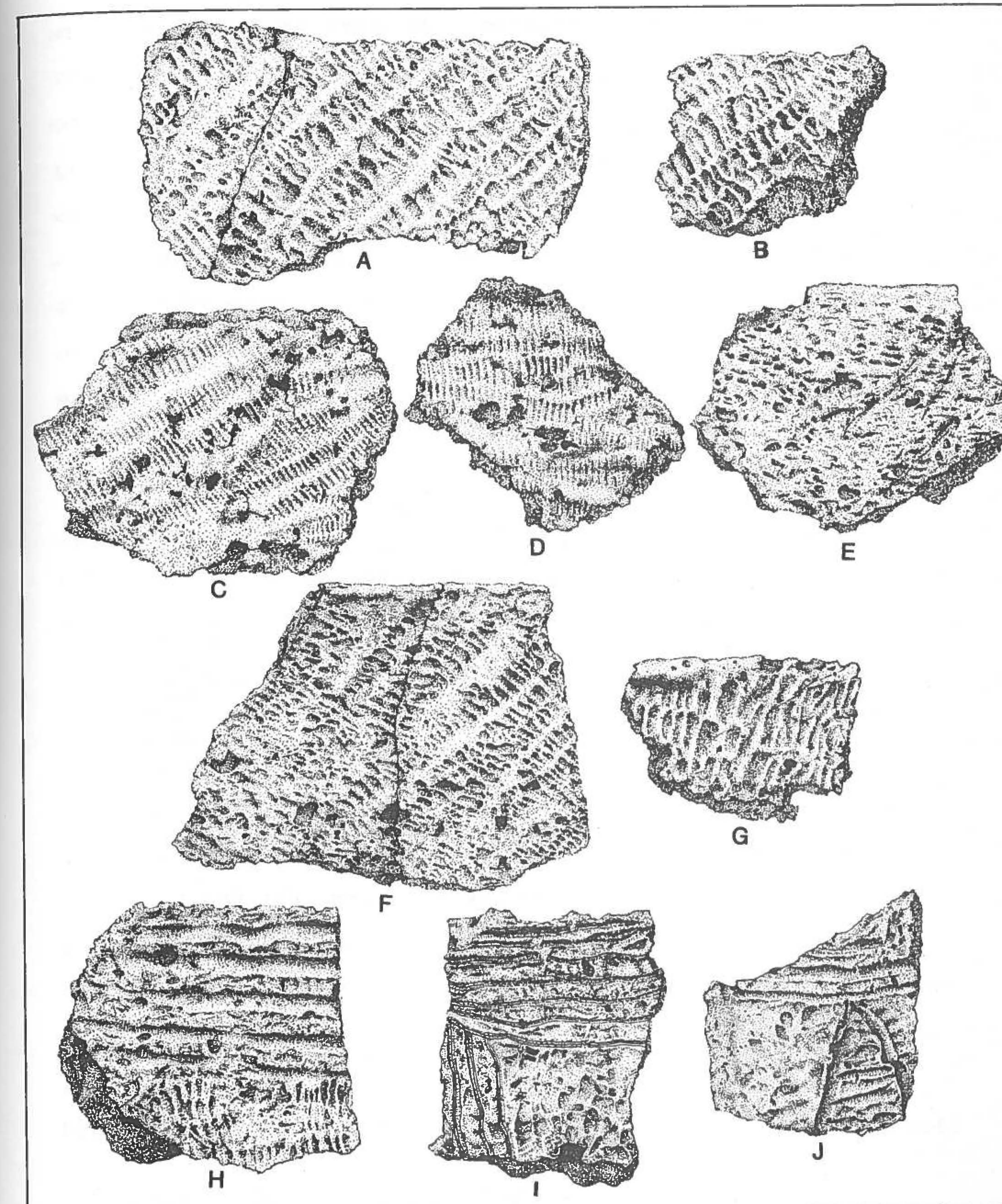
undisturbed feature fill. Level 3 is a dark, soft organic-rich soil with numerous ceramic sherds and abundant charcoal. Level 4 was more compact than Level 3 and was filled with charcoal, but few artifacts. Level 5 is a mottled soil level with little charcoal which defines the bottom of the feature.

A large number of Townsend shell tempered ceramic sherds (32) were recovered from the feature fill, primarily from levels 3 and 4. Of the total of 32 sherds, 6 were rim sherds and the remainder were body sherds. Among the body sherds, three basic surface treatments are represented: cord-marking, wiped-over cord-marking, and smoothed, in order of decreasing frequency. When complete Townsend vessels have been found, a single vessel may show all three surface treatments noted above with cord-marking most prevalent near the rims, and wiping most common near the base. Therefore, it is difficult to use the body sherds to identify individual vessels. However, among the cord-marked body sherds, two very different varieties of cord-marking are present. One type of cordmarking used a paddle with a large, loosely braided cord which was deeply impressed into the clay when the clay was still wet (Figure 8A, 8B). On some sherds where the cord impressions are not smeared and blurry, the cordage can be seen to have a single ply s-twist pattern. The second variety of cord-marking is composed of a very tightly wrapped, lightly impressed paddle (Figure 8C, 8D) and probably represents a separate vessel from that shown in Figures 8A and 8B.

Rim sherds from the feature reveal more information on the number of vessels represented. Two of the six rim sherds show a coarse, deeply impressed cord marking at an oblique angle to the

FIGURE 8

Ceramics from 7S-K-35, Feature 1



vessel rim (Figure 8E and 8F) which is similar to the body sherds depicted in Figures 8A and 8B. Another cord-marked rim is present (Figure 8G) and the cord-marking is similar to the sherds shown in Figure 8E and 8F; however, the sherd in Figure 8G shows cord-marking perpendicular to the rim, not an oblique orientation and probably represents a different vessel. Incised rims are also present and Figure 8H shows a sherd with broad-line incising of five parallel lines near the rim. This design falls into the category of Townsend Corded Horizontal (TCH - Custer 1984:151-152) and the sherd shows that the vessel had a flattened lip with broad line impressions. Some cord-marking is present below the incising and the tight cord and light impression resembles the body sherds in Figures 8C and 8D. Thus, the sherds in Figures 8C, 8D, and 8H are probably from the same vessel. Figure 8I shows another incised rim with a complex geometric design that falls within the Rappahannock Incised (RI4 -Custer 1984:151-152) variety of the Townsend ceramic series. This sherd represents yet another vessel. Finally, another ceramic vessel is represented by a decorated sherd (Figure 8J) which shows a design motif (RI4 - Custer 1984:151-152) and an incising technique that is distinct from the incised sherd in Figure 8I. In sum, analysis of the rim and body sherds shows that there are at least five vessels present in the feature fill and that the following design types co-occur in the feature: Townsend Plain, Townsend Corded Horizontal (TCH), and Rappahannock Incised (RI4 and RI5). Charred wood samples were submitted to Lucinda McWeeney of Yale University for species identification. Of the seven samples identified, four were clearly white oak (Querqus Alba), one could

only be identified as a member of the Querqus Genus, one was identified as a member of the pine (Pinaceae) family, and one was an unidentifiable pithy twig. The oak/Pine mix is consistent with the Southern Oak-Pine forest thought to be present in southern Delaware ca. A.D. 1000 (Custer 1984:36-37, 92-93; Brush et al. 1980).

Organic materials were well-preserved even though no shell was present, and a wood charcoal sample was recovered from Level 4 and submitted for a radiocarbon date. The resultant date was 930± 55 B.P. (UGa - 5548), or 1020 A.D.

Standard 10 liter samples of the feature fill were retained for flotation and heavy and light fractions were analyzed. Table 2 summarizes the materials recovered from the flotation of

TABLE 2

FLOTATION ECOFACTS - FEATURE 1 - 7S-K-35

Level	Fraction	Wt. Charcoal	Wt. Ceramics	Wt. Seeds and Types
3-Area A	Heavy	1.94g	4.96g	--------
	Light	-----	-----	--------
3-Area B	Heavy	4.91g	1.63g	--------
	Light	-----	-----	--------
4	Heavy	12.55g	6.64g	.75g - 4 hickory nut shell frags., 2 acorn shell frags., 4 charred chenopodium seeds
	Light	.62g	-----	--------
5	Heavy	3.63g	1.92g	.82g - 1 acorn shell frag., 4 hickory nut shells
	Light	-----	-----	--------

samples from levels 3-5. Flotation samples from levels 1 and 2 were not analyzed because these levels seemed to be disturbed. It can be seen that the majority of the ecofacts and other small materials were found in level 4. Small pieces of charcoal and small fragments of Townsend ceramics comprise the majority of the flotation remains. Debitage is consipicuously absent and reworking of stone tools apparently did not take place near the vicinity of Feature 1. Food remains from the feature include hickory nut, acorn, and Chenopodium. Most likely the hickory nut and acorn represent food remains; however, the number of Chenopodium seeds is very low and they may not represent a food source at the site. It is interesting to note that the hickory nut shells are charred throughout indicating that they may have been burned as refuse. On the other hand, the acorn shells are charred on the outside only indicating that they may have been roasted as part of the preparation process and then discarded.

Because the contents are somewhat limited in variety, namely, charcoal, ceramics, and minor amounts of plant food remains, it is suggested here that this feature may have been associated with specialized plant food processing. The absence of bone in the feature is not due to poor preservation because fragile plant remains like acorn nut hulls are preserved. The excellent preservation of fragile plant remains underscores the research potential of the additional features at 7S-K-35.

7S-D-9 EXCAVATIONS

The final archaeological investigations reported here are test excavations at 7S-D-9, which is part of the Cape Henlopen

National Register District (Delaware Division of Historical and Cultural Affairs 1976). Our excavations were undertaken to gain additional information about site 7S-D-9 and to salvage archaeological data which were being destroyed as the Great Dune overrode the site and caused it to be eroded and deflated. Before describing the UDCAR excavations, the earlier excavations at the site will be described.

Prior Excavations

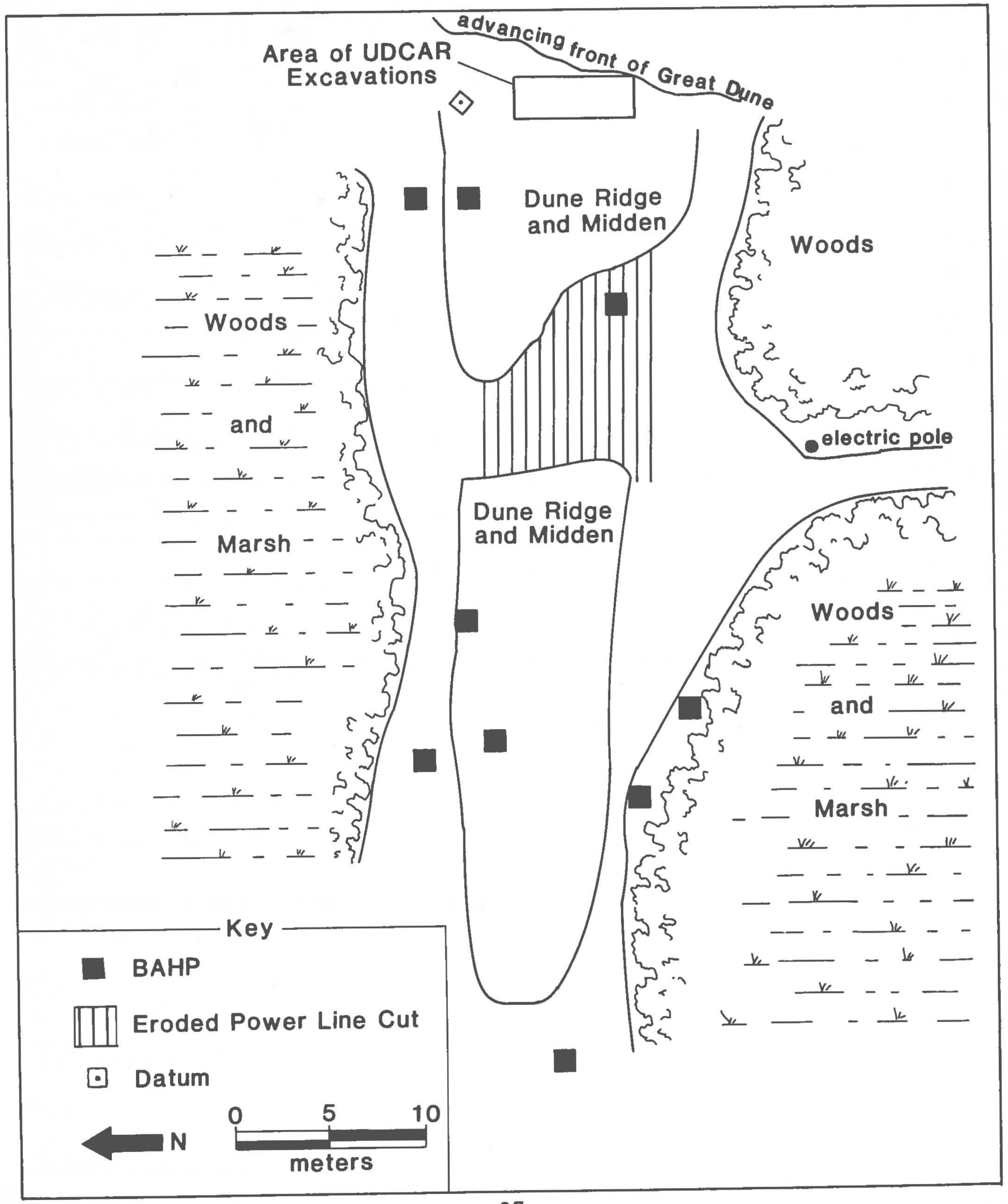
During the summer of 1976, archaeological investigations at 7S-D-9 were undertaken by crews from the BAHP under the direction of Daniel R. Griffith and Richard Artusy. These excavations were part of a series of test excavations at numerous sites in the Cape Henlopen area that resulted in the listing of the area as a district on the National Register of Historic Places (Delaware Division of Historical and Cultural Affairs 1976). Initial examination of the site by BAHP crews revealed that the site was located on a low ridge which runs perpendicular to the Atlantic Coast shoreline. Adjacent to the site is the advancing face of the Great Dune, which is an aeolian depositional feature that is more than 3m high, runs parallel to the Atlantic Coast shoreline, and is advancing inland. As the dune advances inland, the sand covers and kills the vegetation covering the site, which consists of pine, poison ivy, holly, and some prickly pear cactus. This vegetative cover protects the site from aeolian erosion and when the denuded midden emerges from the back side of the Great Dune, the site is eroded and deflated, and all of the midden materials lose their context. A similar process destroyed much of the midden deposits at the nearby 7S-D-22 site. Some of the midden ridge at 7S-D-9 was also destroyed when vegetation on the midden was cut during the construction of a powerline.

