THE SANDOM BRANCH SITE COMPLEX AND REGIONAL CONTEXTS

American Indians carried out their daily activities—large and small, sacred and profane—across the Sandom Branch Site Complex landscape over thousands of years. The archaeological sites themselves are comparatively small, and clearly part of a larger subsistence-settlement system, but the information that they add to our understanding of Delaware's native inhabitants is immeasurable. Artifacts, ecofacts, and features generated by American Indian activities are key to addressing a wide range of research issues pertaining to the prehistory of inland sites in Delaware's High Coastal Plain, as well as to broader issues of anthropological interest. In this section, we explore a variety of research topics, through syntheses of the findings presented in earlier sections, and the presentation of new analyses that build on these findings. As introduced first in Section 2.0, the research areas addressed here began with the basic questions archaeologists ask about pre-Contact American Indians and were expanded to create a more humanistic view of the past: creating a chronological framework; technology, materiality, and social processes; scales of social organization; paleoenvironmental studies; and, a landscape approach. Special attention is placed in this section on the interpretation of thermally altered stone features, because this represents one of the major contributions that developed out of the analyses of the Sandom Branch Site Complex.

3.13 Creating a Chronological Framework

3.13.1 Stratigraphy and Site Formation Processes

The necessary first step in creating a chronological framework for the Sandom Branch Site Complex depended on understanding stratigraphic associations. The relationships between the data of known temporal range and the surrounding non-diagnostic materials were assessed through detailed examination of both horizontal and vertical contexts. In the case of the Sandom Branch sites, the artifact-bearing portion of the soil column was relatively thin. It measured between 20 and 40 cm in thickness in most parts of the two sites and occurred near the modern ground surface. Stratigraphic separation of cultural deposits was challenging to perceive during field recovery and later in data analysis.

Site formation processes impact our understanding of stratigraphic associations, especially relative to organic material selected for dating, or the position of temporally diagnostic artifacts. Part of the archaeological life cycle of a feature is the postdepositional environment in which the feature resides. In spite of appearances resulting from the pace at which we can perceive change, this environment is never completely static. Change may be fast or slow, depending on specific conditions, but archaeological deposits are not absolute nor are they immutable. Recognition of the effects of postdepositional agents, both cultural and natural, on cultural deposits has grown among archaeologists over the past few decades and has led to the documentation of potential disturbance processes (Wood and Johnson 1978; Schiffer 1987). The thermally altered stone features at the Sandom Branch sites, occurring at or near the contemporary ground surface since they were first deposited, would have been subject to many of the processes identified in these studies that may have operated to alter or deform their original morphological characteristics.

Some change may have altered the features while they were exposed on their original occupational surface, resulting from sorting, scavenging, or clean-up activities. Incidental

scattering may also have resulted from trampling or scuffing, as people or animals walked across the site. Some of these processes were evident in large fragments that were missing from the refitted cobbles in Features 30 and 35, implying that the fragments had been either intentionally or incidentally removed. Additional evidence of postdepositional movement was seen in the spatial arrangements of the refitted artifacts from the features, and was corroborated by analyses of each feature and the artifact contents of its surrounding sediment matrix. In most cases, thermally altered stone fragments that occurred in units surrounding the boundaries of the features were found to have been sufficiently similar in material, distribution and size range to imply that they were related to the clustered stone in the features. In each case, the mean size of the scattered fragments was lower than the figure calculated for the feature, suggesting that smaller spalls had migrated postdepositionally from the main concentration both vertically and horizontally.

The direct evidence of artifact displacement noted in refitted fragments was most apparent in artifacts that refitted between the documented boundaries of Features 30 and 35 and proveniences a meter or more distant. Vertical movement was also recorded in refits, between the features and both the overlying A horizon and the underlying B horizon—the latter as much as 40 cm below the level of the feature. While several cultural and natural mechanisms can be proposed as agents for this kind of postdepositional artifact migration, one example was clearly evident during field excavations in the form of a 30-cm-diameter tree growing through the western edge of Feature 35, in the main excavation block in 7NC-J-227. The tree had a tap root, tapering from a maximum diameter of approximately 10 cm that extended deep into the subsoil, well beyond the limits of cultural deposition in this part of the site. As a tree of this size dies and its root system decays, the sediment surrounding the roots will collapse, carrying large and small elements, including silt, sand, and artifacts, downward into voids left by the root channels (Lutz and Griswold 1939).

The uprooting of trees can cause obvious and significant disruption to the affected deposits. Evidence from natural resource studies (Schaetzl et al. 1989; Langhor 1993) and from the archaeological assessment of modern tree disturbances (Mueller et al. 1997; Petraglia et al. 2002) suggests that the disturbance or pit that results from a fallen tree is not particularly deep—typically less than 50 cm—and that unless distinctive soil horizons are broached or the profile becomes rapidly buried, soil formation processes may begin to blend the intermixed sediments in a relatively short period of time. Evidence of this form of disturbance was recorded in several locations at the Sandom Branch sites, including the west wall section of Block A, at 7NC-J-228, where the tree's root ball had brought sandy subsoil to the surface and allowed organic-enriched A horizon deposits to collect well into the original subsoil levels in a form of inverted stratigraphy (Figure 8-1).

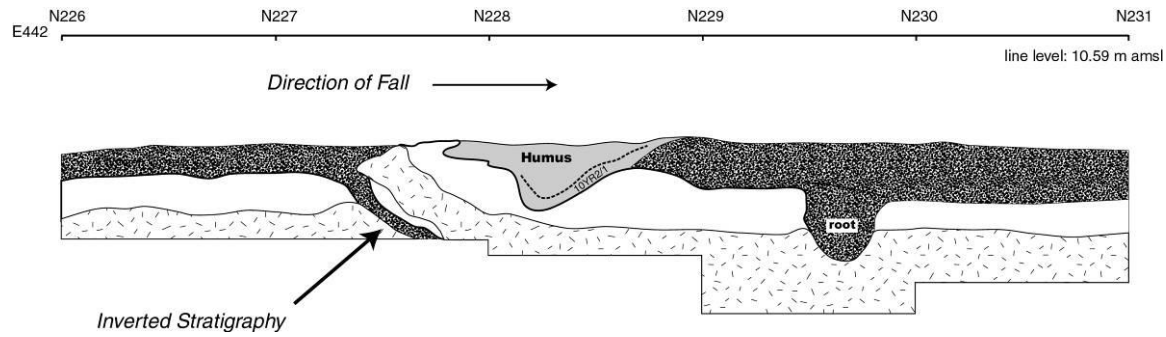


Figure 8-1. Treefall Disturbance along E442 Gridline, Block A.

While this form of disturbance may be catastrophic, it is usually localized and may not be as disruptive across a wide area over an extended period of time as the slow, horizontal growth of tree roots. As they grow, roots can compress surrounding soils, and in coarse, sandy sediment environments can push artifacts from their paths. Root growth was in fact the most readily observable agent of feature deformation across both sites. Feature 26, on the northern edge of Block A, in 7NC-J-228, consisted of a group of thermally altered stone fragments that was sufficiently scattered and visible boundary definition was problematic. The ultimate source of the widespread distribution, whether cultural or natural, could not be determined with certainty, yet root growth appeared to have been an important factor. An oak tree approximately 40 cm in diameter grew through the cluster north of the approximate center of the feature, and one of the large roots near the surface had grown between a group of heated rock fragments, pushing them to either side. In another example, a tree grew through the distribution of stones comprising Feature 17, in the western part of Blocks GHI (Plate 8-1). The root system could be seen uplifting a cluster of stones, forcing them out and away from their original positions. Roots were also recorded in Feature 36, a cluster of stones in the northern part of Blocks GHI, extending between and separating artifact groups (Plate 8-2).

The trees noted thus far were relatively small in diameter and were supported by proportionately small root systems. Two final images will complete the range of evidence of tree growth disturbance that was observed during the excavations at the Sandom Branch sites. In two instances, along the north wall of Blocks GHI (Plate 8-3, see also Figure 7-7), and the north wall of Block A (Plate 8-4), the roots of large trees were observed spreading widely and in some cases deeply into the soil column. Given the diameters of the major roots, there was potential for extensive disruption of feature distributions and the substantial rearrangement of artifacts in the cultural deposits that they might penetrate. Considering the proximity to the ground surface of the thermally altered stone features at both of the sites, and the possibly 2,000-year time span since the features were constructed, used, and abandoned, it is not difficult to imagine the effects that such activity might have had on feature contexts.

Plate 8-1. Tree Disturbance, Feature 17, Blocks GHI.

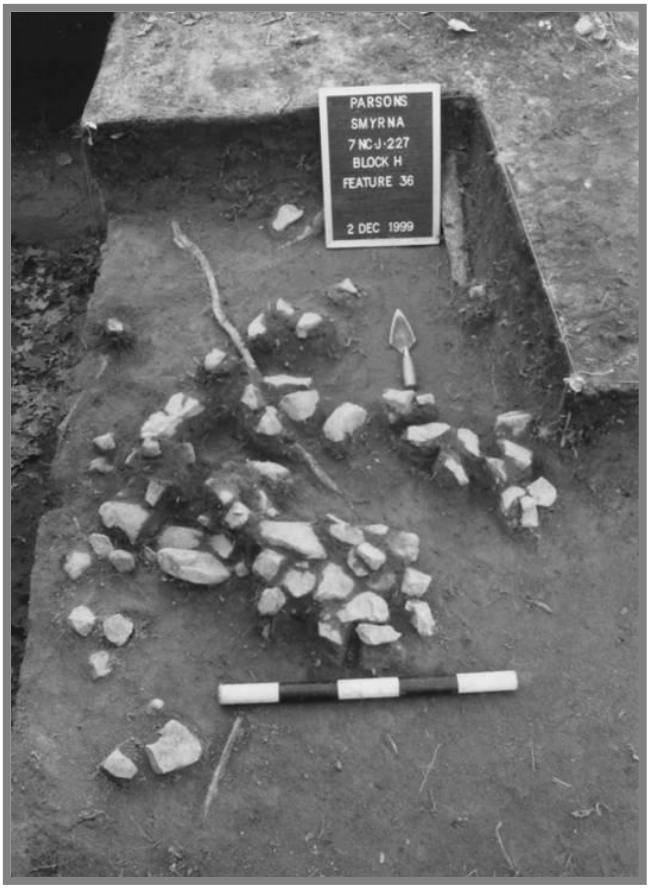


Plate 8-2. Tree Disturbance, Feature 36, Blocks GHI.

Plate 8-3. Sectioned Tree Root System, N72 Gridline, Blocks GHI.

Plate 8-4. Sectioned Tree Root System, E446 Gridline, Block A.

3.13.2 Temporally Diagnostic Artifacts

Also contributing to the construction of a chronological framework were temporally diagnostic artifacts in the form of points and ceramics. Points and ceramics have been assigned broad temporal ranges, and usually within culture historical frameworks developed in other regions of the Middle Atlantic or Northeast. Although somewhat imprecise, temporally diagnostic artifacts remain important in chronology building exercises, especially when combined with stratigraphic information and radiocarbon assays. For example, temporal assignments remain imprecise for small Woodland I stemmed points and clay-tempered ceramics that are common throughout Delaware. Nevertheless, they can provide an overall time frame within which to assess the depositional contexts at the site and so help identify specific component assemblages that can be used to interpret site use.

3.13.3 AMS Assays

Radiocarbon assays can provide a more precise age for an occupation than possible with stratigraphic information or temporally diagnostic artifacts. A less than ideal number of AMS assays were obtained from the Sandom Branch Site Complex because there was insufficient preservation of suitable organic material from discrete contexts. Nonetheless, the AMS assays obtained from features at the Sandom Branch Site Complex are integral to interpreting the occupational histories of these sites (Figure 8-2; Table 8-1). AMS assays were also obtained from bulk sediments in an effort to interpret the transformation of the landscape through time. A graphical display of all the AMS assays obtained as part of this research shows that most date from the Late Archaic into the Middle Woodland. Two of the assays obtained are clearly invalid (Beta-149033 and Beta-149037). Individual assays are discussed below in the discussions of the occupation history of each of the Sandom Branch sites.

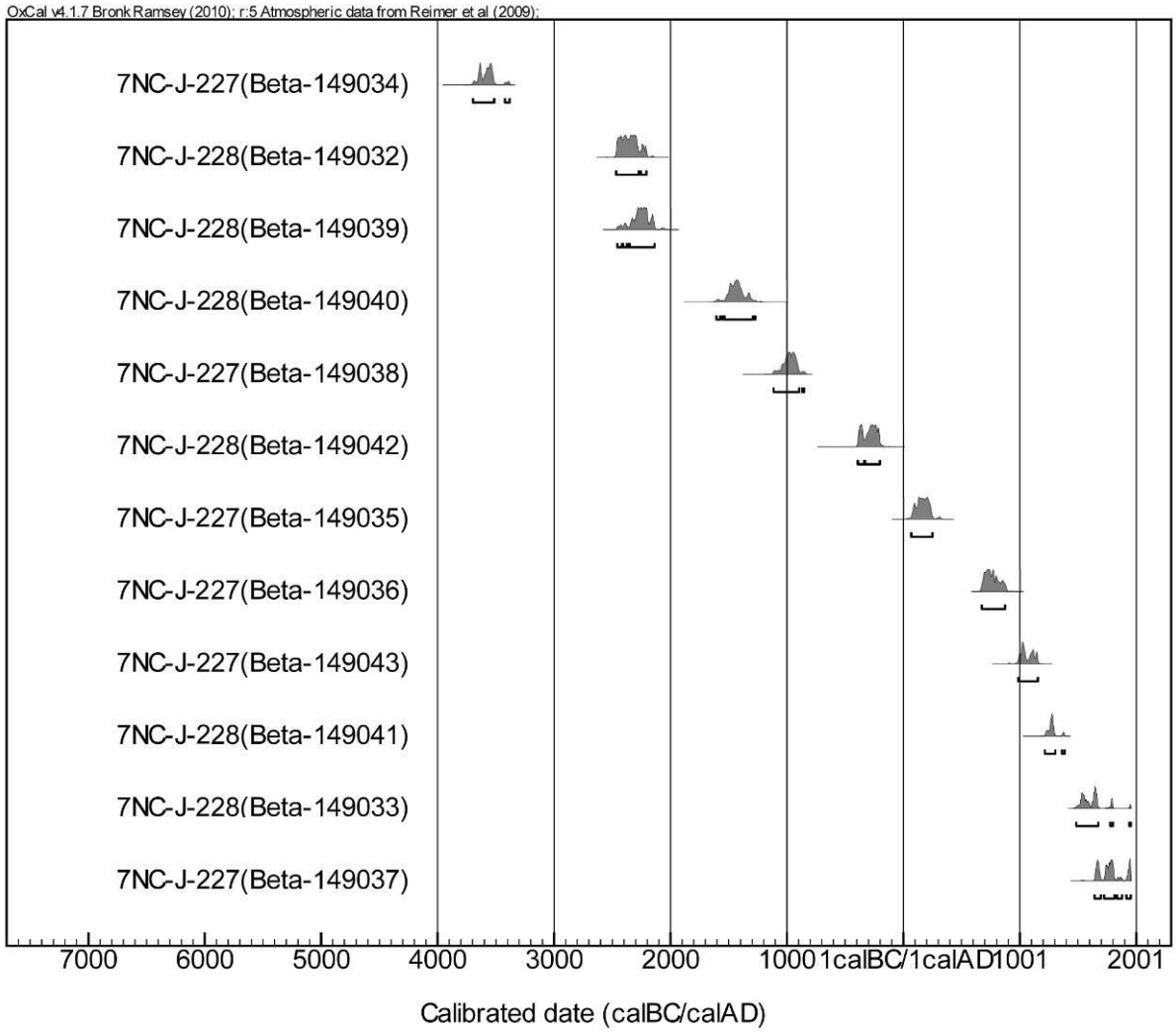


Figure 8-2. Graphical display of AMS assays from the Sandom Branch Site Complex.

Table 8-1. AMS Dates from the Sandom Branch Complex Sites.

Excavation Sample No.	Sample Material	Provenience	Conventional Radiocarbon Age	Calibrated Results (2 Sigma)	Probability (%)	13C/12C ratio (o/oo)	Laboratory Sample No.
			Site 7NC-J-228				
5065	sediment	N222/E398, Cg1 horizon (23-25 cm bs) – off site	240 ± 40 BP	AD 1520 to 1592 AD 1619 to 1685 AD 1732 to 1807 AD 1928 to 1952*	15.2 42.8 33.3 8.5	-27.1	Beta-149033
5066	sediment	N237/E403, Cg horizon (55 cm bs) – off site	680 ± 40 BP	AD 1263 to AD 1325 AD 1344 to AD 1394	59.2 40.8	-27.9	Beta-149041
5064	sediment	N226/E453, 2AB horizon (70-90 cm bs)	2270 ± 40 BP	400 to 347 BC 319 to 207 BC	41.8 58.2	-23.2	Beta-149042
5063	sediment	N224/E451, BC horizon (90 cm bs)	3190 ± 60 BP	1615 to 1372 BC 1344 to 1317 BC	96.8 3.2	-23.3	Beta-149040
5013	charcoal (ring porous)	N229/E445, Feature 7, Str. I-3	3770 ± 40 BP	2334 to 2325 BC 2300 to 2113 BC 2101 to 2037 BC	0.77 86.0 13.3	-27.6	Beta-149039
5054	charcoal (white oak)	N225/E447, Feature 34, Str. I-3	3860 ± 40 BP	2464 to 2269 BC 2259 to 2206 BC	83.7 16.3	-25.4	Beta 149032
			Site NC-J-227				
5028	charcoal (white oak)	N67/E467, Feature 30, Str. II-1	180 ± 40 BP	AD 1649 to 1706 AD 1720 to 1819 AD 1824 to 1825 AD 1832 to 1883 AD 1914 to 1953*	21.4 50.1 0.2 10.0 18.3	-26.0	Beta-149037
5036	sediment	N71/E463, 2AB horizon (70 cm bs)	1010 ± 40 BP	AD 901 to 917 AD 966 to 1059 AD 1066 to 1072 AD 1075 to 1155	2.6 71.3 0.5 25.6	-23.9	Beta-149043
5008	charcoal (unidentified)	N74/E476, Feature 19, Str. I-1	1220 ± 40 BP	AD 685 to 892	100.0	-26.9	Beta-149036
5005	charcoal (white oak)	N70/E465, Feature 5, Str. I-2	1850 ± 40 BP	AD 71 to 249	100.0	-25.3	Beta-149035
5035	charcoal (red oak)	N73/E471, Feature 36, Str. I-1	2780 ± 40 BP	1017 to 829 BC	100.0	-27.4	Beta-149038
5019	charcoal (sweetgum)	N69/E471, Feature 35, Str. I-2	4780 ± 50 BP	3654 to 3498 BC 3435 to 3378 BC	87.0 13.0	-27.1	Beta-149034

*Range suspect because impinges on the end of the calibration data set.

3.13.4 Plotting the Chronological Data

Constructing the chronological framework for the Sandom Branch Site Complex included plotting the chronological data from both of the sites on a single chart (Figure 8-3), showing the AMS dates (displayed as probability distributions using 2-sigma confidence intervals based on uncalibrated conventional radiocarbon ages), and the generally accepted date ranges of the diagnostic artifacts from the sites. The lengths of the lines for each artifact type indicate the time range represented by the type, while the line widths are proportional to the frequency of occurrence of the type at the site. The three forms of data were also considered in combination at each site in order to assess the general chronologies of the individual site occupations.

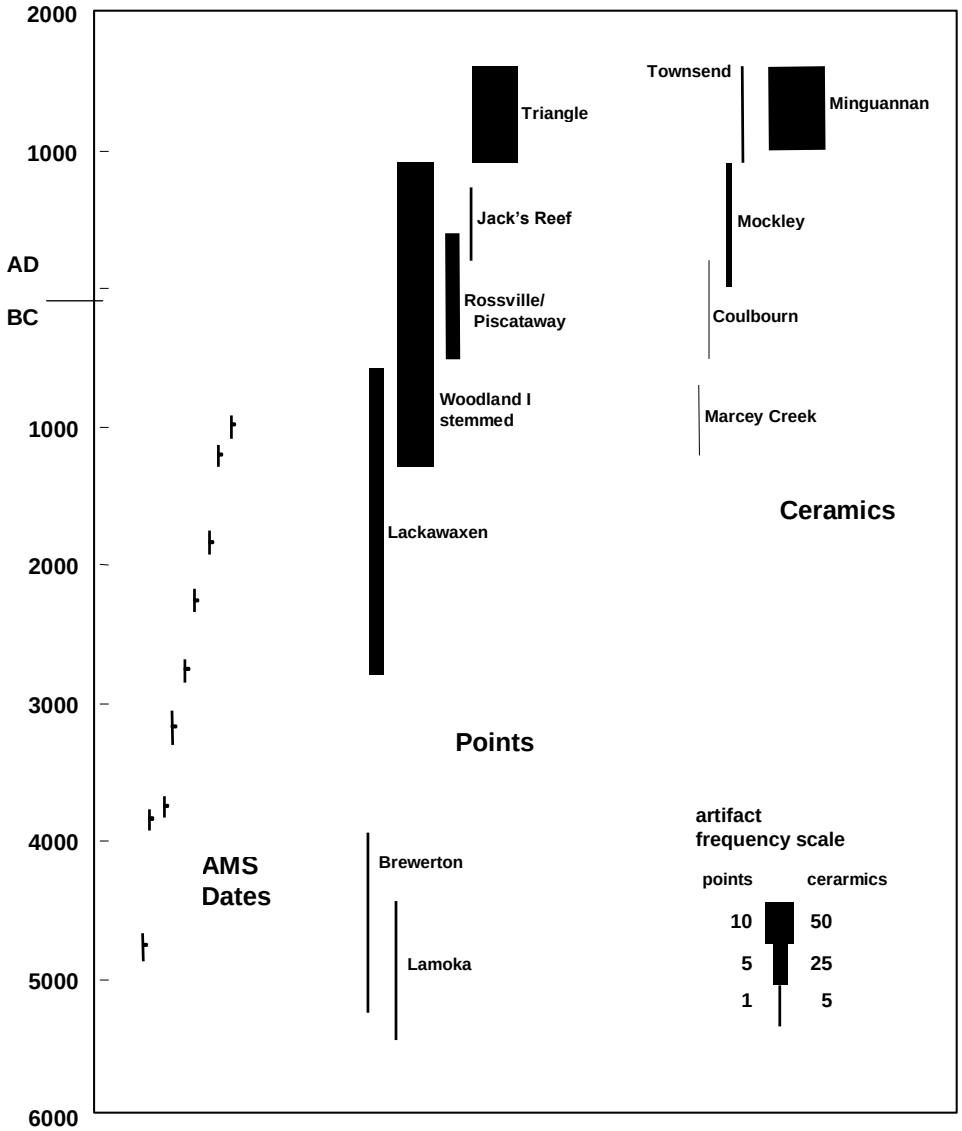


Figure 8-3. Comparison of Chronological Data from the Sandom Branch Complex Sites.