Figure 9 shows the site map of the 1976 BAHP excavations. Nine sets of 1m squares were excavated at varied locations across the site and most produced either artifacts or shell midden matrix. In the test units that recovered shell, clams generally outnumbered oysters and some whelk was present. The midden exposed in these units was approximately 10cm thick. Artifacts recovered from the test units included quartz, chert, and jasper debitage derived primarily from cobble cores, fire-cracked rock, Coulbourn, Mockley, and Townsend ceramics, a bone needle, and a rhyolite Fox Creek stemmed projectile point. Mockley ceramics were the most common ceramics and were found in numerous units throughout the midden area. Some brick and purple bottle glass were also observed on the site's surface.

Based on the BAHP excavations, the site was characterized as a Carey Complex Woodland I shell midden with a limited Woodland II component. The age of this midden and other sites in the area were used in Kraft's (1978) geomorphological reconstructions of the Cape Henlopen Spit Complex. Based on Kraft's reconstructions, the low ridge on which 7S-D-9 is located is a recurved spit tip of a geomorphological ancestor of Cape Henlopen. The spit tip would have been close to a series of shallow estuarine lagoons from which shellfish could have been easily gathered.

FIGURE 9

BAHP Site Map - 7S-D-9



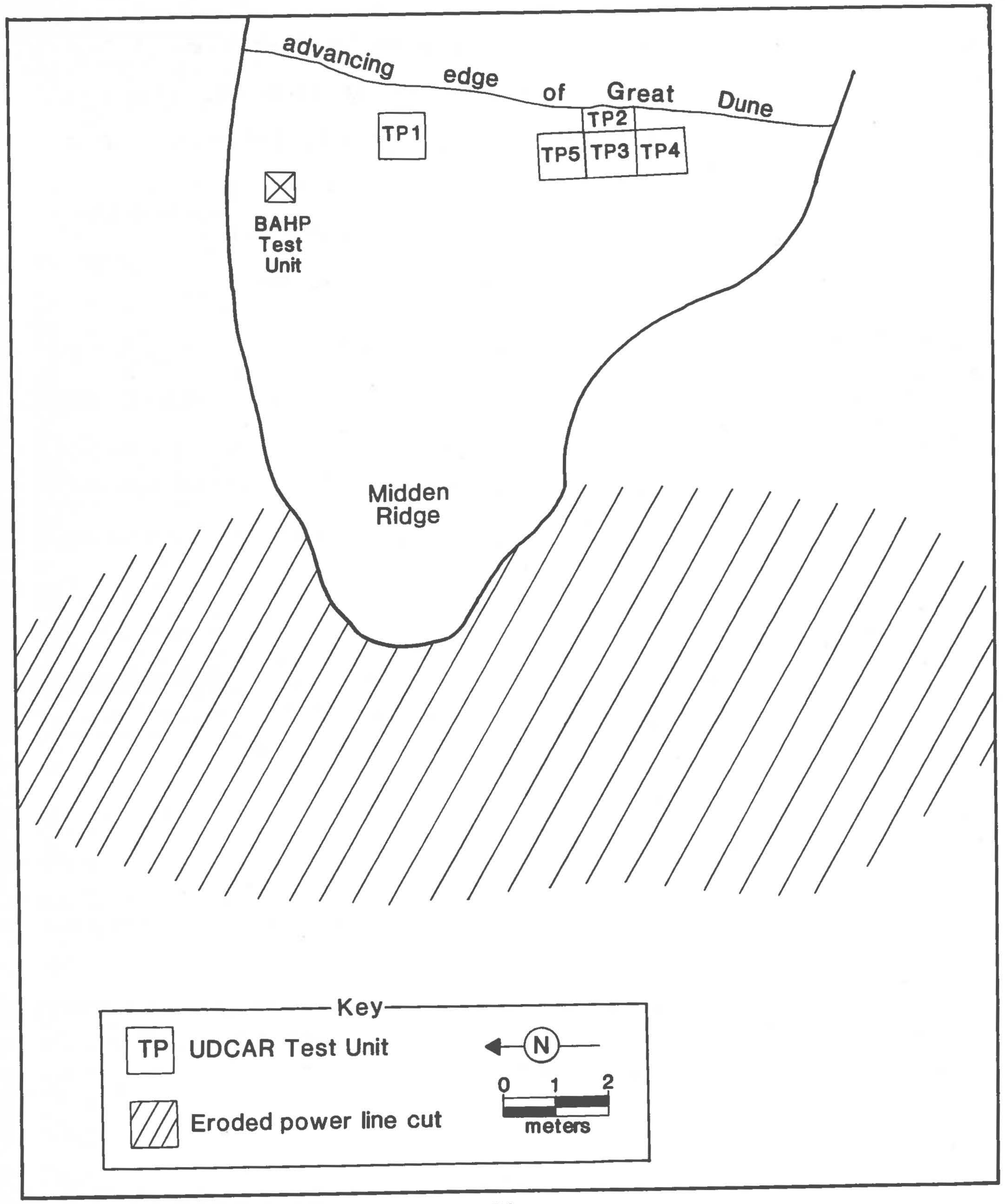
UDCAR Excavations

UDCAR staff began additional test excavations at 7S-D-9 in May 1986. These test excavations were focused on the section of the midden ridge between the face of the Great Dune and the eroded powerline cut (Figure 9) near the BAHP test unit which produced a mix of clam and oyster shell, Mockley ceramics, a rhyolite Fox Creek point base, and jasper debitage. Excavations were focused on this area because it is under threat of destruction from the Great Dune's advance. Indeed, by comparing the location of the BAHP test units in relation to the Great Dune's face on the 1976 map with the 1986 ground locations, it can be seen that the Great Dune has advanced at least 10m in 10 years. The goals of the test excavations were to refine our knowledge of the midden stratigraphy, gather charcoal samples for radiocarbon dating, determine the degree of faunal and floral ecofact preservation within the midden through flotation analysis, gather oyster shell samples for season-of-death, epibion, and other specialized analyses, and identify any additional features within the midden matrix. By gathering these data, it was hoped that we could better understand the nature and importance of the archaeological resource being destroyed by the advance of the Great Dune.

Five 1m test units were excavated and their general location is noted on Figure 9. A more precise map of their location is shown in Figure 10. Test Pit 1 located buried shell midden deposits with a fairly simple stratigraphy that will be described later. In contrast Test Pit 2 encountered stratified midden

FIGURE 10

UDCAR Excavation Map - 7S-D-9

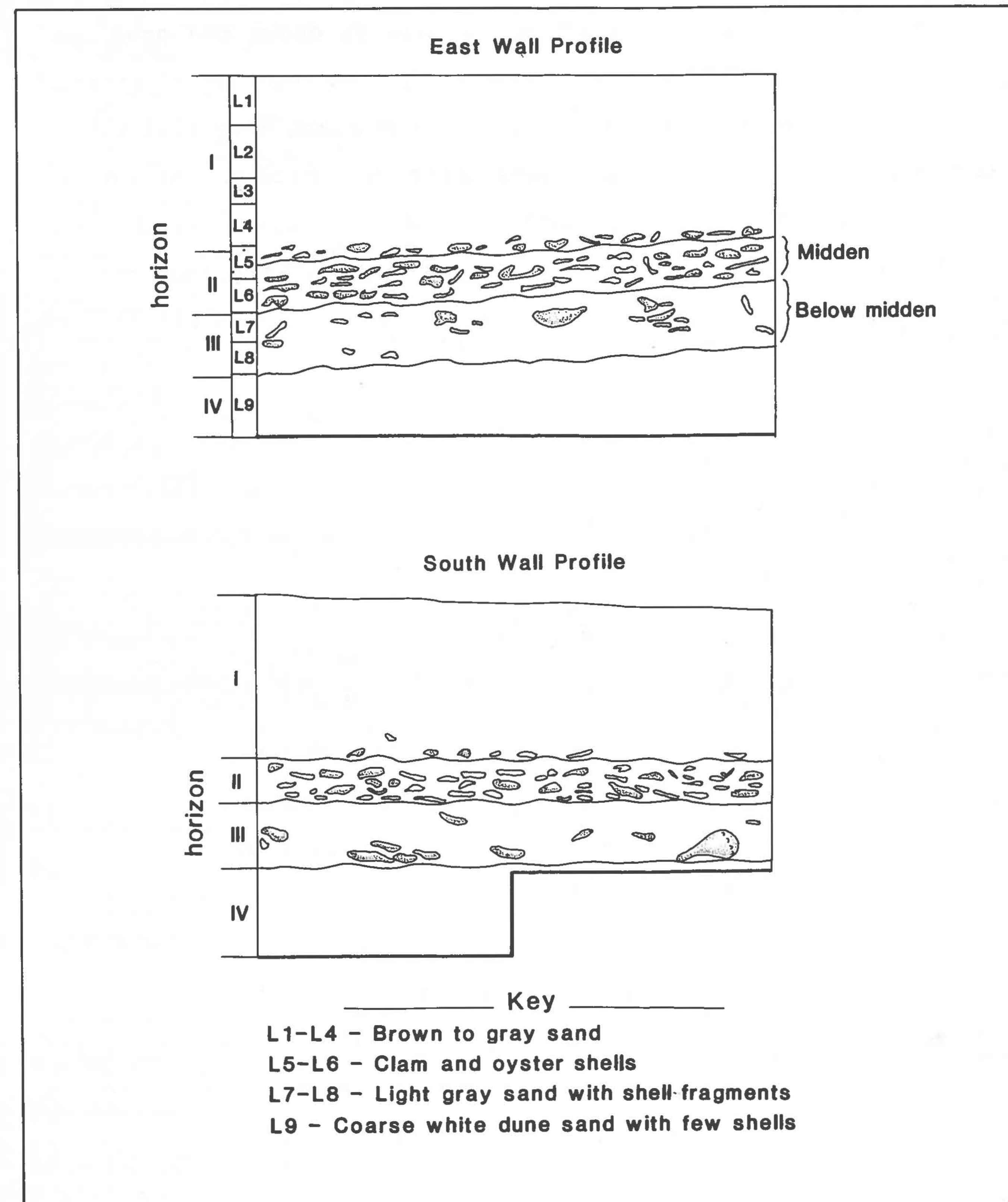


deposits with multiple cross-cutting features. Test pits 3-5 were excavated adjacent to Test Pit 2 in order to more completely expose the features and understand their stratigraphic relation to one another.

<u>Stratigraphy</u> <u>and</u> <u>Features</u>. Figure 11 shows two profiles of Test Pit 1. Levels 1-4 extended to a depth of 40cm below ground surface and contained some clam and oyster shell fragments. Most of the matrix of these levels consisted of brown to gray sand. Levels 5 and 6, extending between 40 and 60cm below surface, consisted of the shell midden with most of the matrix composed of clam and oyster shells. The majority of the artifacts came from these levels. Levels 7 and 8 extended between 60cm and 80cm below ground surface and consisted of a light gray sand with few shell fragments. Numerous artifacts were recovered from these levels which seem to be distinct from the shell midden proper. Level 9 extended from 80cm to 95cm below ground surface and consisted of a coarse white dune sand with few pieces of shells and artifacts. Based on the soil distinctions and artifact and shell distributions, 4 major horizons and depositional events were identified. Horizon I (Levels 1-4) represents recent deposition which overlies and postdates the actual shell midden (Horizon II). Horizon III is differentiated from Horizon II based on the absence of shell in Horizon III and these two horizons may represent different cultural occupations. Analysis of artifacts, noted below, addresses this question. Horizon IV represents the original landscape upon which people lived and upon which the midden was deposited.

FIGURE 11

7S-D-9 Test Pit 1 Profiles



The stratigraphy of Test Pits 2-5 was much more complex than that of Test Pit 1 due to the presence of several cross-cutting features; however, there are some correlations of horizons between the two excavation areas. Figure 12 shows two profiles of Test Pits 2 and 3 and these profiles show most of the features. Levels 1 and 2 correspond to Horizon I in Test Pit 1 and represent modern deposition over the midden, which is probably aeolian in origin. Levels 3 and 4 correspond to Horizon II and are characterized by much shell. Most likely, Horizon II is the actual midden deposit identified in the 1976 BAHP excavations.