Several entries were not included in the chart. The Early Archaic Kirk point (discussed below) was excluded because of the absence of verifiable corroborating data, and its

inclusion would have required the time scale to be nearly doubled before AD 1, compressing the later periods and making the chart harder to read. The three latest dates were also excluded: the date from the tree disturbance in Feature 30, and the two sediment dates taken off site to document the migration of the tributary stream in its valley

7NC-J-227. The earliest dated temporally diagnostic artifact from either site was an Early Archaic Kirk point from 7NC-J-227 (Figure 8-4). This point essentially represents an isolated find and no other data related to an Early Archaic component was found at either site. Nonetheless, this point suggests at least limited site use in the Early Archaic period, and extends the American Indian occupation of the Sandom Branch Site Complex back several millennia. There was a Middle Archaic AMS assay (Beta-149034) but this date was assessed as too early for the cultural context. Another single temporally diagnostic artifact, a Brewerton point, suggests at least casual visits to the site area beginning during the Late Archaic period.

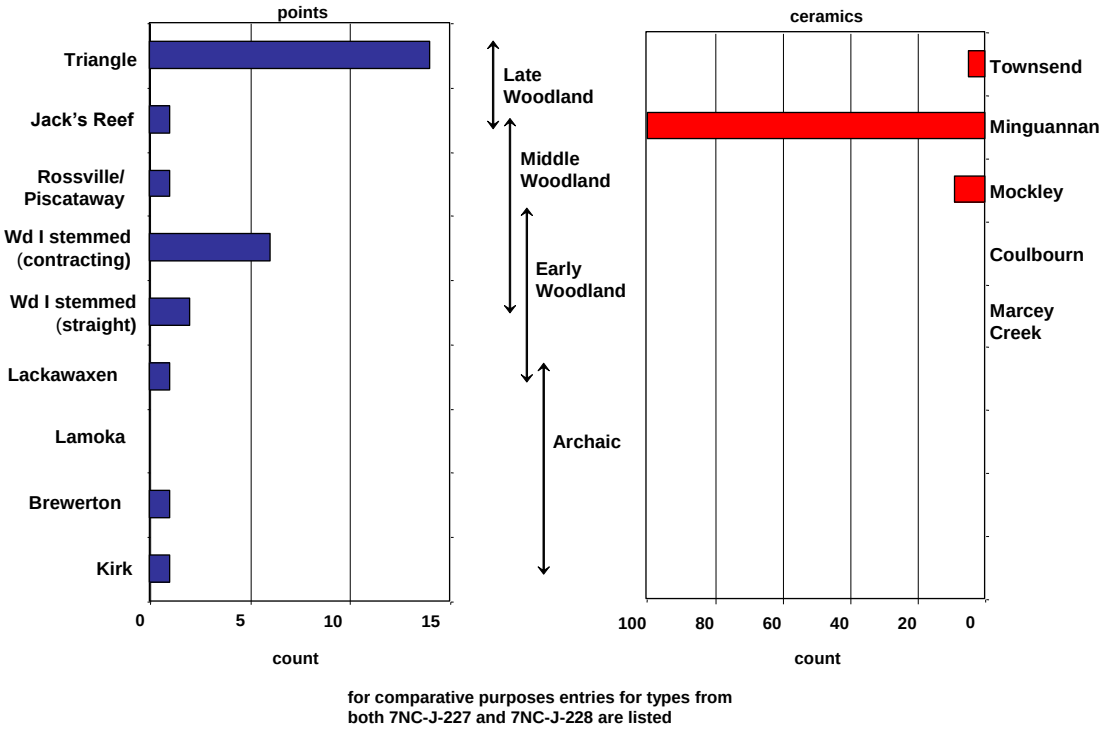


Figure 8-4. Diagnostic Artifacts Recovered from 7NC-J-227.

More securely dated site use at 7NC-J-227 began toward the end of the Late Archaic period, with most of the diagnostic artifacts recovered at the site from the Late Archaic/Early Woodland, Early/Middle Woodland, and Middle Woodland periods. These included two Lackawaxen contracting-stemmed points, eight Woodland I stemmed points, one Rossville/Piscataway point, one Jack's Reef point, and Mockley ceramics (n=4). One AMS assay from Feature 36 (Beta-149038) dates to the beginning of the Early Woodland period. Two AMS dates occurred in the Middle Woodland range, with one from Feature 5 (Beta-149035) falling in the first part of the Middle Woodland and the other from Feature 19 (Beta-149036) in the latter part. A Late Woodland component was documented on the basis of a number of triangle points (n=15) and Minguannan (n=101) and Townsend (n=5) ceramics.

An AMS date was returned on a bulk sediment sample (Beta-149043), but its relationship to the cultural material at the site could not be established. The final AMS date (Beta-149037) from the site was from Feature 30, a thermally altered stone cluster that was disturbed by tree growth. The calibrated two sigma range for this date impinges on the end of the calibration data set and should be considered invalid.

7NC-J-228. A Late Archaic occupation at this site is more substantial than that seen at 7NC-J-228. The Late Archaic presence at 7NC-J-228 includes a Late Archaic Lamoka point and two features, Feature 7 and Feature 34, with AMS assays that date to the middle of the Late Archaic period (Figure 8-5). The AMS assays from these two features were statistically identical, producing a mean pooled age of 3815±28 BP (cal 2 σ BC 2401 to 2143). No additional AMS assays were obtained from cultural contexts at 7NC-J-228. Occupation of the site may have intensified near the end of the Late Archaic, as evidenced by four Late Archaic/Early Woodland Lackawaxen points. Woodland I stemmed (n=7), Rossville/Piscataway (n=3), and Teardrop (n=1) points, along with single sherds of Marcey Creek and Coulbourn ceramics, indicated site use in the Early and Middle Woodland periods. With two triangular points and an absence of ceramics, the Late Woodland occupation of this site was less intense than that evident at 7NC-J-227. Two AMS assays were obtained from sediment, Beta-149041 and Beta-149033, that fell into the Late Woodland period. The latter assay is invalid, as it impinges on the end of the calibration data set, but the former assay documents the migration of the stream channel over the last 700 years, rather than cultural occupation.

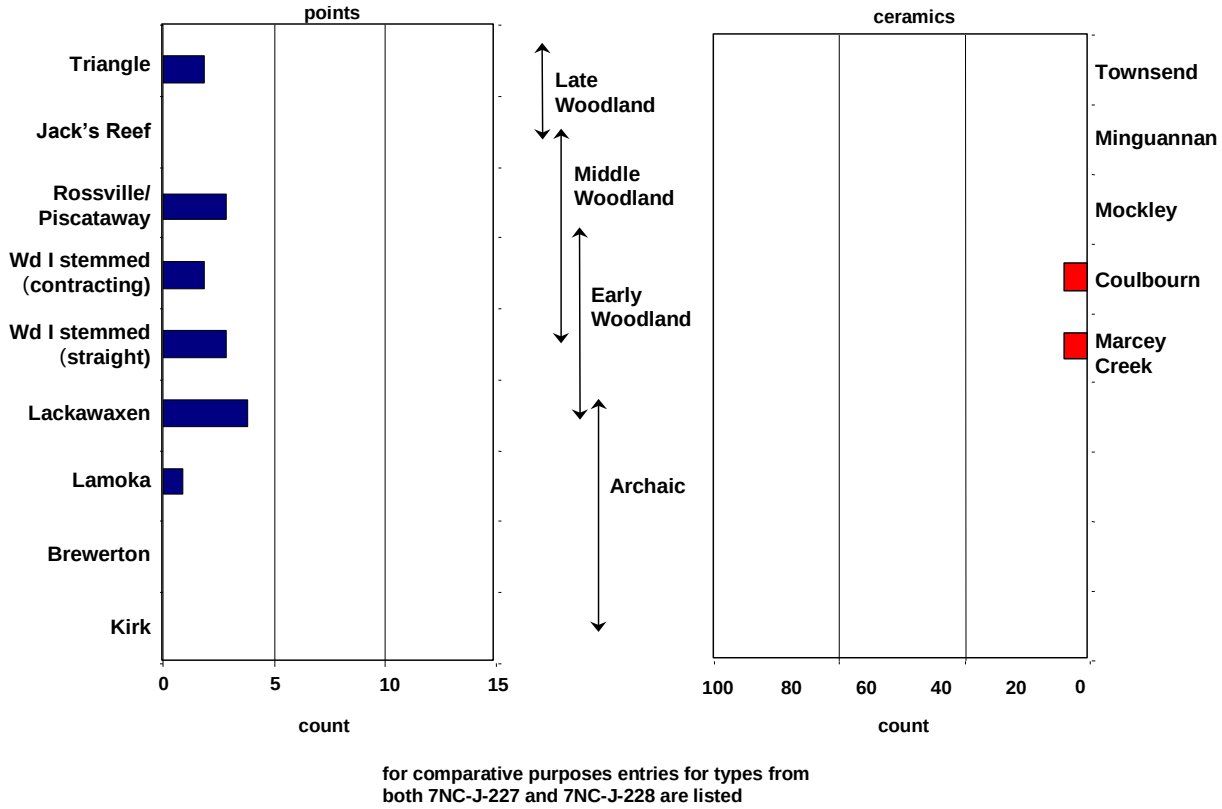


Figure 8-5. Diagnostic Artifacts Recovered from 7NC-J-228.

Discussion

Chronological data obtained during the course of this study is not only useful for understanding the occupation history of the Sandom Branch Site Complex, but also contributes to a broader perspective on social changes that occurred throughout the region. Temporally diagnostic artifacts indicate an American Indian presence at the Sandom Branch Site Complex potentially beginning 10,000 years ago. A more robust occupation at these sites begins toward the end of the Late Archaic period and continues through the Late Woodland period. Although the stratigraphic associations within each site are somewhat complex, there is some suggestion that there may have been horizontal separation of temporal components at the Sandom Branch Site Complex. More intensive occupation is seen at 7NC-J-228 during the Early and Middle Woodland periods, while the Late Woodland occupation at 7NC-J-227 is much more substantial. This could point to shifting emphasis on landscape utilization through the Woodland period.

Two major threads for assessing site formation processes and site integrity were cross-mending thermally altered stone and ceramic refitting. Both procedures were only conducted at 7NC-J-227 and are explored in more detail below. The refitting of thermally altered stone from Feature 30 (40% of stones) and Feature 35 (50% of stones) showed both vertical and horizontal movement from the central core of the features, although vertical movement was more pronounced. Material associated with Feature 30 was documented in both the Middle and Late Woodland components. Ceramic refitting in Block N demonstrated that ceramics were as much as six meters apart, although the mean movement was three meters. The distribution of sherds was largely in the direction of past historic period cultivation efforts. Nonetheless, as numerous plow zone studies have demonstrated, site structure was not surprisingly still clearly preserved in Block N.

One of the challenges with developing the chronological framework for the Sandom Branch Site Complex was the relatively small number of AMS dates and also the fairly small number of temporally diagnostic artifacts. In some cases, there were distinct components that did not have associated chronological data. At 7NC-J-228, there were apparently at least three periods of site use: the lowest level had scattered thermally altered stone and chipped stone; the middle level consisted of pit features that cut into the earlier deposit; and, the most recent American Indian cultural deposit consisted of a series of large, thermally altered stone features. How much time separated these layers was unclear. At 7NC-J-227, stratigraphic evidence more clearly suggested a single, sloping occupational surface. Nonetheless, as we showed in the previous two sections, and as we will explore below, distinct overlapping occupations were clearly present and discernible at the Sandom Branch Site Complex.

3.14 Technology, Materiality, and Social Processes

Knowing *when* American Indians inhabited the Sandom Branch Site complex is certainly important, but we also are interested in *what* they were doing here, especially in the Woodland period. Here we discuss the three major categories of material culture recovered at the Sandom Branch Site Complex: thermally altered stone features; lithic technology; and ceramic technology. We also consider the archaeological evidence for past subsistence practices pursued by the American Indian inhabitants of the Sandom Branch Site Complex.

3.14.1 Thermally Altered Stone Features: Formation, Function, Deformation

Perhaps the most salient aspect of the prehistoric occupations at the Sandom Branch sites was the amount of thermally altered stone that was present in features distributed across the landscape. The features were clearly visible, and although they varied somewhat in morphology, they shared a common depositional context. Based on stratigraphic analysis, they probably shared common occupational surfaces at each site.

Analysis of the features, detailed in Sections 6.3 and 7.3, consisted of an examination of the spatial arrangement of the thermally altered stones and analyses of the physical attributes of the artifacts themselves. The statistics recorded to document spatial arrangements included areal dimensions (length and width), depth, and fragment count. The latter was used in combination with areal dimensions to calculate a figure describing artifact density within each feature. Due to their general lack of depth, the features were treated as two-dimensional constructs, and artifact density was calculated without regard to volume. Selected physical attributes of the stones in each feature were also recorded. These attributes were related to evidence of the processes of heating and burning, and were recorded as a means of assessing the type of activity that produced the archaeological remains. Some of the data collected were qualitative, documenting material type, evidence of discoloration, crazing, or spalling; while others were quantitative, recording fragment weights and percentages of fragmentation and completeness. A further set of data was collected for two selected features during a systematic refit study that provided additional information on both spatial and attribute characteristics.

3.14.2 Feature Formation

The features at the sites were for the most part surface manifestations. In only a few cases was there evidence of a pit excavation associated with any group of thermally altered stones that would have provided a form of enclosure and represented evidence of a formal, multi-segmented facility. As noted in the analysis of chronological data from the sites, little direct evidence of fire was observed at the sites: very little charcoal, and no burned, reddened, or compacted soils, such as are commonly associated with fire-related features. Samples of the small amount of carbon that was present were submitted for dating though lab analysis. The results provided dates that were generally earlier than the date range of the main occupations implied by the bulk of the diagnostic artifacts. On the basis of stratigraphic analysis, the thermally altered stone features appeared to have been associated with the diagnostic artifacts, not the carbon material.

Analysis of the relationship between the areal dimensions of the features and the frequency of thermally altered stone fragments contained in them indicated that the features ranged widely in size and in artifact density, as shown in Table 8-2, displaying feature attributes sorted by area. There were large distributions, covering eight-to-ten square meters, with densities as low as 14 artifacts/m^2, and smaller clusters, less than one square meter, one of which had a calculated density of more than 350 artifacts/m^2. A common factor among all of the features was a high rate of evidence for heating, and particularly a high proportion of fractured stone. Almost all of the thermally altered stones displayed some evidence of exposure to fire, and in most features, over 95 percent of the constituent stone was cracked or fractured.

Table 8-2. Dimensional and Qualitative Attributes of Thermally Altered Stone Features from 7NC-J-227 and 7NC-J-228.

Feature	Count	Weight (kg)	Mean Weight (g)	Area (m^2)	Density (n/m^2)	Fracture
7NC-J-227						
16	21	3.7	177.4	0.26	79.4	81%
35	311	19.3	62.2	0.88	354.4	98%
40	28	2.3	81.7	0.90	31.1	96%
5	224	52.8	236.1	1.20	186.7	95%
36	81	1.3	157.2	1.52	53.4	99%
17	103	11.8	114.9	1.87	55.1	94%
30S	35	3.7	106.8	1.95	17.9	83%
19	47	9.8	209.5	2.04	23.0	96%
30N	442	48.0	108.6	3.40	130.0	93%
30	477	51.7	108.5	5.35	89.1	92%
7NC-J-228						
21cluster	135	8.1	59.8	0.45	300.0	100%
45 cluster	160	21.8	136.3	1.30	123.1	88%
1	315	36.5	115.8	1.32	238.6	80%
22	71	8.6	120.7	2.50	28.4	92%
21 all	183	12.7	69.3	3.30	55.5	98%
45 all	226	28.1	124.2	8.00	28.3	88%
23	141	11.9	84.4	10.00	14.1	98%
26	170	18.8	110.9	10.00	17.0	98%

A number of experimental studies have been conducted to determine the rate at which evidence of heating occurs on stone. Early investigations, such as House and Smith (1975:75-80), focused on attribute characterization in an effort to differentiate between thermally altered stone and chipped stone in assemblages in which large amounts of cryptocrystalline stone were used for both purposes. The heat retention potential of the available stone types was also assessed. Later work by Witkind (1977), Jones (1981), Cavallo and Kondrup (1986), Cavallo (1987), Thoms (1989), Latas (1992), Custer and Silber (1995), and Topping (1998), considered various additional aspects of heat retention, breakage rate, and a variety of characteristics that distinguish burned rock. A common finding of these studies was that for many types of material, a considerable amount of heating, both in terms of temperature and the period of exposure, may be required to alter the physical properties of the stone to the point that it fractures. Some materials, particularly crystalline stone such as quartz, may break apart readily, but heating combined with slow cooling generally tends to have relatively little effect beyond color alteration on cobbles of most materials. Reuse increases the rate of fracture, as does rapid cooling by immersion in liquid (Cavallo 1987; Custer and Silber 1995). Evidence from an experimental study conducted at the Hickory Bluff site (Petraglia et al. 2002) suggested that while intense heating can lead to fragmentation, short-term heating, even when repeated, may have little effect on many materials. Examination of stones used in conjunction with a sweat lodge ceremony conducted at the site indicated that some stones brought to high heat for use in the sweat lodge pit fractured, while similar stone used in a ceremonial cooking hearth did not crack during two episodes of heating.

The evidence suggests, then, that intense and long-term heating are typically required to fracture most cobbles extensively, and that the speed at which the stone is cooled can have a direct effect on the rate of fracture. At the Sandom Branch Site Complex, the rate of fracture was high in each feature and the individual fragments were relatively small, presumably indicating intense or prolonged heating (Plate 8-5). In addition, the results of a formal refit study and informal refitting accomplished during normal cataloging indicated that while a large number of fragments refitted, indicating that they had remained relatively close together after fracturing, few cobbles could be reconstructed to more than 50 percent of their estimated original size. In most cases, large pieces were missing from the cobbles, suggesting that the fragments had been sorted for reuse, either on-site or before the stones were brought to their present location (Plates 8-6, 8-7).

3.14.3 Feature Function

Feature typologies based on morphological attributes are numerous and varied, and most contain a presumption of function. In Delaware, major studies of feature type have included Thomas's (1981) work at Delaware Park (7NC-E-41), and Custer's (1994) work with the University of Delaware at a variety of sites on DelDOT's SR1 corridor. Most typological systems assign thermally altered stone concentrations to fairly general categories based on size. Functions are assumed to be utilitarian in nature, connected with some form of resource processing. Non-specified ritual or ceremonial uses may also be mentioned as an alternative interpretation.

Thermally altered stone, for example, may accumulate in a sweat lodge without extensive, direct evidence of burning. As noted in ethnographic and participant observer accounts, stones were typically heated in fires some distance away from the ceremonial structure and were placed in a clean pit inside the lodge, providing little opportunity for the introduction of large amounts of charcoal or ash (Black et al. 1997:49-50; Bruchac 1997; Egghart 2003). Yet, this sort of activity did not appear to have been responsible for the thermally altered stone features at the Sandom Branch sites. The extensive fragmentation of stones observed in the Sandom Branch features was uncharacteristic of what may be expected of material used in a sweat lodge. Experimental evidence cited earlier suggests that cracking and the break-up of heated rock is most often associated with reuse or rapid cooling. Stones used in a sweat lodge were considered particularly sacred and were seldom reused intentionally (Bruchac 1997:36), and thus, highly fragmented and repeatedly heated stone is unlikely to have been associated with this form of ceremonial activity. In addition, even with the application of water to the stones in order to produce steam within the lodge, relatively little fragmentation of the cobbles may be anticipated. Observations at the Hickory Bluff ceremony, also noted earlier, indicated that fragmentation of stones in the sweat lodge pit was limited in extent and frequency, and actually resulted from the heating process, not the application of water to produce steam (Petraglia et al. 2002). In sum, the thermally altered stone features at the Sandom Branch sites did not appear to display attributes associated with their use in a sweat lodge ritual.

Plate 8-5. Thermally Altered Stone Refit Group 30-B1.
(above: refitted; below: unassembled).

Plate 8-6. Thermally Altered Stone Refit Group 30-A1, Showing Large Missing Fragments.

Plate 8-7. Thermally Altered Stone Refit 30-F, Showing Large Missing Fragments

Clearly, the thermally altered stone features at the Sandom Branch sites comprised the remnants of extensive fire-related activities. Based on the absence of other direct evidence of in situ burning and on the high degree of fragmentation documented among the individual stones from each provenience, the majority of the features appeared to represent the remnants of stone-boiling activities. Considering that most of the features were surface deposits, located on or near their original occupational surfaces rather than in excavated basin contexts, and given their often scattered distributions, it appeared that most of the artifacts were not in their primary use locations, but had been brought to the site near the end of their use-life cycles. Thus, with few exceptions, the thermally altered stone features at the Sandom Branch sites appeared to consist of disposal of rocks used in stone-boiling activities that occurred in another location.