Below Horizon II, the stratigraphy becomes complex due to the features. Figure 13 shows the plan view of the features. Immediately below Horizon II (Level 4), Feature 1 was identified as a gray and brown mottled sand in distinction to the natural yellow sandy subsoil. As can be seen from Figure 13, Feature 1 fills all of Test Pit 3 and large portions of Test Pits 4 and 5. Within Feature 1 are several separate and discrete episodes of pit fill which were identified as separate features. Feature 2 is a shallow dark gray sandy soil embedded within the lighter soil of Feature 1 along the border of Test Pits 3 and 5. Feature 3 is a dense accumulation of unburned oyster shells extending along the south end of Feature 1 in Test Pit 4. Feature 4 is a small pit of dark brown sand and burned shell (Figure 13) which is found immediately below Horizon II in Test Pit 5 and extends into Feature 1. Feature 4 is not shown on the profiles in Figure 12. Feature 5 is a dense accumulation of charcoal in a small

FIGURE 12

7S-D-9 Test Pits 2 and 3 Profiles

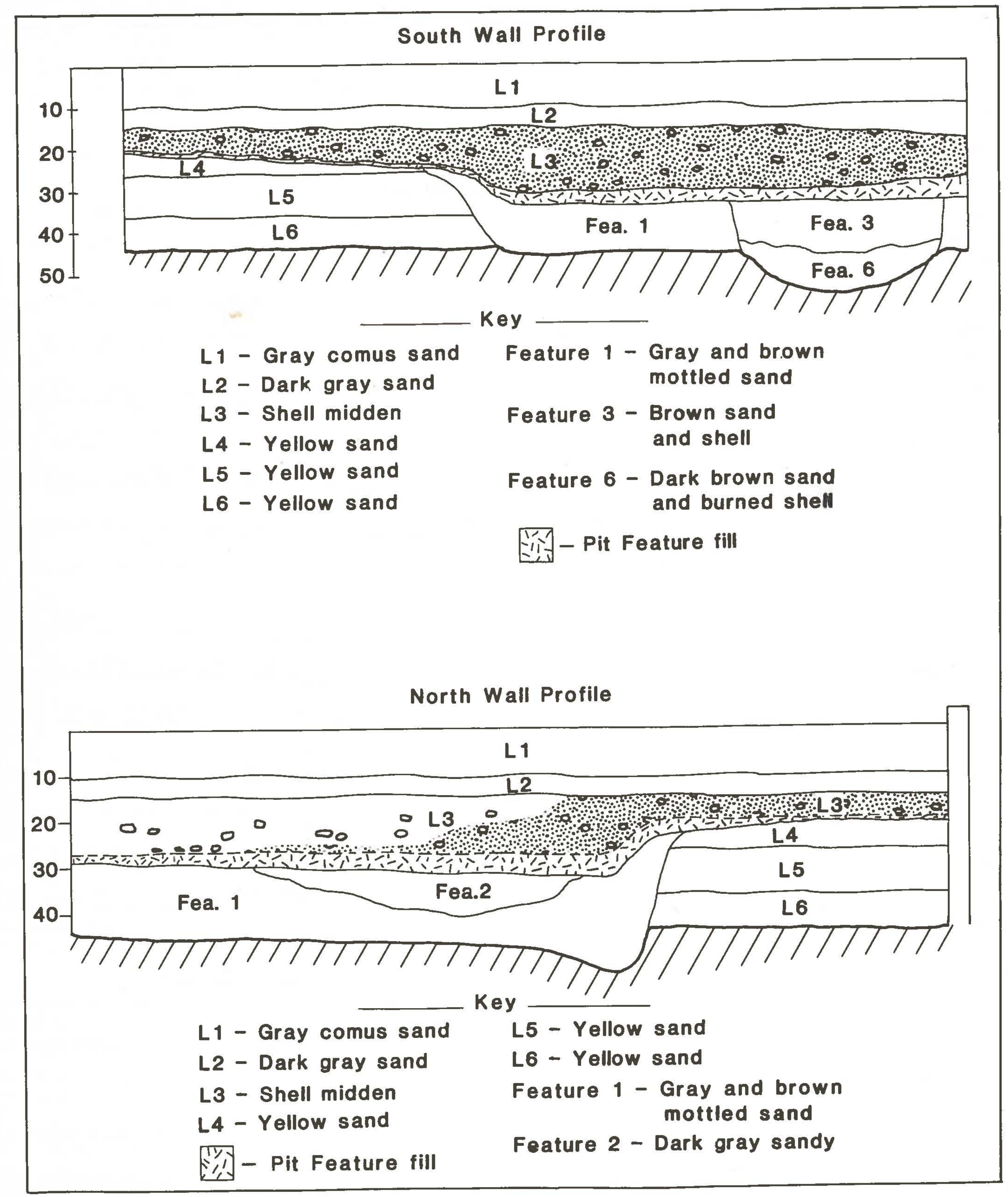
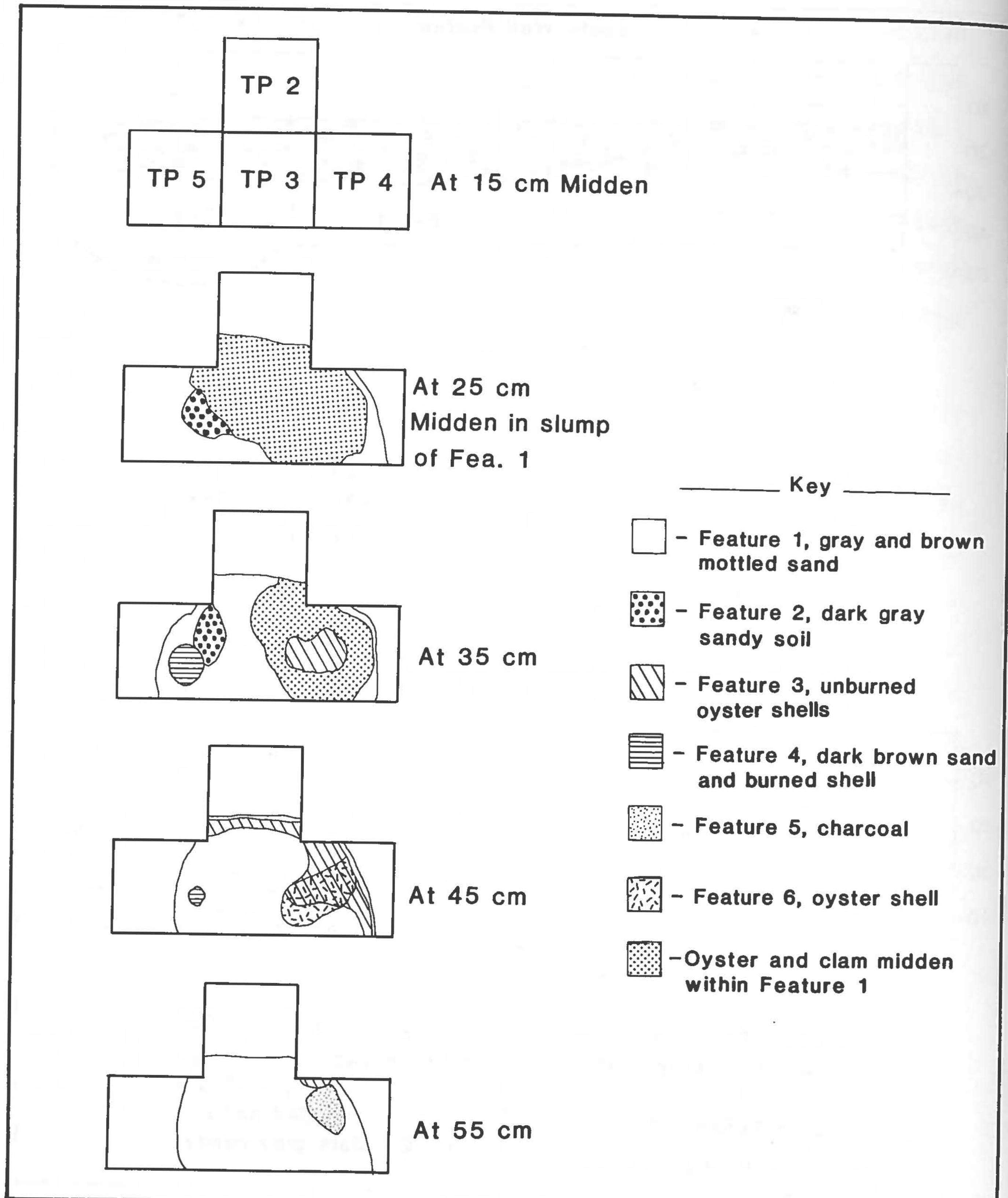


FIGURE 13

7S-D-9 Feature Plots



shallow basin in the base of Feature 1 and is thought to represent a hearth (Figure 13). Feature 6 is an accumulation of oyster shell immediately below Feature 3 (Figure 12).

The interpretation of these features is based on the identification of Feature 1 as a portion of a pithouse. The size, shape, and configuration of Feature 1 are similar to other pithouses identified in Delaware (Artusy and Griffith 1975; Thomas 1981; Custer, Watson, and DeSantis 1987) and the presence of an interior hearth (Feature 5) reinforces that interpretation. Charcoal from Feature 5 was submitted for radiocarbon dating and produced a date of 1400 $\pm$ 50 B.P. (UGa-5447). Features 3 and 6 are thought to represent individual dumpings of oyster shells which partly filled Feature 1. The remainder of the pit fill of Feature 1 slightly postdates the deposition of Features 3 and 6. Later Features 2 and 4 were excavated into the fill of Feature 1. Features 2 and 4 may be related to the later deposition of Horizon II. Most likely, Horizon II significantly postdates the occupation of Feature 1. Figure 14 summarizes the depositional sequence of soil horizons and features.

Artifacts. A variety of artifacts were collected during the screening of midden soils from the site. The various types of artifacts will be described first and then their distribution through the profile and within features will be discussed.

Lithic debitage is the most numerous artifact class at the site. Table 3 shows a summary of frequency of flakes by presence of cortex and size class. It can be seen that cryptocrystalline materials are the most common raw materials comprising 92% of the assemblage. Most of this debitage is in the small size category

FIGURE 14

Depositional Sequence at 7S-D-9

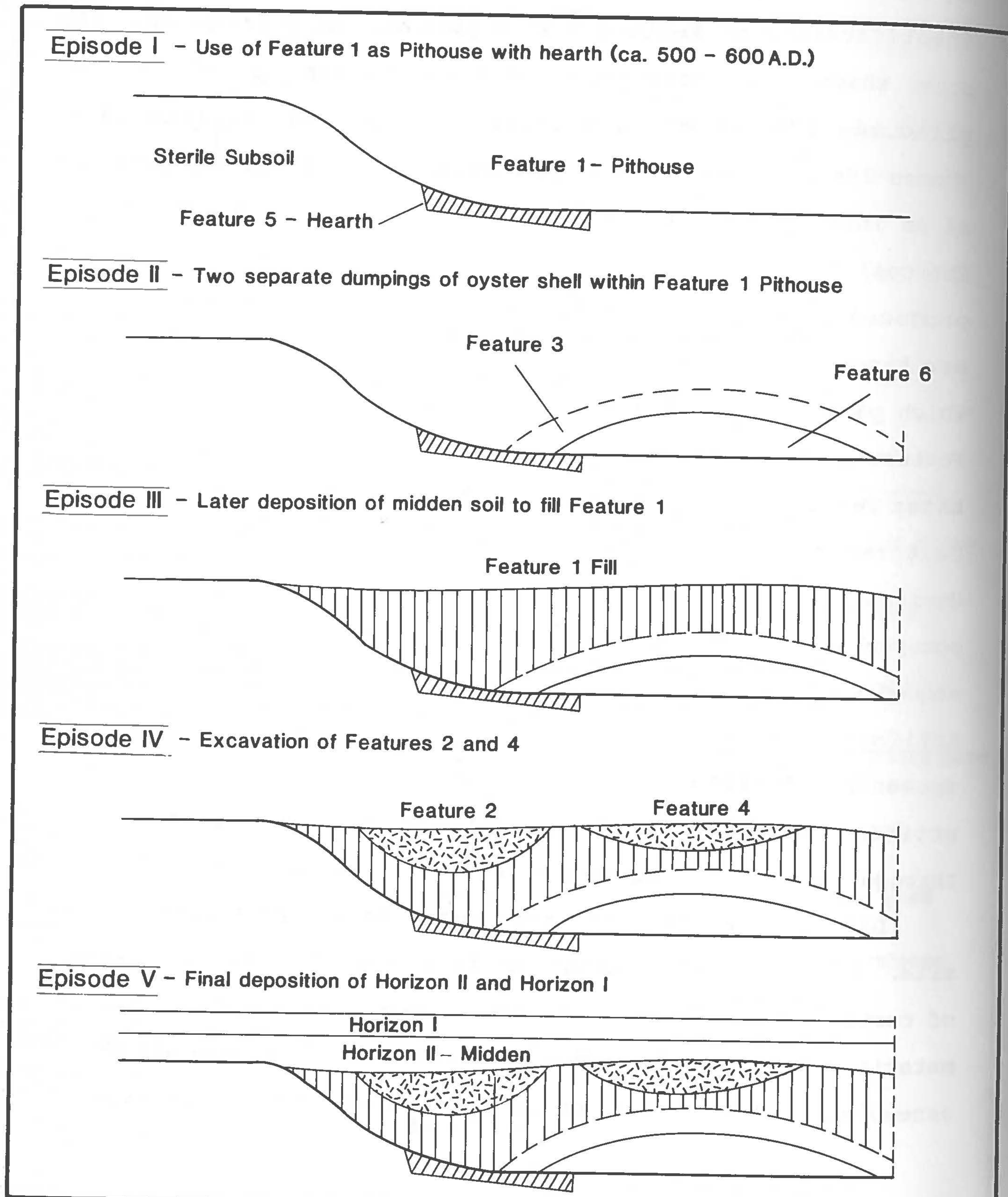


TABLE 3

7S-D-9 LITHIC DEBITAGE SUMMARY CATALOGUE

Raw Material	Non-Cortex	Cortex	<2cm Size	>2cm Size
Jasper	218(58)	159(42)	332(88)	45(12)
Chert	131(65)	72(35)	185(91)	18(9)
Rhyolite	46(100)	0(0)	35(76)	9(24)
Quartz	2(33)	4(67)	4(67)	2(33)
Totals	397(63)	235(37)	556(88)	74(12)