As indicated, there were features that appeared to have been in their original contexts, including Feature 1 at 7NC-J-228, and Feature 5 at 7NC-J-227. Feature 1, in Block A at 7NC-J-228, was the only thermally altered stone feature that was directly associated with another feature—Feature 9, a wide, but relatively shallow basin (Figure 8-6). This basin feature contained relatively few artifacts in comparison to the deeper pits in the southern part of Block A. Artifact analyses suggested that the artifacts in the pit were dissimilar to those in the surrounding sediments. They were, in contrast, similar to the artifacts in Feature 1 and may have been residual debris from that feature, implying that the rock cluster and basin were contemporary. Feature 1 included considerably more unfragmented cobbles than were found in other thermally altered stone features at the site, suggesting that the feature resulted from either a different function or different formation processes. The latter was likely the case. The cluster of stones occurred next to the processing area, and unlike stones in other disposal features, had not been transported some distance away. Such an activity would probably have involved sorting out whole, non-fragmented cobbles. Feature 1, then, appeared to be a form of clean-out debris removed from Feature 9.

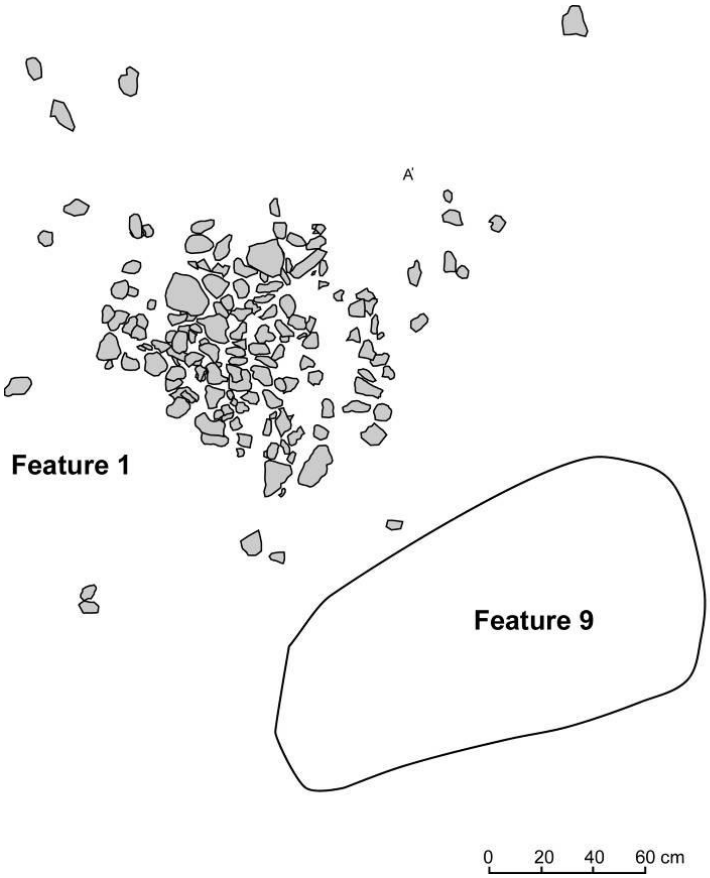


Figure 8-6. Plan View of Feature 1 and Feature 9, Block A, 7NC-J-228.

Feature 5, at 7NC-J-227, consisted of a basin that had been purposefully lined with thermally altered stones (Plate 8-8, Figure 8-7). While there was no direct evidence of burning in or around the feature other than the thermally altered stone fragments, the rocks appeared to have been in a primary context, not moved from another location. This feature fits descriptions from the ethnographic literature of a pit oven, in which a basin was lined with thermally altered stone and either covered and buried to trap the heat generated by the stone lining, or topped with additional heated stone (Guernsey 1984; Thoms 1989). The lined pit was still apparent in the documentation of Feature 5. Assuming that the shape of the feature was not heavily affected by postdepositional processes, the scatter of stones to the west and northwest of the basin may have been the remains of a lid or cap that would have functioned as the upper heating element. Experimental evidence has suggested that heating and slow cooling has relatively little effect on cobbles of most materials, particularly when the stones are buried (Custer and Silber 1995; Topping 1998). The stones comprising Feature 5 displayed a high frequency of fragmentation, 95 percent, similar to most of the disposal features at the two sites. The implication drawn from this statistic was that the stones had been fractured prior to their use in the pit oven. The feature thus may have post-dated the stone-boiling activity that produced the majority of the burned rock fragments at the site, and the stones used to construct Feature 5 may have been selected from clusters that were still visible on the ground surface at the time of a later occupation or subsequent activities.

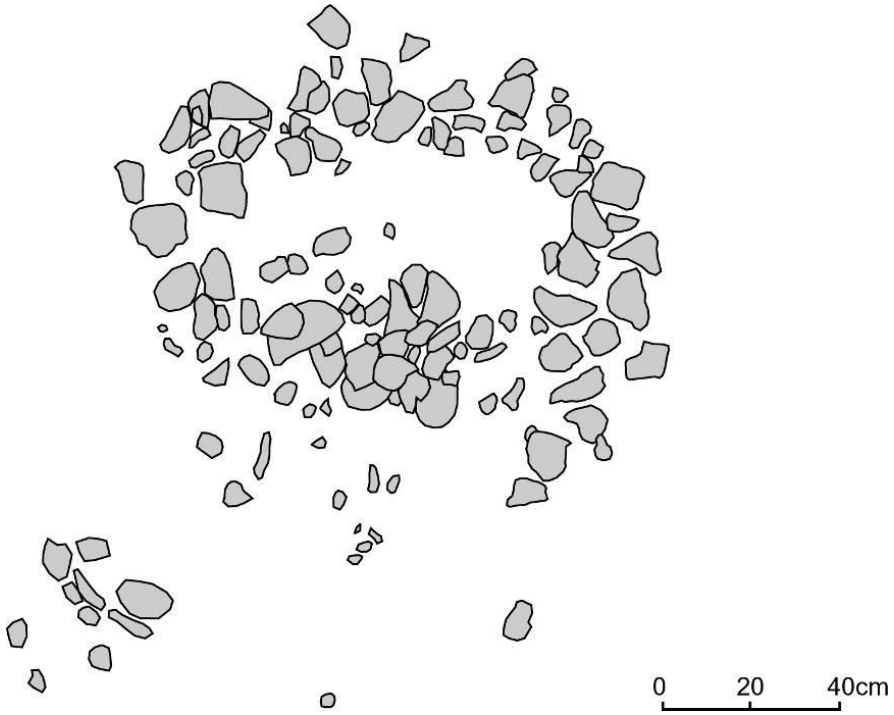


Figure 8-7. Plan View of Feature 5, Block GHI, 7NC-J-227.

Plate 8-8. Profile Section of Feature 5, Block GHI, 7NC-J-227.

Comparative Data

Data from three sites were reviewed to provide regional comparison for the thermally altered stone features encountered on the Sandom Branch landscape. Hickory Bluff (7K-D-411) was a large American Indian site located on a terrace above the St. Jones River, near Dover, Delaware, and was occupied from the Late Archaic through Late Woodland periods (Petraglia et al. 2002). The Lake Powell sites (44JC1052 and 44JC1053) were small, interior sites on the Coastal Plain of Virginia, similar in setting to the Sandom Branch sites, and containing a series of thermally altered stone features dating to the Middle Woodland period (Gallivan and Blouet 2001). Site 28ME1-B was situated on the levee bordering a tributary of the Delaware River, in central New Jersey, and contained extensive thermally altered stone features attributed to Late Archaic and Early Woodland populations (Cavallo 1987).

Hickory Bluff. Recognizing the complexity of feature formation in terms of the variety of cultural and natural processes that go into the archaeological structure of a feature, several formation scenarios were presented in the early portions of the Hickory Bluff analysis. The scenarios modeled construction characteristics, such as size sorting, material selection, and associated pit excavation, and also considered the potential effects of several postdepositional processes. The latter were referred to as interactions, and consisted of the effects of unspecified natural agents and a set of cultural alterations that included trampling, reuse or

scavenging, and maintenance cleaning. The scenarios were segregated into single and multi-state processes. A large number of thermally altered stone features was identified at the site. They were documented with extensive descriptive analyses in terms of morphology and the attributes of the heated rocks, and were grouped according to size. The features were considered *en masse* as an example of the complexity of site formation and a reflection of repeated use of the same landform by small groups over an extended period of time that may have lasted as much as 3,500 years, ranging from the Late Archaic to the Middle Woodland.

Lake Powell. Gallivan and Blouet (2001) reported a series of thermally altered stone features at two small, interior Coastal Plain sites (44JC1052 and 44JC1053) on Lake Powell, in James City County, Virginia. The lake is an artificial reservoir, and the sites originally were located on raised terraces above low-order tributaries of the James River, in settings similar to that for the Sandom Branch Site Complex. Twenty-three thermally altered stone features were identified and assigned to the Middle Woodland period based on the recovery of Varina and Mockley ceramic wares. All were essentially surface features, with little evidence of pit excavation. There were no other feature types recorded at the site. Three feature categories were defined on the basis of a bivariate plot of surface dimensions (length vs. width). Several qualitative attributes were recorded on fragments from seven fully excavated features out of the original sample. Two attributes concerned the percentage of stones in each feature showing evidence of heating—a distinction was made between heat alteration (judged by color) and fragmentation (cracking). The percentage of quartzite fragments in each feature was also recorded. Due to small sample sizes, conclusions based on comparative analyses of the attributes between the categories were difficult to support. Nonetheless, functional interpretations were advanced, and in each case reflected a variation on the cooking theme—small features were considered to have been multi-purpose hearths used by individual groups, such as a nuclear family; medium-sized features were considered to have been cooking facilities; and large features were interpreted as roasting platforms. The latter two feature types were considered public facilities on the basis of size.

28ME1-B. Among the remains at 28ME1-B, located on a low terrace adjacent to wetlands in the estuary portion of the Delaware River, were extensive concentrations of thermally altered stone fragments. Three feature types were recognized:

- large concentrations of unbroken pebbles or cobbles (likened to Kinsey's [1972] roasting platforms or platform hearths) were interpreted as shallow rock ovens for roasting fish or meat;
- extensive and dense concentrations of broken rock were interpreted as steam cooking facilities; and,
- widely spread scatters of broken rock and charcoal flecks were considered to have been the culled or discarded fragments from the other features.

Without evidence of charcoal or pit excavation in association with the heated stone, the initial interpretations were later questioned by Cavallo (1987). Informal experimentation with the creation of thermally altered stones led to the conclusion that features were all related to stone-boiling. High depositional integrity was assumed, so that the most tightly clustered concentrations were interpreted as the contents of hide or woven containers, in one

case dumped together in "slightly overlapping stone concentrations" (Cavallo 1987:181). Based on the location of the site in an freshwater tributary of the Delaware River, the activity that created the spent rock was considered to have been the rendering of fish oil obtained during anadromous fish runs.

Comparative Analysis

Quantitative data reported from the three sites were used in a comparative study of the Sandom Branch Site Complex features. The most consistently reported variables were dimension attributes and artifact counts. These data were used in bivariate plots of size versus artifact density.

Figure 8-8 shows the results of the analysis for the two Sandom Branch sites. Large features occur to the right on the x-axis of the chart, and small features to the left; densely clustered features are located high on the y-axis, and scattered distributions low. While there were several outliers on both axes of the Sandom Branch plot, most of the features occurred in a range of less than four square meters and had less than 250 artifacts/m^2.

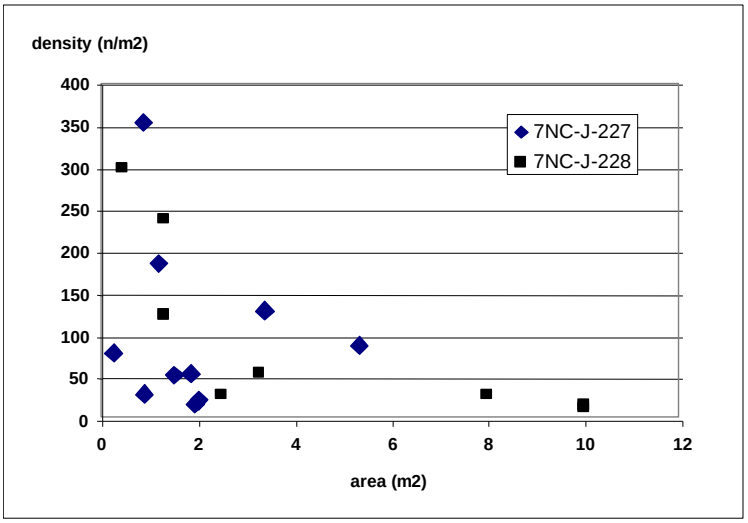


Figure 8-8. Density Analysis of the Thermally Altered Stone Features at the Sandom Branch Sites.

When plotted on the same axes with the Sandom Branch features (Figure 8-9), the small thermally altered stone features from the Hickory Bluff site (Type A1-a, defined as <1 m in maximum dimension) clustered in the lower right-hand corner of the chart and were smaller than the majority of the features from the Sandom Branch sites. Moreover, with the exception of a single outlier on the y-axis, artifact densities were low in comparison with the Sandom Branch features.

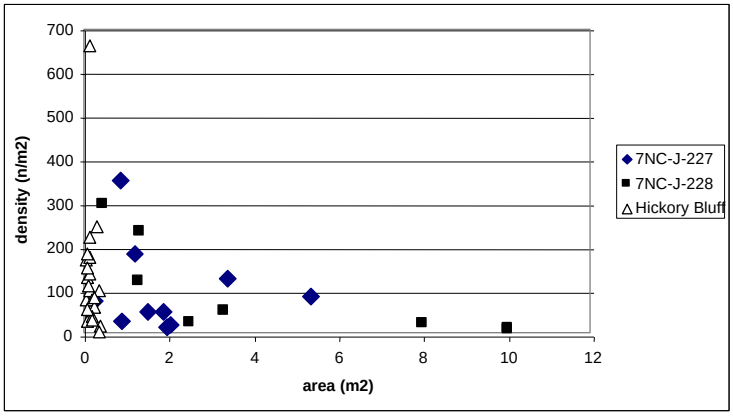


Figure 8-9. Comparative Analysis of Thermally Altered Stone Features at the Sandom Branch Sites and Type A1-a Features from the Hickory Bluff Site.

In contrast, feature types A1-b (>1 m and < 2 m) and A1-c (> 2m) were distributed farther to the right on the x-axis, reflecting their larger areas, but they remained for the most part low on the y-axis in comparison with the Sandom Branch features (Figure 8-10). The lower artifact densities indicated by the plot suggested more scattering of the individual stones in the features at Hickory Bluff, but little indication in the report was presented to determine whether the distributions may have been the result of the original functions of the features or of postdepositonal alterations.

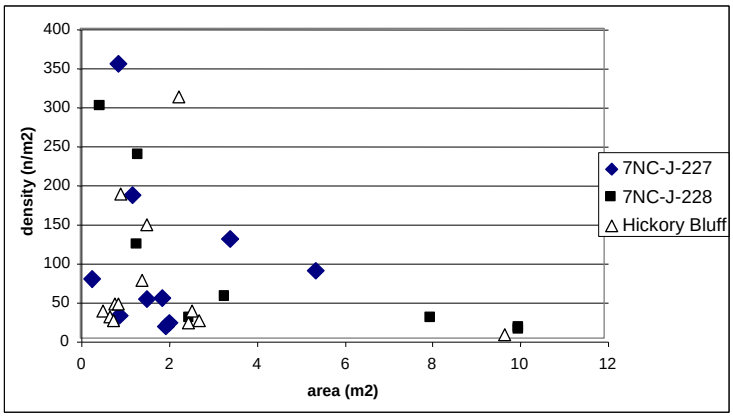


Figure 8-10. Comparative Analysis of Thermally Altered Stone Features at the Sandom Branch Sites and Type A1-b and A1-c Features from the Hickory Bluff Site.

The Lake Powell features, when plotted on the same axes, were intermingled with the Sandom Branch features (Figure 8-11), which indicated a degree of overlap in the size and density ranges. Yet most of Lake Powell features occurred well to the left of the chart, indicating that they were smaller than most of the Sandom Branch features and displayed on average slightly higher densities.

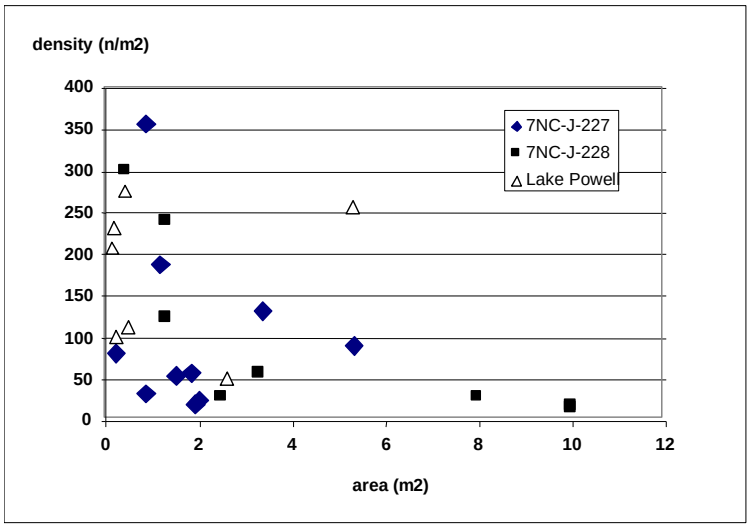


Figure 8-11. Comparative Analysis of Thermally Altered Stone Features at the Sandom Branch and Lake Powell Sites.

The physical variation represented by the plots from the two sites was clear. Whether this represents significant variation in the use and post-abandonment histories of the features was less obvious. The functions of the Lake Powell features seemed to have been assumed by the researchers without explicit consideration of formation processes and alternative mechanisms that might have accounted for their forms. Yet, several additional characteristics that were reported for the Lake Powell features provided further comparative information. The frequency of fractured stone in each feature at the Lake Powell sites was substantially lower than the figure documented at the Sandom Branch sites. At Lake Powell, the fracture rate per feature averaged 50 percent, with a range of 26-91 percent. In contrast, the rate per feature at the Sandom Branch sites was 93 percent, with a range of 81-100 percent. If the frequency of fractured stone can be taken as an indication of the type and extent of heating, a significant difference in the activities producing the features in the Delaware and Virginia locations is implied.

Data from two sets of features were available from 28ME1-B—a group of features interpreted as single "inverted container dumps," and a group of larger features interpreted as "scattered container dumps." When plotted against the Sandom Branch data, the density figures for single container features was located high on the left side of the chart (Figure 8-12), which was anticipated, since the feature groups at 28ME-1-B had been segregated in the analysis on the basis of visual characteristics—the single container features looked small and tightly clustered. Further, the plot illustrated the generally smaller, more densely packed nature of the clusters at 28ME-1-B in comparison with the Sandom Branch features.

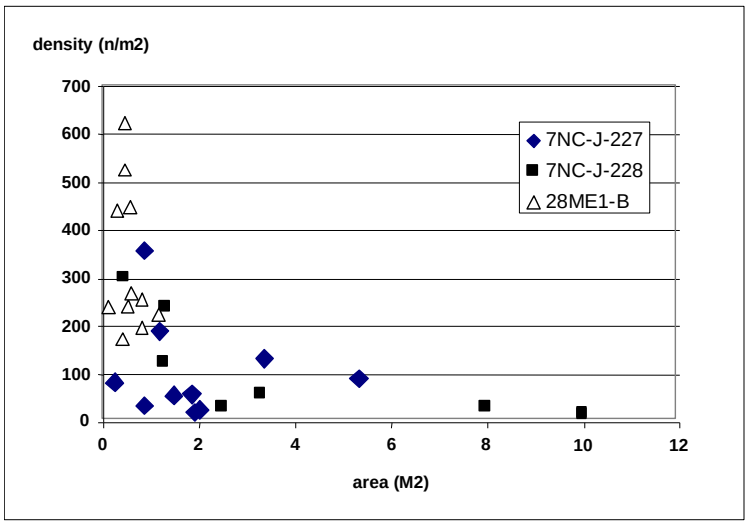


Figure 8-12. Comparative Analysis of Thermally Altered Stone Features at the Sandom Branch and Single Container Features from 28ME1-B.

Figure 8-13, in contrast, shows the general overlap of attributes between the scattered container group at 28ME1-B and the Sandom Branch features. The intermingling of points from the data sets indicated that, on the basis of the area-to-density ratio, the features were virtually indistinguishable.

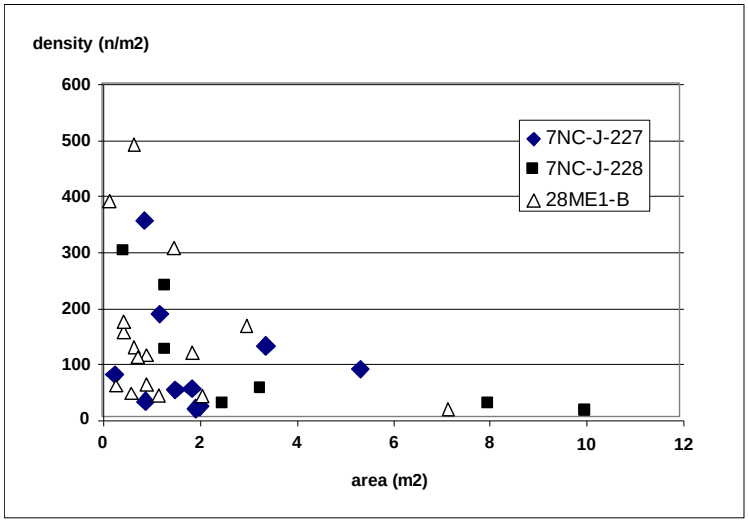


Figure 8-13. Comparative Analysis of Thermally Altered Stone Features at the Sandom Branch and Scattered Container Features from 28ME1-B.

In summary, the features at the two Sandom Branch sites were similar in area and density, and—based on similarities in the heat-related attributes of their constituent stones—they were formed in a similar fashion. The Sandom Branch features as a group were unlike most of the features from the Hickory Bluff site, the latter of which were typically smaller and less dense. Similarly, they were unlike the Lake Powell features that were also smaller but more tightly clustered than the Sandom Branch features. The Lake Powell features were interpreted as the undisturbed remains of cooking fires. The larger, less densely concentrated

features from 28ME1-B were interpreted as scattered distributions of pot-boilers and displayed the greatest similarity to the Sandom Branch features with respect to size and artifact density.