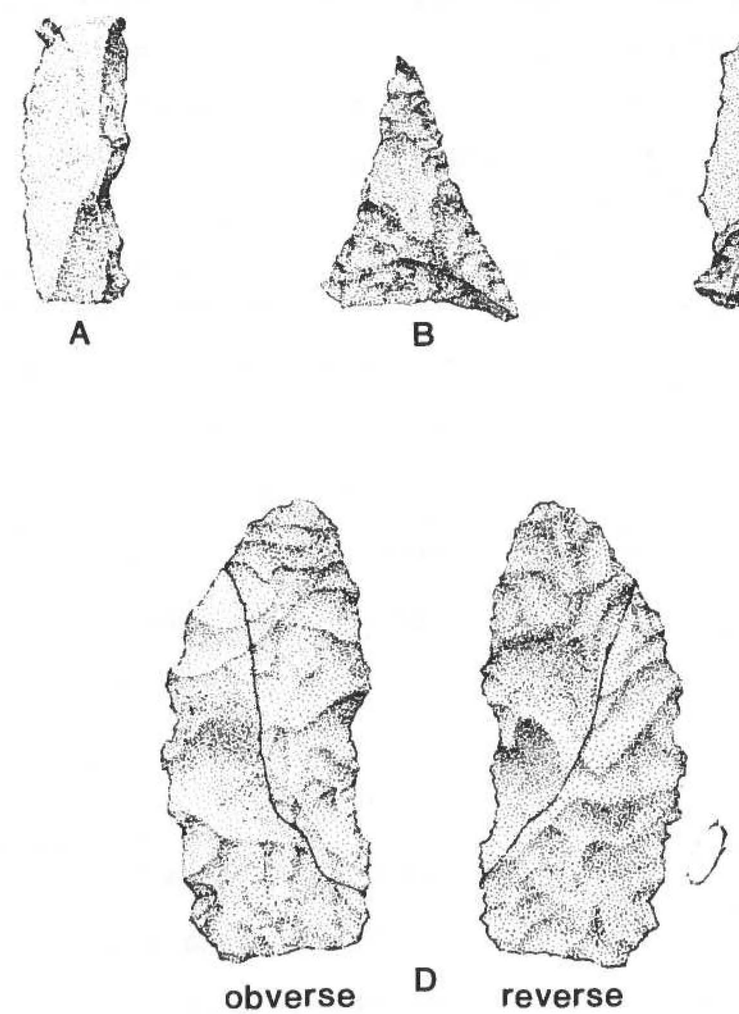
( ) = % values of non-cortex/cortex and by size classes

and is probably derived from very late stage biface reduction or tool resharpening. Utilized flake tools are uncommon, although an elongated blade-like flake tool of chert (Figure 15A) is part of the assemblage. The lithic debitage from the site also shows a high percentage of cortex indicating that much of it is derived from cobble cores and 2 jasper cobble cores were found. Some non-local rhyolite is present and all is of the aphanitic variety (Stewart 1984).

Three bifaces were recovered from the excavations and are shown in Figure 15. One of the bifaces is a jasper triangular projectile point (Figure 15B) that was recovered from Horizon II of Test Pit 2. This biface is a finished tool with carefully resharpened edges. A small impact fracture is present on one side of the tip and one corner of the base has been broken and then resharpened. A heavy patina has developed over most of the point indicating that it was exposed at or near the ground surface for some period of time. A jasper side-notched point

FIGURE 15

Lithic Artifacts - 7S-D-9



(Figure 15C), which has been broken longitudinally from near its tip to one of its notches, was recovered from Feature 5, the hearth in the bottom of the pithouse, in direct association with the A.D. 550 radiocarbon date. This point's edges have not undergone final edging. The fracture of the point runs along an internal fracture plane within the raw material and the break is

believed to have occurred during final thinning when a thinning blow caused the internal fracture plane to release rather than the planned thinning flake. Thus, this point would represent a manufacturing reject. The final biface in the assemblage is a thick jasper biface (Figure 15D) with a transverse fracture extending from close to the tip to the opposite corner near the base. Both pieces of the biface were found close to one another at the base of Feature 1 in Test Pit 5. The transverse fracture was caused by a misdirected thinning blow and the flake scar from this blow can be observed to terminate in a hinge fracture along the fracture face in Figure 15D. Thus, this biface represents a manufacturing reject. The presence of debitage from late stages of biface reduction, biface rejects, and a hammerstone indicate that tool production took place at the site.

Numerous ceramic sherds were recovered from the middens and features. Of the total of 223 ceramic sherds, only 5 sherds are not Mockley cordmarked body sherds. They were Three Wolfe Neck cordmarked body sherds, one Coulbourn cordmarked body sherd, and one Townsend fabric impressed body sherd. The distribution of these ceramic types through the profile is discussed below. Most of the sherds are too small to discuss minimum vessel counts, and no rims are present in the assemblage. It is interesting to note that two separated modeled Mockley vessel bases are present indicating that at least two vessels were present. The presence of vessel bases and body sherds, but no rims, suggests that vessels which had been broken near the rim or orifice, but not at the base, may have been retained and used in their broken form.

Island site in central Pennsylvania (R. Michael Stewart, personal communication 1987).

Numerous bone fragments and large charcoal fragments were recovered from the 1/4 inch screen. Bone materials included turtle shell fragments, fish otoliths and vertebrae, a squirrel skull, small fragments of deer long bones, and bird bone fragments. An especially interesting bone artifact was found deep in Feature 1 close to the hearth (Feature 5). Figure 16 shows this proximal end of a deer long bone which has been modified for use as a tool handle. The bone has been split longitudinally and drilled through the proximal end. Large floral remains recovered include hickory nut and butternut shell fragments, which are completely burned and charred indicating that they were discarded as refuse and burned.

The artifacts described above are distributed in different ways through the profile. Table 4 shows the distribution of artifacts through the levels in Test Pit 1. Levels 1-3 correspond to Horizon I, which was interpreted as modern aeolian deposition, and the small amount of artifacts in this horizon supports this contention. Levels 4-6 correspond to Horizon II, which is the shell midden, and the bulk of the artifacts came from this horizon. Finally, Levels 7-9 correspond to a lower non-shell midden (Horizon III). In these levels, the frequency of artifacts, except for debitage, was lower than Horizon II. The presence of the one Coulbourn sherd in Horizon III could indicate that this horizon was deposited earlier than Horizon II. The distributions of debitage in Horizons II and III were

FIGURE 16

Bone Tool Handle - 7S-D-9

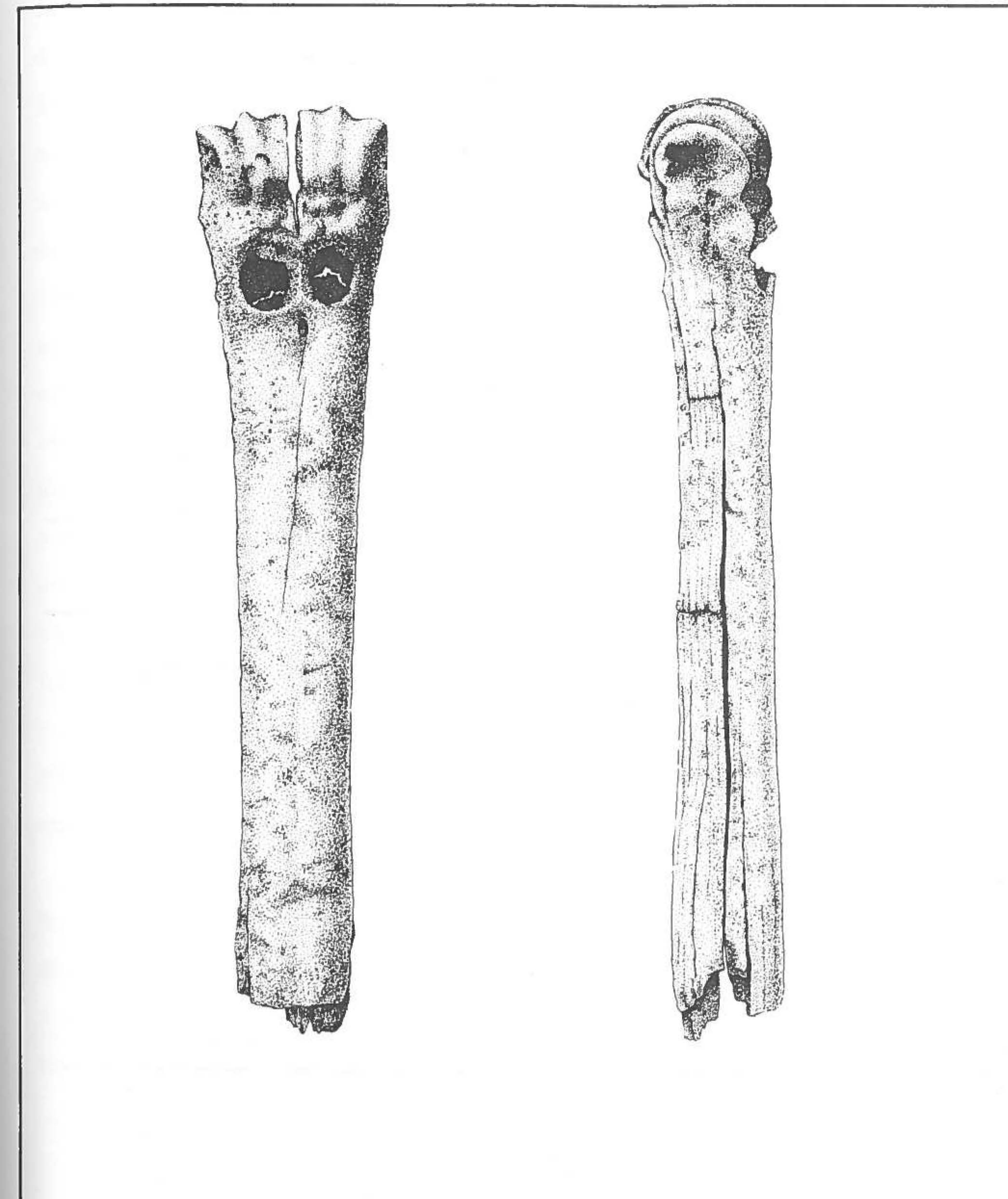


TABLE 4

DISTRIBUTION OF ARTIFACTS IN TEST PIT 1

Level	Ceramic Sherds	Flakes	Other
1	-----	--	-----
2	-----	--	-----
3	1 Mockley	1	-----
4	1 Mockley	8	-----
5	44 Mockley	13	hammerstone, deer bone, turtleshell,
6	1 Mockley	23	hickory nut, turtleshell, bird bone, fish bone
7	4 Mockley	81	deer, turtle
8	3 Mockley 1 Coulbourn	29	hickory nut
9	3 Mockley	--	-----

TABLE 5

DISTRIBUTION OF DEBITAGE IN TEST PIT 1 - HORIZONS II AND III

	Total Jasper Flakes	Total Chert Flakes	% Jasper by Horizon	% Chert by Horizon	Cortex %
Horizon II	28	15	65%	35%	26%
Horizon III	80	27	75%	25%	32%
Difference-of-Proportion Test Statistic			1.19	1.19	.75
p value			>.10	>.10	>.10

compared to see if there were any significant differences. Table 5 shows the distribution of debitage by horizon and a chi-square test was applied to the flake counts by material. The test statistic was equal to .98 (degrees-of-freedon = 1, p = .32) indicating that there were no significant differences in debitage distributions between the horizons. Difference-of-proportion tests were applied to raw material and cortex percentages by horizons and the test statistics noted in Table 5 all indicate no significant differences. Thus, there are no real differences in debitage distributions between Horizons II and III. Given the fact that there is only one Coulbourn sherd in Horizon III, there are insufficient data to say that Horizon III is a different occupation from Horizon II. Because there are some Mockley sherds in Horizon III, and because the debitage in Horizons II and III are similar, it is most likely that Horizon III is a non-shell living surface. The artifacts dropped on this surface were probably deposited by the same people who later covered this surface with the sheet shell midden of Horizon II. Also, it is likely that Horizon III is the same land surface into which Features 1 and 5 were excavated in the area of Test Pits 2-5. The Coulbourn sherd may be a stray sherd from an earlier occupation of the surface of Horizon III.

Table 6 shows the distribution of artifacts from the various horizons and features in Test Pits 2-5. Mockley ceramics were found in Horizon II and the Feature 1 fill, exclusive of Features 3 and 6. There are no diagnostic artifacts in Features 2 and 4 to indicate if they are associated with either Horizon II or the

TABLE 6

DISTRIBUTION OF ARTIFACTS IN TEST PITS 2-5

Horizon/Feature	Flakes	Ceramics	Other
Horizon II	41	36 Mockley	hickory nut, turtle shell, bird bones, triangular projectile point
Horizon III	5	3 Wolf Neck	------
Feature 1	218	29 Mockley	turtle shell, fish bone, hickory nut, fire-cracked rock
Feature 2	20	------	turtle
Features 3 and 6	1	------	------
Feature 4	--	------	hickory nut
Feature 5	10	------	1 side-notched point
Floor of Feature 1	45	------	squirrel skull, bone tool handle, jasper biface

Feature 1 pit fill. The similarity of the ceramics in Horizon II and Feature 1 fill suggests that they are related depositional events along with Features 2 and 4, which occur at the interface of Horizon II and Feature 1. A triangular point was found in Horizon II in association with the Mockley ceramics and this association has been reported at other Middle Atlantic sites (Geier 1983; Custer et al. 1983; Custer 1984:83-85). One Townsend sherd was recovered while cleaning up slump from a disturbance of the site during a weekend, and because of its uncertain context, this sherd is not considered in the stratigraphic interpretation.

There are no artifacts to guide in the stratigraphic interpretation of Features 3 and 6. The side-notched point, bone tool, jasper biface and Feature 5 with its A.D. 550 radiocarbon date all are associated closely in time and reflect the date of the use of Feature 1 as a pithouse. However, the similarity of artifacts through the Feature 1 fill and through Horizon II suggests that the A.D. 550 radiocarbon date also applies to the later pit fill and the Mockley ceramics as well. The presence of earlier Wolfe Neck ceramics in Horizon III is similar to the find of a Coulbourn sherd in Horizon III of Test Pit 1 and may represent an ephemeral occupation of the site prior to the later Mockley occupation which produced the features and midden horizons.

Shellfish Remains. Shellfish remains comprise the major portion of the site's matrix and their analysis provides some insights about the depositional history of the site. Also, application of techniques developed by Kent (n.d.) for analysis of oyster shell allows the determination of collecting environments and site seasonality. Table 7 lists counts of the major shellfish species by the stratigraphic units and features. The major shellfish species represented include American oyster (Crassotrea virginica), hard clam (Mercenaria mercenaria), and conchs or whelks (Busycon carica and Busycon canaliculatum). The frequency of the shellfish species is tabulated by shell count and weight of shell. Shell counts are based on frequency of left valves for bivalves. As can be seen, the species composition varies among the features and stratigraphic units across the site. For example, clams are more frequent in Horizon II, clams and oysters

TABLE 7

SHELLFISH SPECIES COUNTS - 7S-D-9

Provience	Oyster Count	Oyster Count%	Clam Count	Clam Count%	Whelk Count	Oyster Wt.	Oyster Wt.%	Clam Wt.	Clam Wt.%
Horizon II - T.P. 1	9	9	88	91	15	.67	4	14.11	96
Horizon II - T.P. 2-5	119	32	296	68	5	4.58	13	30.3	87
Feature 1	156	49	165	51	9	5.22	15	30.12	85
Feature 2	6	46	7	54	--	.25	20	.98	80
Feature 3	186	91	18	9	--	4.26	87	.61	13
Feature 5	8	73	3	27	2	.26	42	.36	58

(by count) are almost equally frequent in Features 1 and 2, and oysters are more frequent in Features 3 and 5. It should also be noted that relative frequencies of shell by individual counts and weights do not always agree. This discrepancy is due to the large size and dense composition of many of the clam shells compared to the oyster shells. Thus, the shell weights tend to over-represent the clam frequencies; however, the weights may more accurately represent relative edible meat quantities.

Horizon II in Test Pit 1 and Horizon II in Test Pits 2-5 have been correlated based on artifact assemblages and the soil matrix. The shell assemblages can be compared on the basis of shell counts and weights using a chi-square test. For shell counts the chi-square test statistic is equal to 14.75 ($p<.001$) and for shell weights it equaled 80.25 ($p<.001$). Both values indicate significant differences and there are significantly more oysters in Horizon II of Test Pits 2-5. Horizon II and the fill

from Features 1, 2, 3, and 5 from Test Pits 2-5 have sufficient shell samples to allow comparative analysis of the species composition. Table 8 summarized the paired chi-square tests for these features and Figure 17 shows the similarities of features based on oyster percentages. The differences between Features 3 and 5, Feature 5 and Features 1 and 2, and Features 1 and 2 and Horizon II are all significant. Features 1 and 2 show similar shellfish species composition. Differences in shellfish species composition of features is most likely related to different depositional events. Features 1 and 2 were probably the result of related depositional events.

Various attributes of the oyster shells in the features can be studied and compared among the features to understand depositional events, local estuarine environments, and shellfish collecting strategies (Kent n.d.). Based on the presence of various oyster parasites and other epifauna, the salinity of the water from which the oysters were gathered can be identified. Also, the presence of ribbing on the shells' surface indicates that the oysters were collected from shallow waters, generally less than .5m-1m deep. Table 9 shows a tabulation of the frequency of ribbing and the varied salinity regimes from which oysters in Horizon II and Features 1 and 3 were collected. It can be seen that the majority of the oysters were collected from waters of Salinity Regime I which is below 10 parts per thousand (ppt) for about half the year and is seldom above 20 ppt. Feature 3 does include some shells from Salinity Regime II (below 10 ppt for about 1/4 of the year, below 15 ppt for half of the year, and occasionally above 20 ppt). A chi-square test was

TABLE 8

COMPARISON OF SHELL COUNTS AND WEIGHTS
BY PROVENIENCE UNITS HORIZON II

	Horizon II	Feature 1	Feature 2	Feature 3	Feature 5
Feature 1	c-29.85 (<.001)* n-3.80 (.05)*	-----			
Feature 2	c-1.11 (.291) w-4.70 (.03)*	c-.01 (.92) w-2.46 (.12)	-----		
Feature 3	c-211.03 (<.001)* w-1361.47 (<.001)*	c-97.72 (<.001)* w-1251.62 (<.001)*	c-20.09 (<.001)* w-223.29 (<.001)*	-----	
Feature 5	c-7.94 (.004)* w-40.51 (<.001)*	c-1.61 (.61) w-32.74 (<.001)*	c-.81 (.37) w-8.59 (.003)*	c-2.21(.14) w-75.31 (<.001)*	-----

Key:
c - count ( ) - p value
w - weight * - significant difference

FIGURE 17
Shellfish Comparison - 7S-D-9

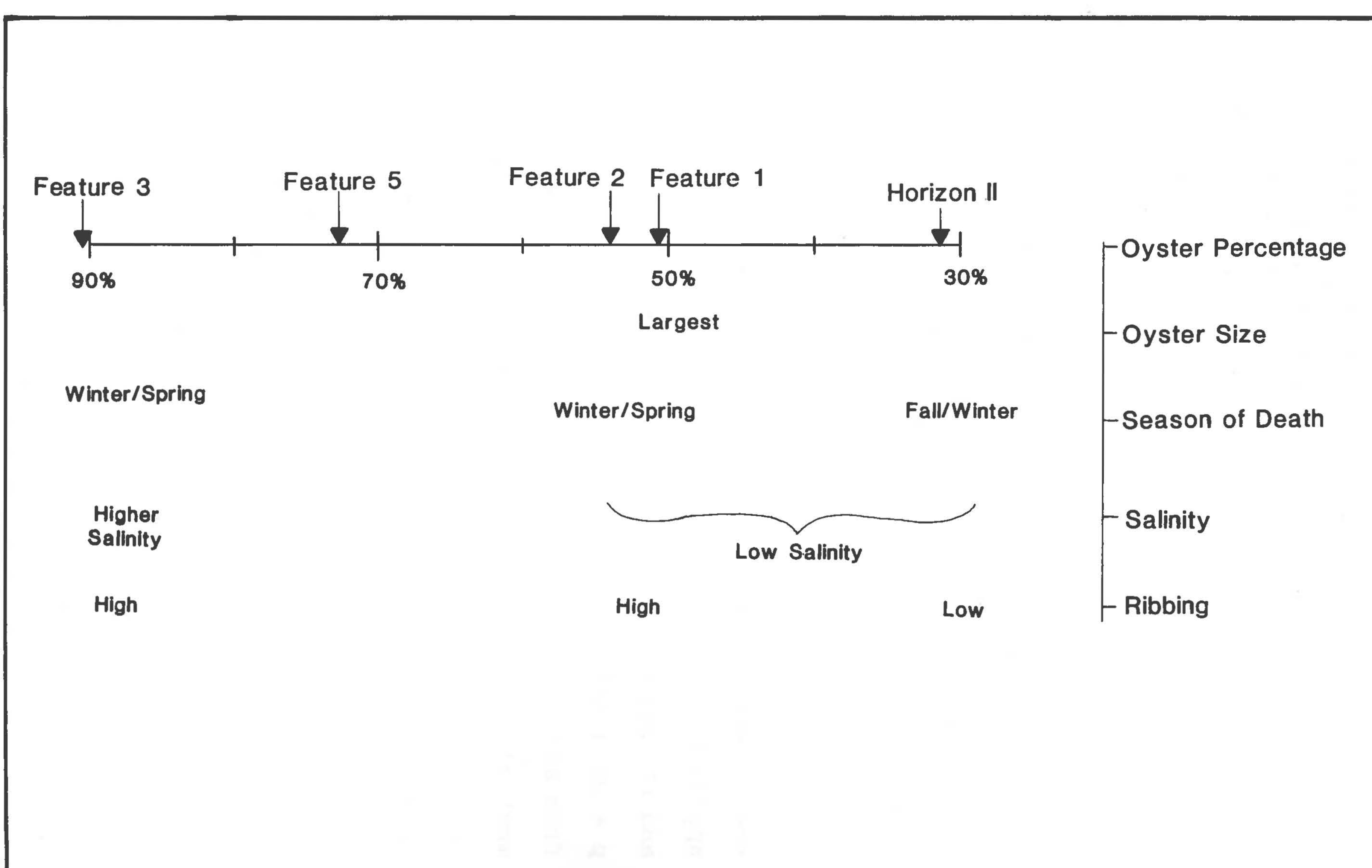


TABLE 9

OYSTER SHELL ATTRIBUTES - 7S-D-9

Provience	% Ribbed	Salinity Regimes I	II	III	IV
Feature 1	97	89	7	1	3
Feature 3	89	83	14	1	2
Horizon II	85	93	3	0	3

Key:

I - Salinity below 10 ppt for about half of the year and rarely above 200 ppt.

II - Salinity below 10 ppt. for about one-fourth of the year below 15 ppt. for about half of the year, and occasionally above 20 ppt.

III - Salinity occasionally below 15 ppt. and above 20 ppt. for one-fourth to half of the year.

IV - Salinity rarely below 15 ppt. and above 20 ppt. for most of the year.

applied to the distributions of shells from Salinity Regimes I and II and the test statistic was equal to 6.97 (D.O.F. = 2, p = .003) and indicates that there are significantly more oysters from Salinity Regime II in Feature 3. Table 9 also shows that most of the oysters showed signs of ribbing and were gathered from shallow water environments. Difference-of-proportion tests were used to compare the percentages of ribbing and the results are shown in Table 10. The high percentage of ribbing in Feature 1 is significantly different from the percentages from Feature 3 and Horizon II, which showed similar percentage values.

Oyster shell size, shell shape, and season of death can also be determined and compared among Horizon II and Features 1 and 3. Figure 18 shows the frequency distributions for these attributes.