3.14.4 Lithic Technology and the Use of Local Gravel Resources

Chipped Stone

Chipped stone tools at the Sandom Branch Site Complex showed evidence for a variety of activities, including cutting, scraping, heating, grinding/crushing, and hunting. These tools were often made through bipolar reduction, and instances of tool finishing and maintenance were also documented here. What was not directly obvious is where the raw material for these stone tools was obtained by the area's American Indian inhabitants, which has implications for the size of social networks and the extent of external contacts. Systematic comparison of the lithic artifact assemblage with locally available raw materials provides insight into the decisions made regarding the selection of stones for tool manufacture. Examining the sizes of available raw materials is critical as well, as this can be linked to technological stages used to create stone tools. As we shall see, the inhabitants of Sandom Branch did not have to draw on extensive social networks to obtain most of the raw materials that they employed when manufacturing their tools.

Previous research in Delaware at the Snapp Site (7NC-G-101), Lums Pond (7NC-F-18), and Hickory Bluff (7K-C-411) suggested that the prehistoric inhabitants of those sites used locally available pebbles and cobbles as raw materials in the manufacture of stone tools (Custer and Silber 1995; Petraglia et al. 1998, 2002). Evidence of this use consisted of artifact assemblages containing high frequencies of tested pebbles and cobbles, late stage bifaces and finished points with patches of remnant cortex, small-sized cortical debitage, and evidence of bipolar reduction. Similar evidence was documented in the chipped stone assemblages at the Sandom Branch sites.

Data recovered from both 7NC-J-227 and 7NC-J-228 indicated that American Indians used pebbles and cobbles for stone tool manufacture throughout the occupational history of the Sandom Branch landscape. Samples of readily available pebbles and cobbles were collected from selected locations along Sandom Branch and Blackbird Creek. Blackbird Creek is the trunk stream into which Sandom Branch flows roughly 1,000 m northeast of the sites. The study sample consisted of a series of eight 5-gallon container loads of gravel from Sandom Branch and five 5-gallon container loads from Blackbird Creek. The samples were collected from gravel bars located in the stream beds (Plate 8-9), from exposed gravel deposits eroding from the side walls of tributary gullies, and from gravel-bearing C-horizon deposits exposed in the excavation blocks at the Sandom Branch archaeological sites. Details regarding the sampling methods, sample locations, and attribute recording for the samples from both creeks are presented in Appendix E.

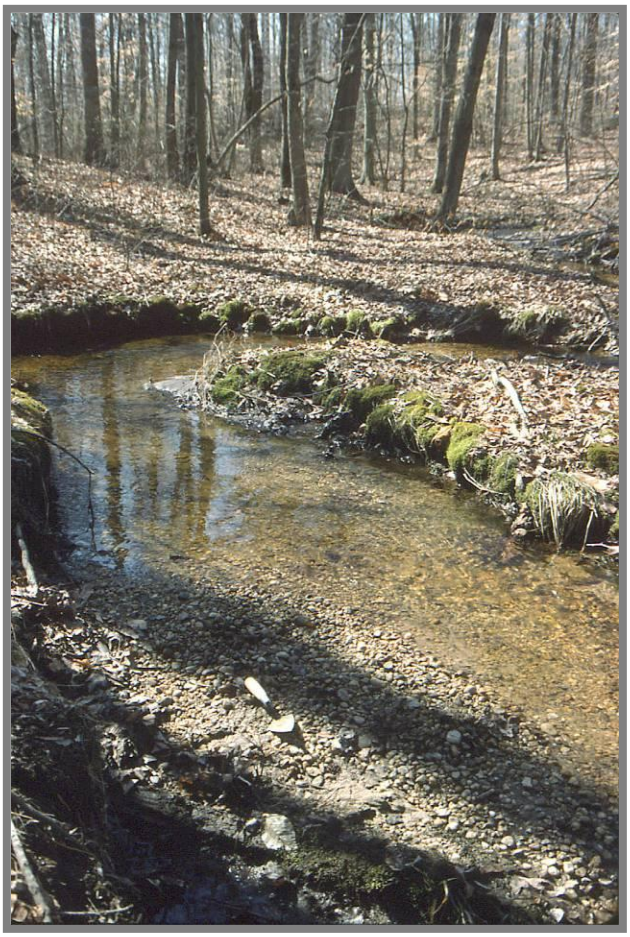


Plate 8-9. Gravel Bar on the South Bank of Sandom Branch.

Spatial analyses, discussed in Sections 6.0 and 7.0, identified two main temporal components within the large excavation blocks at the Sandom Branch sites. The chipped stone artifacts from each component were examined for attributes that could indicate the use of locally available raw materials for chipped stone tool manufacture (Table 8-3). Over one-third of the debitage from each group retained cortex, implying that the primary reduction of pebble or cobble material occurred in the immediate vicinity. In addition, several bifaces and points retained cortex on their proximal ends (Plate 8-10). Most of the points from the sites were relatively small, an attribute that may have been connected with restricted Non-local materials, such as argillite and rhyolite, accounted for less than two percent of the lithic assemblage at the Sandom Branch Site Complex.

Table 8-3. Chipped Stone Artifact Attributes by Component, 7NC-J-227 and 7NC-J-228.

	7NC-J-227		7NC-J-228	
	Middle Woodland	Late Woodland	Early (A-horizon)	Late (E2-horizon)
cortex frequency	31%	37%	41%	42%
point cortex frequency	20%	0%	0%	--
biface cortex frequency	50%	87%	26%	50%
bipolar cores	yes	yes	yes	--

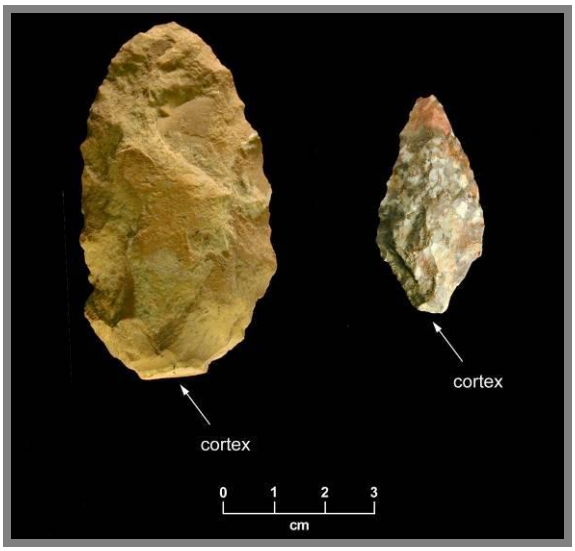


Plate 8-10. Remnant Cortex on the Proximal Ends of Cryptocrystalline Artifacts.
[Late Stage Biface (left) and Woodland I Contracting Stemmed Point (right)]

Table 8-4 compares raw material frequencies of the chipped stone artifacts with the gravels collected from the Sandom Branch and Blackbird Creek watersheds. The samples from each watershed were similar in material frequencies, and so they were combined for the analysis. The high frequency of cryptocrystalline material in the chipped stone assemblages (65-70 percent), contrasted with a low frequency (12 percent) in the gravel sample. The finding indicated a distinct preference for this particular material and, given the relative frequencies, implied that people expended considerable effort to sort through the gravel deposits to obtain it. Quartz, the second most frequent lithic material among the artifacts (25-30 percent), appeared to have been much more readily available in the gravels, since it comprised 63 percent of the total in the collected samples. Quartzite was even less well represented among the artifacts at the sites, despite a frequency in the gravels nearly twice that of cryptocrystalline material.

Table 8-4. Comparison of Raw Material Frequencies of Chipped Stone Artifacts and Locally Collected Gravels.

Material Type	Gravel Sample		7NC-J-227		7NC-J-228	
	Count	Freq.	Count	Freq.	Count	Freq.
quartz	1210	63%	534	33%	461	26%
quartzite	385	20%	21	1%	43	2%
cryptocrystalline	232	12%	1,055	65%	1,250	71%
sandstone	71	4%	--	--	--	--
conglomerate	6	<1%	--	--	--	--
siltstone	3	<1%	--	--	--	--
diabase	1	<1%	--	--	--	--
ironstone	5	<1%	1	<1%	1	<1%
limestone	2	<1%	--	--	--	--
argillite	--	--	3	<1%	2	<1%
rhyolite	--	--	20	1%	1	<1%
schist	--	--	--	--	1	<1%
gneiss	--	--	--	--	1	<1%
unidentified	4	<1%	--	--	--	--
Total	1,919		1,634		1,760	

Further evidence of the selection process could be seen when artifact length was compared to gravel size. Beginning with cryptocrystalline materials, the lengths of bifaces, points, and cores were tabulated as frequencies, along with the frequency of occurrence of the maximum dimension of cryptocrystalline gravels (Table 8-5). For the purposes of this study, gravels smaller than 30 mm in length were excluded from analysis as these were considered too small to have been selected for bifacial reduction; their high representation in the samples also would have reduced the relative frequencies of larger stones, making patterning among the larger pieces more challenging to interpret. As indicated in the table, the artifacts fit well within the dimensional range of the gravels. No artifacts exceeded the maximum dimension of the gravels, implying that all could have been manufactured from gravels similar in size range to those in the study samples. The mean size of cryptocrystalline cores was larger than the mean size of gravels of that material, implying the selection of larger-sized clasts for use in tool making (Table 8-6). A similar pattern was noted for quartz artifacts, although the mean size of quartz cores was substantially larger than that of quartz gravels, suggesting that with quartz occurring more frequently in the gravels, large clasts may have been more readily available.

Table 8-5. Frequency Distribution of Cryptocrystalline Gravel and Selected Cryptocrystalline Artifacts.

Length in mm	Gravel Sample		7NC-J-227 Points		7NC-J-228 Points		7NC-J-227 Bifaces		7NC-J-228 Bifaces		7NC-J-227 Cores		7NC-J-228 Cores	
	n	Freq.	n	Freq.	n	Freq.	n	Freq.	n	Freq.	n	Freq.	n	Freq.
<30	--	--	4	50%	1	100%	--	--	--	--	--	--	--	--
30-35	2	1%	1	13%	--	--	--	--	--	--	--	--	--	--
35-40	42	18%	--	--	--	--	2	25%	--	--	--	--	--	--
40-45	80	34%	2	25%	--	--	3	38%	2	33%	--	--	2	22%
45-50	44	19%	1	13%	--	--	2	25%	1	17%	2	50%	3	33%
50-55	32	14%	--	--	--	--	1	13%	--	--	2	50%	1	11%
55-60	14	6%	--	--	--	--	--	--	--	--	--	--	2	22%
60-65	6	3%	--	--	--	--	--	--	--	--	--	--	--	--
65-70	5	2%	--	--	--	--	--	--	1	17%	--	--	--	--
70-75	1	>1%	--	--	--	--	--	--	1	17%	--	--	1	11%
75-80	2	1%	--	--	--	--	--	--	--	--	--	--	--	--
80-85	1	>1%	--	--	--	--	--	--	--	--	--	--	--	--
85-90	0	--	--	--	--	--	--	--	1	17%	--	--	--	--
90-95	1	>1%	--	--	--	--	--	--	--	--	--	--	--	--
95-100	--	--	--	--	--	--	--	--	--	--	--	--	--	--
100-105	--	--	--	--	--	--	--	--	--	--	--	--	--	--
105-110	--	--	--	--	--	--	--	--	--	--	--	--	--	--
110-115	1	>1%	--	--	--	--	--	--	--	--	--	--	--	--
115-120	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	232		8			1	8		6		4		9	

Table 8-6. Size Comparison Between Cryptocrystalline and Quartz Gravels and Artifacts.

	length	
sample	cryptocrystalline	quartz
gravel	43.3 mm	43.8 mm
points	26.8 mm	37.8 mm
bifaces	36.1 mm	45.7 mm
cores	47.5 mm	78.3 mm

3.14.5 Thermally Altered Stone

Thermally altered stones were the most common artifact class at the Sandom Branch Site Complex, and usually were recovered from feature contexts. Spatial analyses suggested that the features shared similar depositional planes at each site, and thus they were considered to be contemporary. The majority of the thermally altered stone at each site consisted of quartzite: 75 percent at 7NC-J-227, and 58 percent at 7NC-J-228. To assess the relationship between the artifacts and local gravels, the whole, unfractured clasts of thermally altered quartzite from the sites were compared to the quartzite in the gravel samples. The size comparison was made by weight, since the lengths of thermally altered stones were not measured during the cataloging process due to the highly fractured nature of the artifact type.