FIGURE 18

Oyster Shell Attribute Distributions - 7S-D-9

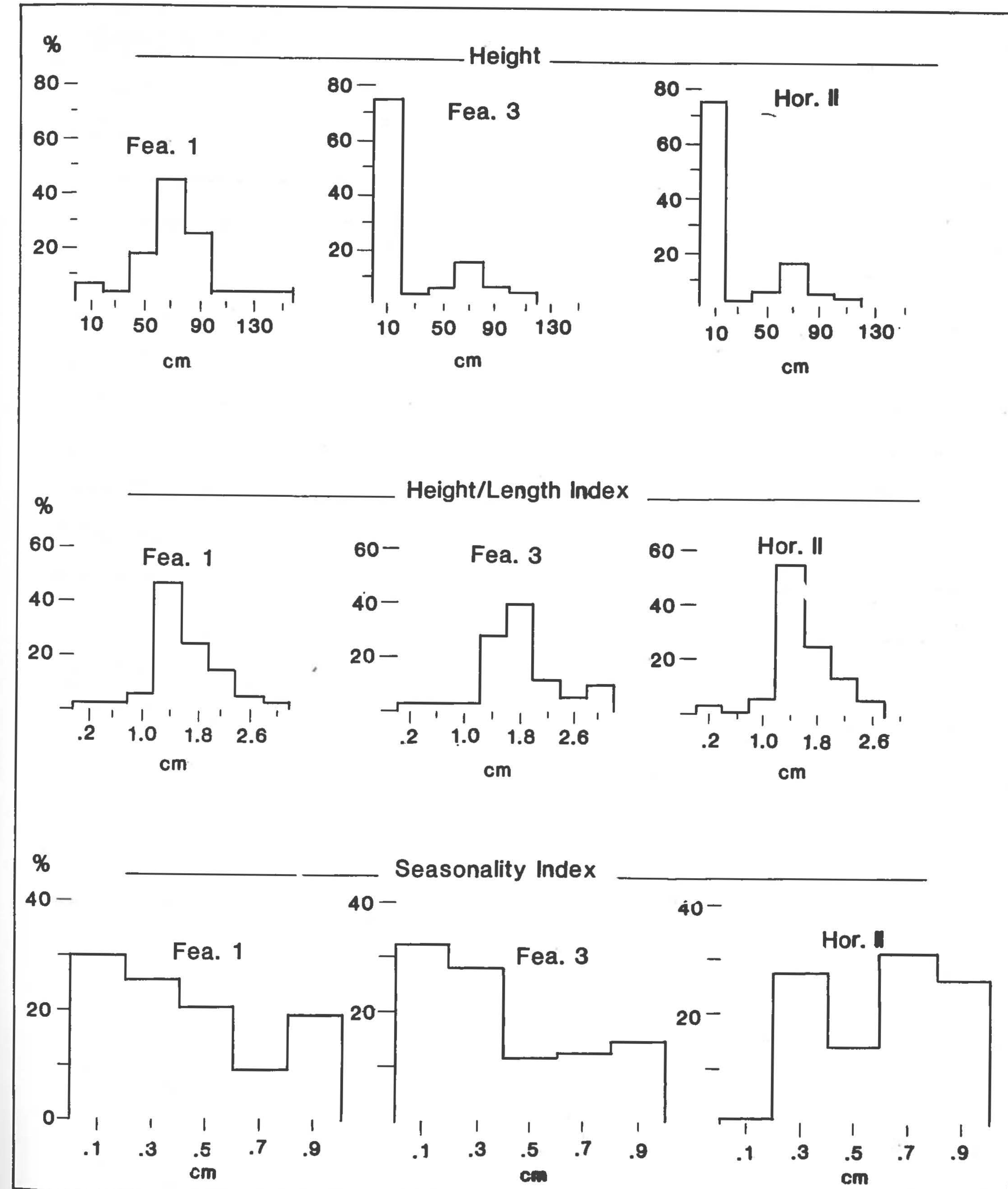


TABLE 10

COMPARISON OF RIBBING FREQUENCIES - 7S-D-9

Feature 1	-----		
Feature 3	2.55	-----	
Horizon II	3.25	1.80	-----
	Feature 1	Feature 3	Horizon II

Shell height is simply an indicator of shell size, and the distributions in Figure 18 show that Feature 1 had more larger oysters than Feature 3 and Horizon II. The height/length index is a measure of shell shape which is indicative of the environment within which the oyster grew. The distributions of height/length index shown in Figure 18 all indicate that the oysters are mudflat oysters and there are no apparent differences among the varied proveniences. The seasonality index is a measure of the relative proportion of growth that had taken place between the end of the last winter growth check (which occurs generally in early March) and the death of the oyster. It can be seen that Features 1 and 3 contain oysters gathered primarily during the early spring with the shells from Feature 3 showing a particularly focused procurement during the months of February through April. Horizon II is quite different and shows oyster procurement through the fall and into early winter. The varied season of collection for shells in Horizon II is a good indicator of varied episodes of deposition between Horizon II and Features 1 and 3. Figure 17 summarizes the various shellfish data comparisons.

To summarize the information on shellfish remains from the site, the varied associations of clams, oyster, and limited whelk, indicate that the inhabitants of the site were exploiting nearby mudflats in shallow waters of relatively low salinity, for the most part with salinity below 10 ppt. This collection also took place primarily during cold weather months.

The shellfish data also provide insights on depositional processes at the site. Horizon II differed in shellfish composition between Test Pit 1 and Test Pits 2-5 even though it is similar in terms of artifacts and soil characteristics between the 2 areas. Also, Horizon II was clearly differentiated from the underlying features in Test Pits 2-5 in terms of shellfish species composition, season of oyster collection, and incidence of shell ribbing. Because of the artifact and soil similarities in Horizon II in the area of Test Pit 1 and Test Pits 2-5, and because of its clear differentiation from the underlying features, Horizon II is thought to be the result of the same depositional event across the site which is distinct in time from the depositional events which produced the underlying features. Yet, these two depositional events were sufficiently close in time to produce very similar ceramic artifact assemblages. It should be noted that prior to analysis of the shellfish, it was not clear if Feature 2 was related to Feature 1, into which it intrudes or Horizon II (Figure 12). Shellfish species composition percentages indicate that Features 1 and 2 are very similar and are related in time. The general fill of Feature 1 is of interest because of the large size of the oysters and it is differentiated from Feature 3 on the basis of oyster frequency, oyster size, and salinity regimes. Feature 3 is clearly a depositional event distinct from the general Feature 1 fill. The high percentage of oysters and significantly greater proportion of oysters from a higher salinity environment in Feature 3 reinforces the initial stratigraphic interpretation of Feature 3 as a special dump of oysters into Feature 1 after its use as a pithouse. The sequence of filling of Feature 1 can be reconstructed as follows. After Feature 1 was used as a pithouse, ca. A.D. 550, a large amount of oysters collected from a relatively high salinity environment were dumped into it during the early spring. During the same season, the general fill of Feature 1 accumulated, including some large oysters from low salinity environments. Around this time Feature 2 was also intruded into the Feature 1 pit fill. Horizon II later accumulated over the site and during the time period of the accumulation of Horizon II, clams were exploited more frequently than oysters. The deposition of Horizon II took place later than the filling of Feature 1, but within the time range of the utilization of Mockley ceramics.

In order to further investigate the relationship of the depositional events which produced Horizon II, Feature 1, and Feature 3 in Test Pits 2-5, the growth patterns on oyster shell hinges were examined through the use of acetate peels (Kent n.d.) for distinctive growth patterns or "marker years". These patterns develop when distinctive seasonal environmental conditions cause either accelerated or reduced growth rates. The "marker years" can then be used to correlate the timings of shell

collection and deposition within the features and horizons. Many of the shells from Horizon II, Feature 1, and Feature 3 show a distinctive "marker year" which is characterized by a very long warm weather growth period. In Feature 1, 71% of the shells show this distinctive growth episode during the summer immediately prior the spring season of collection. The same growth episode is seen during the same time period in 75% of the oysters from Feature 3. Based on the high frequency of this "marker year", Features 1 and 3 are interpreted as probably being deposited during the same year. The same distinctive "marker year" is present on shells from Horizon II. However, the marker year is found two years prior to the year of shell collection (Figure 19) on 36% of the shells in Horizon II. Therefore, at least some of the shell and associated soils of Horizon II accumulated within two years after the filling of Feature 1.

Wood Analysis. Charred wood samples from Features 1, 3, 5, and Horizon II were submitted to Lucinda McWeeney of Yale University for species identification. Table 11 lists the species identification by provenience. Feature 5, the pithouse hearth, is different from the other features with its hardwood oak assemblage. The remainder of the assemblages are dominated by softwood pines. The choice of a slower and cleaner burning hardwood for an interior domestic hearth makes sense. The association of the faster burning, smoky softwoods with the shellfish remains and general midden deposits suggests that pine was used for food preparation fires, notably oyster roasting or smoking. The association of oak and pine in the samples is consistent for local paleoenvironmental reconstructions ca. A.D.

FIGURE 19

"Marker Year" in Shell Growth Patterns

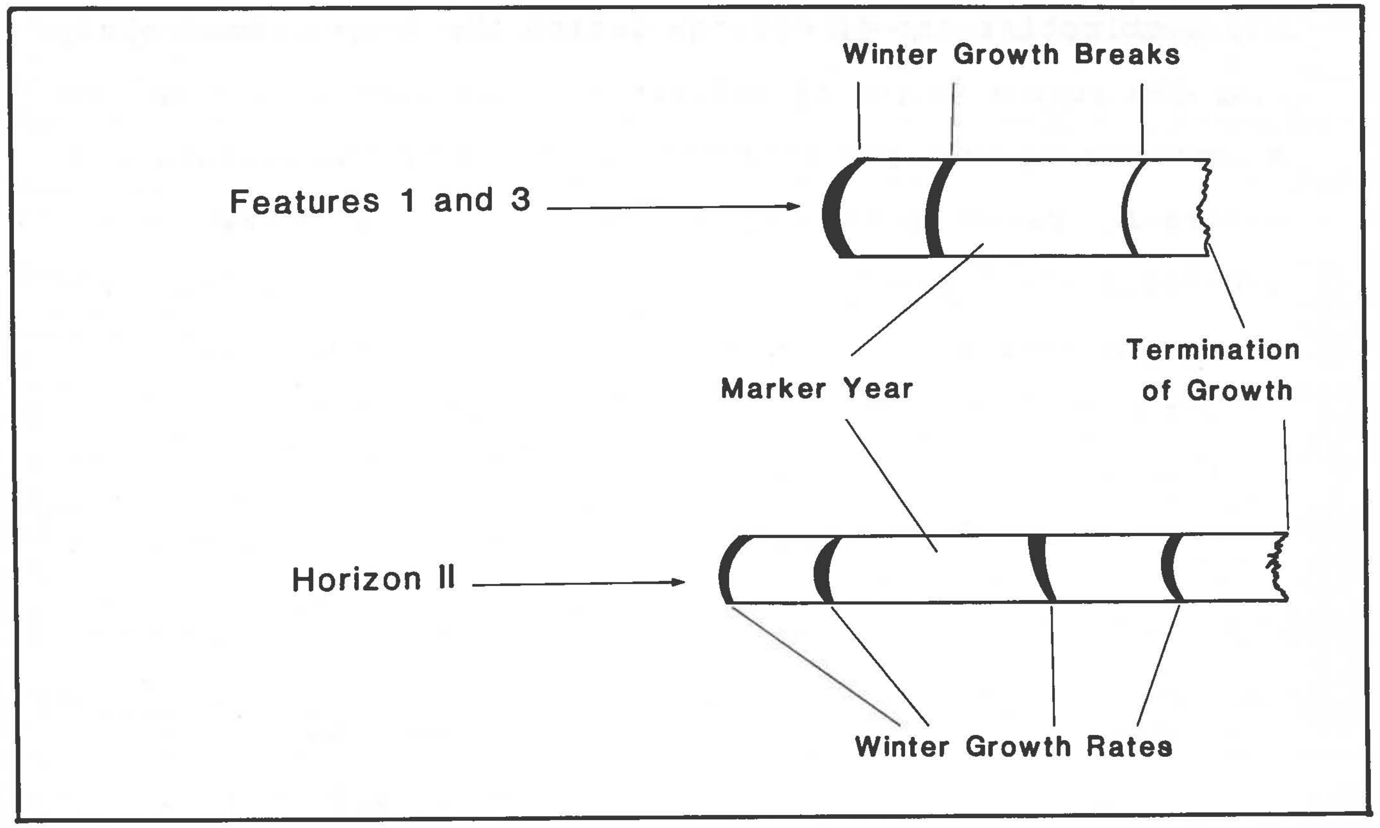


TABLE 11

CHARCOAL IDENTIFICATION BY FEATURES

Feature	Species Present
1	4 Genus Pinus (Pine)
3	3 Genus Pinus (Pine) 1 Genus Quercus (Oak) 1 hardwood twig
5	4 Genus Quercus (Oak)
Horizon II	1 Genus Pinus (Pine)

500 (Brush et al. 1980; Custer 1984:36-37, 92-93).

Flotation Analysis. A series of flotation samples were taken from general excavation levels and features at 7S-D-9 and light and heavy fractions were collected. Table 12 lists the artifacts and ecofacts recovered from the flotation of soils from Test Pit 1 and Table 13 shows the same data for Test Pits 2-5. No materials were collected from the light fractions. Figure 20 shows the distribution of artifacts and ecofacts from the flotation samples of various levels of Test Pit 1. The distribution of artifacts and ecofacts in the flotation materials from Test Pit 1 confirms the initial interpretation of the midden stratigraphy and the differentiation of Horizons II and III. Levels 4-6, noted as Horizon II, consists of a shell midden level with concentrations of bone, debitage, and charcoal in the flotation samples. Levels 7-9, noted as Horizon III, has little shell but does contain large amounts of debitage and charcoal. In the flotation sample from Level 5, a small amount of charred hickory nut shell is present and these ecofacts are charred both inside and out. The presence of these nut shells and their charring suggests that hickory nuts were consumed at the site, discarded, burned, and then deposited in Horizon II. The presence of hickory nuts, which are available in the late summer through fall, correlates with the oyster shell seasonality data which indicated a fall season of collection. Most of the bone remains from the flotation are fragmentary; nonetheless, remains of deer, fish, bird, and turtle can be identified, and these species were probably used as food by the site's inhabitants.

TABLE 12

FLOTATION MATERIALS - TEST PIT 1 - 7S-D-9

Catalog Number	Level	Sample Vol.(L)	Shell Weight(kg)	Charcoal Weight	Hickory Nut Weight	Bone Weight	Flake Count	Flake Weight	Comments
86/44/1	1	20	--	--	--	--	--	--	--
86/44/2	2	20	--	--	--	--	--	--	--
86/44/3	3	20	--	--	--	--	--	--	--
86/44/4	4	20	1.01	--	--	--	2	.32	--
86/44/5	5	20	13.93	1.20	.10	4.15	10	1.92	fish, deer turtle
86/44/6	6	20	8.16	1.83	--	2.73	11	1.81	turtle, deer, bird
86/44/7	7	20	2.38	1.14	--	1.12	2	.09	turtle
86/44/8	8	20	.15	1.43	--	.52	15	3.11	--
86/44/9	9	20	--	--	--	--	--	--	--

KEY:
L = liter
kg = kilograms

TABLE 13

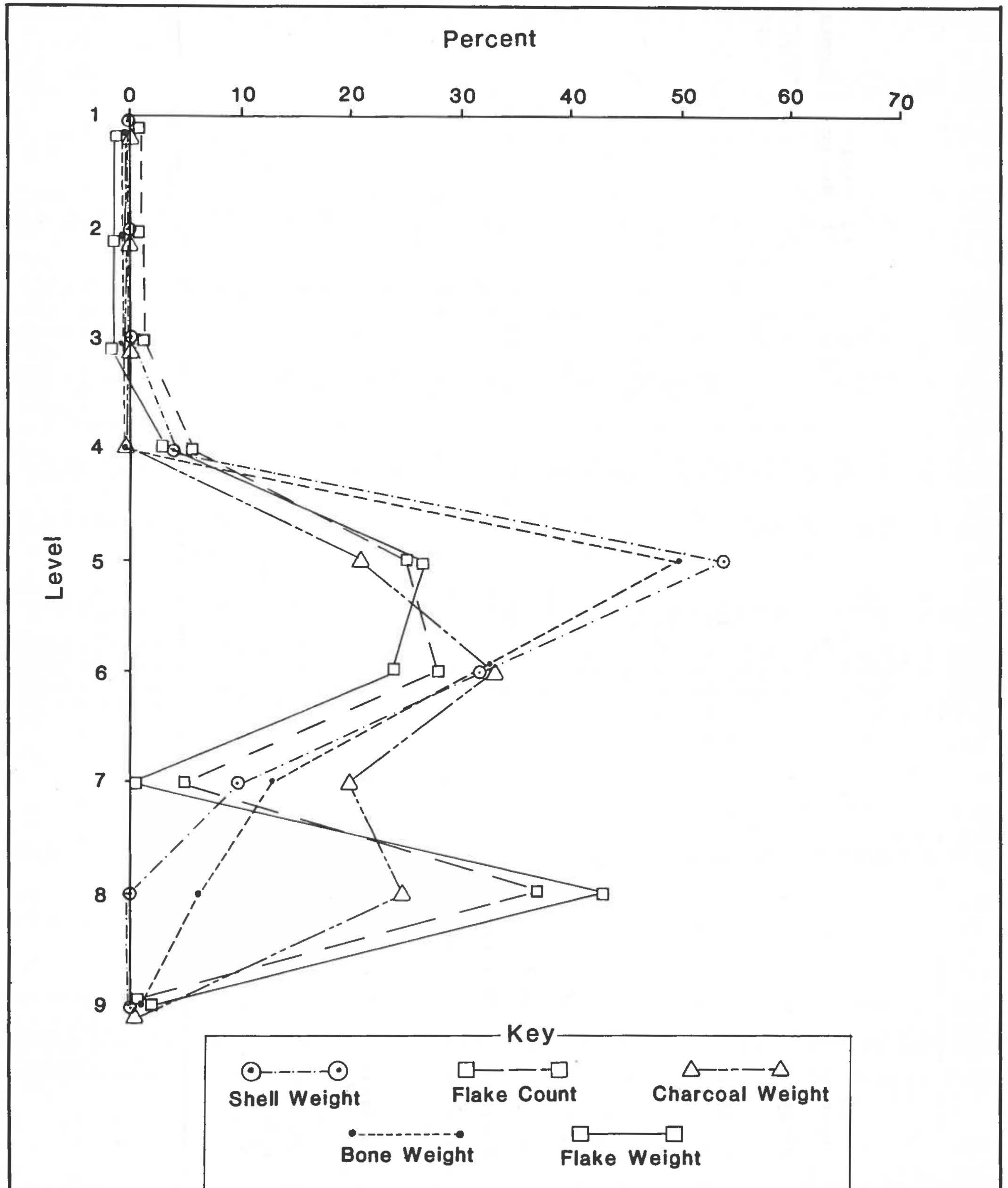
FLOTATION MATERIALS - TEST PITS 2-5 - 7S-D-9

Catalog Number	Feature/ Horizon(H/L)	Shell Weight(kg)	Sample Volume(L)	Charcoal Weight	Hickory Nut Weight	Bone Weight	Flake Count	Flake Weight	Comments
86/44/11	Horizon II(H)	4.44	20	.04	---	.93	7	2.21	turtle, fish
86/44/16	F.1 (H)	4.96	20	.51	---	2.15	25	1.86	fish
	F.1 (L)	---	20	3.19	---	.18	--	--	--
86/44/19	F.2 (H)	.51	10	.15	---	.74	13	1.78	--
86/44/37	F.2 (H)	1.26	20	.75	---	.23	10	.67	--
86/44/20	F.3 (H)	1.14	10	.19	---	---	2	.05	--
	F.3 (L)	---	10	.35	---	---	--	--	--
86/44/42	F.3 (H)	12.22	20	.65	---	---	--	--	--
86/44/47	F.4 (H)	.25	10	.15	---	---	--	--	--
	F.4 (L)	---	10	.59	---	---	--	--	--
86/44/45	F.5 (H)	.91	20	7.09	1.39	---	1	.05	--
	F.5 (L)	---	20	6.98	---	---	--	--	--

KEY:
H/L = heavy/light fraction
kg = Kilograms
L = liters

FIGURE 20

Flotation Material Distribution - Test Pit 1 (7S-D-9)



The flotation remains from Test Pits 2-5 cannot be ordered in a sequence of levels and are instead organized by feature. Figure 21 shows the distribution of the flotation materials among the features. Shell is primarily concentrated in Horizon II, Feature 1, and Feature 3, as was noted previousy. Charcoal was concentrated in Features 1 and 5. The very high frequency of charcoal in Feature 5 underscores its interpretation as a hearth. The greatest frequency of bone is found in the upper horizon and features, primarily Feature 1. A similar distribution is seen for debitage. The different distributions of flotation materials among the features and Horizon II indicate their varied depositional histories. Horizon II and the Feature 1 fill contain a variety of materials and represent general living site debris. Feature 3 with its preponderance of shell and little else is a short-term dumping of oysters as noted previously. Feature 5 is different and the large amount of charcoal in the hearth-fill includes some charred hickory nuts. Among the very fragmentary bone remains are turtle and fish remains in Horizon II and Feature 1.

By combining the information from the flotation and the screening, it is possible to describe the diets of the site's inhabitants. Table 14 lists the floral and faunal remains recovered from flotation and 1/4" screening. No attempt was made to quantify the relative proportions of the subsistence items in the diet because of the small sample of the site that was excavated. Nonetheless, it is possible to make some very general statements about the relative frequency of some food remains.

Flotation Material Distribution Test Pits 2-5 (7S-D-9)

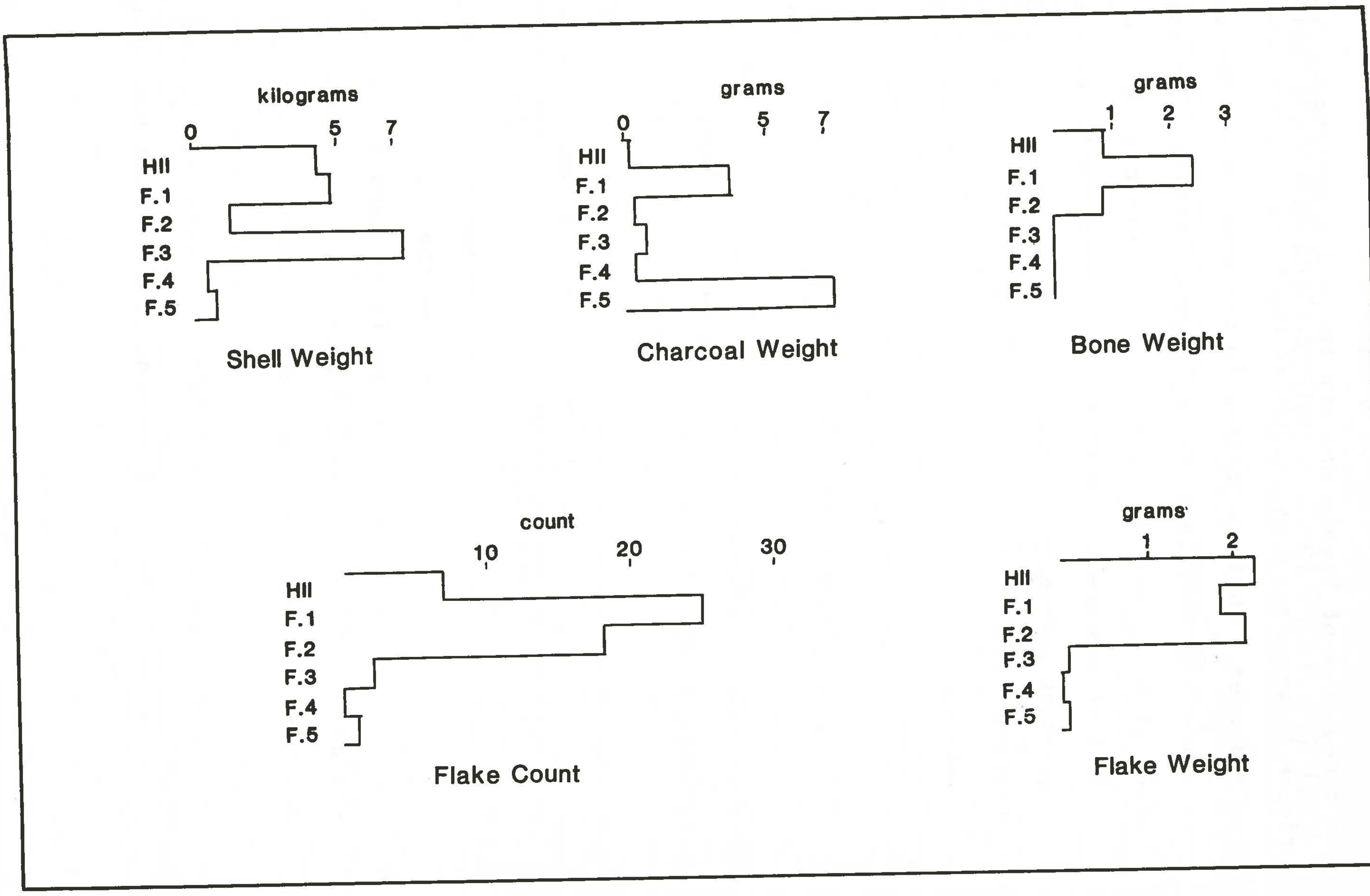


TABLE 14

COMPARATIVE FAUNAL AND FLORAL REMAINS

Test Unit	Horizon/ Feature	Flotation H	BN	D	F	T	B	S	1/4" Screen H	BN	D	F	T	B	S	General Shell O	C	W
1	Horizon II	X		X	X	X			X		X	X	X	X		X	X	X
1	Horizon III					X			X		X		X					
2-5	Horizon II				X	X			X				X	X		X	X	X
2-5	Feature 1				X				X			X	X			X	X	X
2-5	Feature 2												X					
2-5	Feature 3															X	X	
2-5	Feature 4								X									
2-5	Feature 5	X							X	X					X	X		

KEY:

H = Hickory
BN = Butternut
D = Deer
F = Fish
T = Turtle
B = Bird
S = Squirrel
O = Oyster
C = Clam
W = Whelk

Shellfish are clearly the most frequent food remains, and even though their high relative frequency may be due to variable preservation, there are so many shellfish in the midden that they must have been a major food source. Hickory nuts, deer, and turtle are the most frequent food resources after shellfish. The deer bone remains are extremely fragmentary and they may have been crushed for marrow extraction and boiling for bone grease in soups or gruels. Hickory nuts may have been roasted, but the complete charring of the nut shells indicates that meat was extracted raw rather than after roasting in the shell. Boiling, or rendering of nut meats for oil, may have taken place at the site. Fish, birds, and squirrel provided minor contributions to the diet.

<u>Summary Site Interpretations</u>. Site 7S-D-9 is a small base camp with a series of occupations that span the later part of the Woodland I time period. The major occupation exposed during the present investigations was a Carey Complex (A.D. 0 - 600) component; however, some slight tracts of an older Wolfe Neck or Delmarva Adena Complex occupation were also encountered. The Carey Complex occupation occurred primarily during cold weather months, and during this time a small pit house with a central hearth was constructed. A variety of aquatic resources were exploited in the nearby shallow tidal flats and deer and hickory nuts from adjacent terrestrial settings were also exploited. Limited stone tool production, mainly late stage biface reduction and resharpening, took place at the site and in the process lithic resources were carefully husbanded. After the pit house

was abandoned, it was filled rapidly by purposeful dumping of shell and organic midden soils. Seasonality data indicate that the pit house may have been used over the course of one winter. In general, the intensity of the occupation at 7S-D-9 indicates that coastal resource utilization was more highly focused and involved a more sedentary occupation than previously thought (Custer 1984:132).

DISCUSSION

The results of the UDCAR survey and test excavations have implications for a number of research topics in Delmarva Penisula and Middle Atlantic archaeology. Each topic is discussed below.

<u>Site Distributions and Settlement Patterns</u>

The results of the UDCAR survey of Angola Neck, Piney Neck, and the upper Cowbridge Branch drainage show that the general prehistoric settlement of interior portions of Delaware's inland bays was more intensive than previously thought. A range of both base camps and procurement sites are found throughout the area surrounding the inland bays and their high and low order tributaries. Prior to the UDCAR survey, the majority of the sites known for the Atlantic Coast region were late prehistoric Woodland II sites post dating A.D. 1000. The UDCAR survey identified many additional Woodland II sites; however, numerous Woodland I sites were also identified. Most of the Woodland I archaeological complexes identified for the southern Delmarva Peninsula including Clyde Farm, Delmarva Adena, Wolfe Neck, Carey, and Late Carey complexes are represented in the sites' occupations. Woodland I components are also found at both small procurement sites and larger base camps, such as 7S-K-33 and 35 and 7S-F-30, 32, 33, 34-36, 39, 44, 46, and 47. The absence of earlier sites predating Woodland I times is probably due to the submergence of coastal landscapes by sea level rise because this section of the Delaware coast has been changed to the largest extent, compared to other areas, during the Holocene (see Figure 3 and Kraft et al. 1976).

The extensive Woodland I settlement of the inland bay area is due to the fact that during Woodland I times this area was equivalent to the mid-drainage zone of central Delaware (Custer 1984:27) which included the oligohaline ecotone where freshwater and saltwater environments intermingled. Woodland I settlement focus on this environmental zone has been documented elsewhere (Custer 1984:143-145), especially along the St. Jones and Murder-kill drainages (Custer and Galasso 1983) and along the Appoquinimink and Leipsic drainages (Custer and Bachman 1986; Custer, Bachman, and Grettler 1986). Unlike the case along other drainages to the north, however, the later Woodland II Slaughter Creek Complex archaeological sites of the Atlantic Coast Zones are found in the same general area as the earlier Woodland I sites. In fact, many of the inland bay base camps are multicomponent with both Woodland I and Woodland II occupations (Custer and Griffith 1986:34-44). In contrast, along many of the more northern Delaware Bay drainages, the Woodland II sites are located further inland along the drainages compared to the Woodland I sites. It is suggested here that along the more extensive drainages of the northern Delaware Coastal Plain, continuing Holocene sea level rise forced the oligohaline ecotone

further into the interior during Woodland II times and settlements shifted inland accordingly. In the shorter and wider drainages of the Delaware Atlantic Coast, such as Indian River and Rehoboth Bay, continued sea level rise caused the marshes to increase in size close to the coast, but not to continue to expand inland. The extensive and wide salt marshes of the inland bays were productive settlement locations and retained many ecotone characteristics through Woodland II times. A similar phenomenon has been suggested for the Slaughter Creek drainage in the lower Delaware Bay (Custer and Griffith 1986:33-35). The smaller size of the southern Delaware coastal drainages also fostered higher population densities, larger site sizes, and greater cultural complexity during Woodland II times (Custer and Griffith 1986:55-57).

With respect to site specific settlement patterns, the data from the limited test and salvage excavations at 7S-K-35 and 7S-D-9 show that coastal resource utilization at some locales in the Atlantic Coastal zone involved a greater degree of sedentism than was previously expected. At 7S-K-35, the sedentism is indicated by numerous Woodland I and II storage pits while at 7S-D-9 the sedentism is indicated by a pit house with extensive associated midden deposits. In both cases it is hypothesized that these sites represent residential bases from which forays for the procurement of subsistence resources took place. Limited subsistence data from 7S-K-35 and extensive data from 7S-D-9 indicate that at these two sites, this pattern of site utilization took place during cold weather months.

Ceramic Chronology

The association of several design motifs on a variety of Townsend ceramic vessels from a Woodland II feature at 7S-K-35 has some important implications for the development of the Townsend ceramic chronology. The initial study of the Townsend ceramic chronology by Griffith (1977; 1982; Griffith and Custer 1985) indicated that complex design varieties, such as the Rappahannock Incised motifs (RI3-7) characterized the earlier portions of the Woodland II Period prior to A.D. 1300. The more simple Townsend Corded, Towsend Plain, and simple varieties of Rappahannock Incised (RI1, RI2) were thought to characterize the later Woodland II time period after A.D. 1300. Ceramic associations from several sites clearly supported this chronology; however, recent excavations at the Bay Vista site in the Atlantic Coast Zone (Custer et al. 1985) produced a shell radiocarbon date of 850±55 B.P. (UGa - 1440) - A.D. 1100 with an association of simple Townsend ceramics (Custer et al. 1985:10-13). This date and ceramic association contradicted the initial Townsend chronology and it was suggested that either there was a problem with the Bay Vista radiocarbon date or perhaps the Townsend chronology needed some revision.

The association of undecorated Townsend Plain, Townsend Corded Horizontal and complex Rappahannock Incised ceramics (RI4, RI5) in Feature 1 at 7S-K-35 with a radiocarbon date of A.D. 1020 also contradicts the intial Townsend chronology and also suggests that the Bay Vista date may not be inaccurate. We suggest that the Townsend ceramic chronology may be revised such that the simple Townsend designs are found throughout the Woodland II

Period (A.D. 1000 - 1600). Complex incised designs, including most of the Rappahannock Incised varieties, are found primarily during the early Woodland II time period (A.D. 1000 - 1350). Thus, the presence of simple Townsend ceramic designs is not diagnostic of a late Woodland II occupation. Nonetheless, it should be noted that simple design motifs occur at the pre-A.D. 1350 sites, and the designs tend to be incised rather than corded. Thus, Griffith's (1977) observation that corded horizontal design motifs are more common during late Woodland II times has not been contradicted.

Projectile Point Chronology

Over the past few years, there has been an increasing concern among Middle Atlantic archaeologists that traditional projectile point chronologies are not sensitive to the degree of variability in projectile point assemblages (Evans 1984). In light of this concern, there is an interest in identifying projectile point assemblages from closed contexts that represent limited points in time. The features from Test Pits 2-5 at 7S-D-9 represent a time interval of less than 5 years and the biface assemblage includes side-notched, triangular, and Fox Creek points at A.D. 550. This variability has been seen at other Coatal Plain sites (Custer, Stiner, and Watson 1983; Griffith and Artusy 1977; Geier 1983) and is greater than what would have been expected from traditional typologies.

Rhyolite Utilization

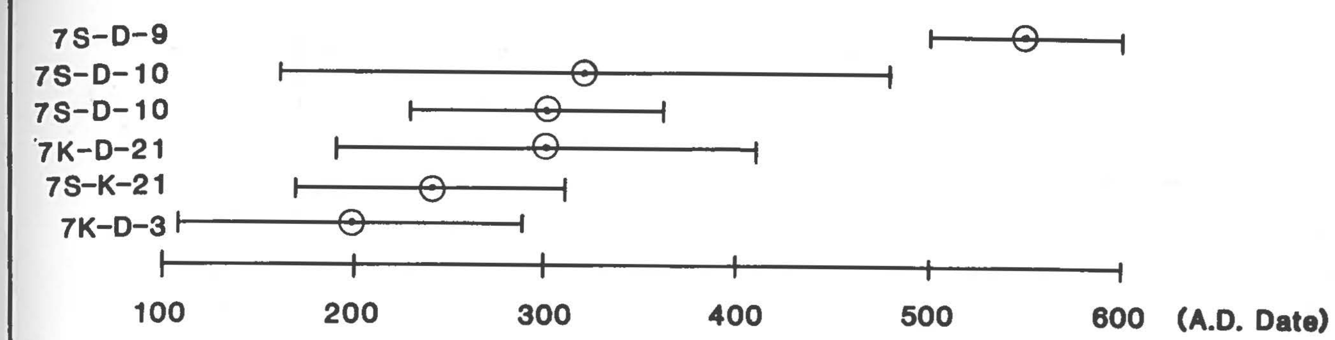
Excavations at 7S-D-9 produced a fox creek rhyolite projectile point and rhyolite debitage and all of the rhyolite is of the aphanitic variety. At the rhyolite outcrops in the Blue Ridge of Pennsylvania and Maryland there are four visually distinctive varieties of rhyolite suitable for tool manufacture and usually 3 of the varieties occur together at any given outcrop site (Stewart 1984). Because only a single variety occurs at 7S-D-9, it may be suggested that the trade and exchange systems which brought rhyolite to the Atlantic Coast area during Carey Complex times involved a degree of preferential selection of certain varieties of rhyolite. Similar selections are seen throughout the Delmarva Peninsula during late Paleo-Indian and Woodland I times (Custer 1988).

Coastal Resource Utilization

Excavations at several Carey Complex midden sites over the past few years allow a comparative analysis of resource utilization in a variety of environmental change. Figure 22 shows the ranges of radiocarbon dates for a series of Carey Complex sites with midden or other archaeological features which produced subsistence remains. It can be seen that the date for 7S-D-9 is somewhat outside the date ranges for the other sites; however, the sites can still be meaningfully compared. Of the sites noted in Figure 22, two (7S-K-21 - Custer, Stiner, and Watson 1983; 7S-D-10 - Griffith and Artusy 1977) are coastal sites with similar shell midden sites. The Wolfe Neck site (7S-D-10) is a shell midden located within 5 km of 7S-D-9 (Griffith and Artusy 1977) and the Wilgus site (7S-K-21) is a thin shell and organic earth midden on the south of Indian River Bay. In contrast, the Carey Farm site (7K-D-3) and the Hughes-Willis site (7K-D-21) are located in the mid-drainage zone of the St. Jones

FIGURE 22

Radiocarbon Dates for 7S-D-9 and Related Mockley Sites



Site Dates:

7K-D-3	1750 ± 90 BP	I-5817
7S-K-21	1710 ± 70 BP	UGa-1762
7K-D-21	1650 ± 110 BP	I-6060
7S-D-10	1625 ± 160 BP	UGa-1273b
7S-D-10	1620 ± 65 BP	UGa-1273a
75-D-9	1400 ± 50 BP	UGa-5447

River and ecofacts are found in storage pits which were later used as refuse pits (Griffith 1974; Thomas et al. 1975). All of the sites represent base camps.

Table 15 lists the varied ecofact data from the sites, and given the different excavation and flotation strategies utilized, a more detailed comparison cannot be made except for a comparison of 7S-D-9 and 7S-K-21. Among the 3 coastal sites (7S-K-21, 7S-D-9, and 7S-D-10), 7S-D-10 shows the use of the greatest variety of shellfish. 7S-D-9 and 7S-K-21 show a more focused use of clam and oyster. The one interior site showing shellfish use

TABLE 15

CAREY COMPLEX SUBSISTENCE DATA

Site/Provenience	Seasonal Use	Shellfish O	C	W	M	Ot	Faunal D	B	F	T	S	Do	Floral H	BN	A	C	Am	OS
7K-D-3	Fall-Winter	X					X	X		X	X	X	X					
7S-D-10	?	X	X		X	X	-----------No Data-------------											
7K-D-21	Fall-Winter						X	X		X			X	X				
7S-K-21	Fall-Spring	X	X				X	X	X	X	X	X	X	X	X	X	X	X
7S-D-9	Fall-Spring	X	X	X			X	X	X	X			X	X				

References: 7K-D-3 Griffith 1974
7S-D-10 Griffith and Artusy 1977
7K-D-21 Thomas et al. 1975
7S-K-21 Custer, Stiner, and Watson 1983
7S-D-9 this volume

KEY:

O = Oyster
C = Clam
W = Whelk
M = Mussel
OT = Other
D = Deer
B = Bird
F = Fish
T = Turtle
S = Small mammals
H = Hickory
BN = Butternut
A = Acorn
C = Chenopodium
Am = Amaranth
OS = Other seeds
Do = Dog

(7K-D-3) produced only oyster remains, which would have been the only shellfish available in the St. Jones mid-drainage zone. Few differences are observable in faunal utilization, except to note that a variety of species are used. Among the floral resources, hickory and butternut are found at all of the sites, but in this category the variable flotation strategies make comparisons impossible.

Sites 7S-D-9 and 7S-K-21 were dug using comparable methods of excavation and flotation and can be compared on a more detailed basis. At 7S-K-21 (Custer, Stiner, and Watson 1983), it is believed that shellfish, stored Amaranth and Chenopodium, and turtles provided the basis of a fall-spring occupation. A variety of freshwater fish, deer, and small mammals supplemented the diet. The occupation season at 7S-D-9 is similar, and shellfish, nuts, and deer provided the bulk of the subsistence base with fish, turtle, and small mammals as a small supplement. Conspicuously absent from the floral assemblage at 7S-D-9 are seeds of any kind. It is suggested here that the recurved sand spit tips of the Cape Henlopen setting for 7S-D-9 were not conducive edaphic settings for Amaranth and Chenopodium. Indeed, today such plants are rare in the site area although a few seed-bearing halophytes are present in the marsh. On the other hand, there are many edaphic settings conducive to the growth of Amaranth and Chenopodium along the marshes of Indian River near 7S-K-21. Thus, the absence of seeds at 7S-D-9 is a matter of natural availability.

It is interesting to note that there were sedentary coastal occupations at both sites (7S-K-21 and 7S-D-9) based on very different resource use patterns. Seeds were very important at 7S-K-21, but were not used at all at 7S-D-9. The implication of this finding is that somewhat sedentary coastal occupations could be based on varied resource use and that subsistence patterns were closely tied to local microenvironmental conditions during Carey Complex times. In sum, coastal resource utilization is quite variable during Carey Complex times.

In conclusion, the UDCAR survey and test excavations in the Atlantic Coast Zone of Delaware looked at only a small sample of the area's archaeological record. The large amount of information gained from this small sample only highlights the rich potential of the region's archaeological record for enhancing our understanding of prehistoric lifeways.

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