Figures 8-14 and 8-15 show the frequency distributions by weight for the quartzite gravels and the artifacts from each site. In both cases, the thermally altered stones from the features were consistently larger than the majority of the stones naturally occurring in the gravel beds. In addition, the distributions indicated that there were few large quartzite cobbles at all in the deposits that were sampled. Considering the fact that quartzite comprised only about 20 percent of the entire gravel sample, the actual number of large clasts available for use would have been low.

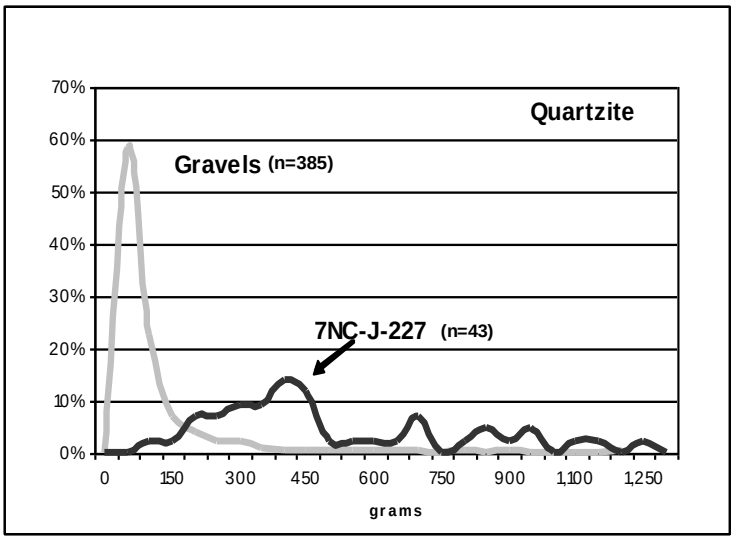


Figure 8-14. Frequency Distribution by Weight of Quartzite Gravels and Whole Thermally Altered Quartzite from 7NC-J-227.

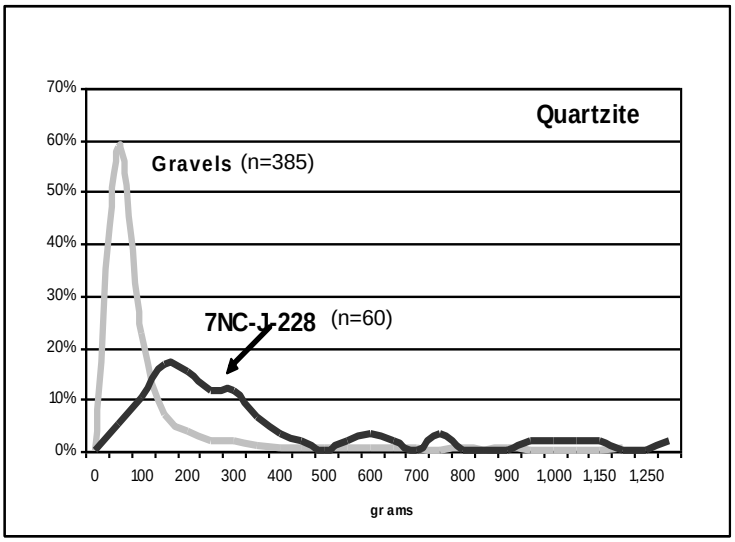


Figure 8-15. Frequency Distribution by Weight of Quartzite Gravels and Whole Thermally Altered Quartzite from 7NC-J-228.

In sum, the results of the comparisons provided quantified evidence of the selection of stone for use in lithic tool manufacture and in feature construction. In spite of their relative scarcity among the gravels, people sought out cryptocrystalline materials for use in tool production, while a clear preference was shown for using quartzite in heat-related activities. It is clear that the large volume of rock documented in the thermally altered stones stone features at the sites was procured locally—it is not likely that such an amount of material was transported great distances. Yet the relative absence of large cobbles in nearby gravel deposits indicated that considerable effort was required for the occupants of the Sandom Branch Site Complex to collect suitably sized material.

3.14.6 The Organization of Ceramic Technology

An examination of ceramic technology provides further insights into raw material selection by the inhabitants of the Sandom Branch Site Complex and the extent to which they depended on local or non-local sources for clays and tempering agents. This was accomplished through mineralogical analysis of clay and temper from ceramic vessels, coupled with experimental studies using locally collected clays. Impressions on ceramics, notably cordage-twist patterns, potentially reflect intra-and inter-social ties and these were explored as well.

3.14.7 Comparison to Regional Types

The sample of prehistoric ceramics from the Sandom Branch sites included 128 sherds from 7NC-J-227 and two sherds from 7NC-J-228. Some of the sherds conformed closely to established ware descriptions, others appeared to be uncommon varieties of established wares, and a small number were too small or weathered to confidently group as a ware. An Early Woodland, steatite-tempered Marcey Creek sherd and a Middle Woodland, clay-tempered Coulbourn sherd, both from 7NC-J-228, closely conformed to known type descriptions. Even though the sherds were small, their distinctive tempers allowed for secure identification. Middle Woodland Mockley and Late Woodland Townsend sherds from 7NC-

J-227 were highly weathered and lacked clear surface treatment or decoration, as did one of the Late Woodland Minguannan lots (MI2) from the site. Their groupings were based on paste characteristics alone. Since shell and quartz-tempered wares are common throughout the Middle Atlantic, those lots are considered only general forms of identification. The schist-tempered lot (SCH1) and the sand-tempered lot (S1) from 7NC-J-227 consisted of small, weathered sherds that were not typed. The remaining two Minguannan lots (MI1 and M13) from 7NC-J-227 fit the Minguannan type description outlined by Custer (1985). However, they were a collared form that is described as occurring only rarely (Custer 1987). These two vessel lots provided the best opportunity for comparison to regional types because they contained decorated rims, allowing for comparative analysis of decoration style and vessel form.

In general, Minguannan ceramic designs have been described as close to and sometimes indistinguishable from other Late Woodland wares in surrounding areas, including Potomac Creek, to the west, and Overpeck, Bowmans Brook, and Riggins, to the north. Potomac Creek is a crushed quartz or sand tempered, cord-marked ceramic occurring in the Piedmont and Coastal Plain of Virginia and Maryland. Overpeck is a grit-tempered, cord-marked ware from the Lower and Middle Delaware Valley (from Trenton northward to the Delaware Water Gap), while Bowmans Brook is a grit and sand-tempered ware, typically having a smoothed exterior and a geographical distribution centered in coastal New York (Staats 1974; Custer 1996: 269, 289). Riggins has been reported with a range throughout the Lower and Middle Delaware Valley, as well as southern Maryland (Thurman and Barse 1973), and is described as grit-tempered (quartz, sand, gneiss, argillite). Typical of Late Woodland ceramics in the Middle Atlantic coastal region, Riggins can be cord-marked, fabric-impressed, or incised (Wall et al. 2001). The Minguannan decorative motifs also overlap with those of Townsend ware in Delaware, and may follow a similar pattern of motif simplification over the Late Woodland period (Griffith and Custer 1985).

Similarities are also evident between Minguannan and Shenks Ferry, a contemporary, quartz-tempered, cord-marked ware with collared rims that was distributed throughout the Susquehanna Valley (Heisey 1971; Kinsey and Graybill 1971), and was related to the Montgomery Complex of the northern Maryland Piedmont (Slattery and Woodward 1992; Custer 1996:276). Yet, after analyzing design grammars and mapping geographic zones of particular ceramic styles, Custer contends that the distributions of the wares, Shenks Ferry to the north and Minguannan to the south, signal a major cultural boundary across southeastern Pennsylvania. Further, he equates the two ceramic wares with different language groups—Iroquoian with Shenks Ferry and Algonkian with Minguannan—and proposes that Minguannan ceramics were brought into the Delmarva peninsula by Algonkian speakers who settled in the region. This migration hypothesis is an amalgam of earlier research that includes Flannery's (1939) definition of a Central Coastal Algonkian culture area, and Griffith and Custer's (1985) observation that this culture area has the same general boundaries as the distributions of Townsend, Minguannan, Overpeck, and Bowmans Brook ceramics. Fiedel (1987, 1990) built on glotto-chronological analysis conducted by Luckenbach et al. (1987) to argue that proto-Algonkian speakers migrated into the Middle Atlantic region from their heartland in southern Ontario. Fiedel identified two waves of population movement: one around 600 BC to 200 BC; and the other around AD 300 to AD

700. The regional appearance of Mockley has been linked with the second of these proposed Algonkian waves (Gardner and Nash 1990; Stewart 1998).

The Minguannan vessels from both lots at 7NC-J-227 were collared and decorated with a cord-wrapped stick, or pseudo-cord. The appliquéd collars were formed either by the addition of a strip of clay around the rim of the vessel, or by folding the lip over and sealing it against the body. Thickened or appliquéd rims are characteristic of some Middle Atlantic wares, particularly in areas to the west of Delmarva. Contemporary with Minguannan, Potomac Creek ware exhibited applied rims in approximately 10 percent of the sample from the type site, Potomac Creek (44ST2) (Blanton et al. 1999). A much larger percentage of collared forms are found in association with Shepard ware, a crushed quartz and igneous rock tempered, cord-marked ceramic that is slightly earlier than Potomac Creek and occurs generally in Piedmont contexts. Slattery and Woodward (1992) reported that between 70 and 75 percent of Shepard ware vessels had collared rims. Comparisons have been made between Shepard ware and early Shenks Ferry forms (Heisey 1971). Griffith (1982) has noted occasional appliqués on the Middle Woodland Hell Island ware in Delaware. Griffith (1980) has also described rare occurrences of appliqué rims in Townsend Corded vessels in southern Delaware and the Eastern Shore of Maryland. He proposed that the appearance of the rim form along with the increased use of pseudo-cord motifs in the Late Woodland signaled a change in external influences in Delmarva, with the direction of external input shifting from the north to the west after AD 1285 (Griffith 1980:37).

The applied collar form was technologically different from the high, molded collar that is seen on late Owasco and Iroquoian pots that were the successors to Shenks Ferry in the culture area dominated by Iroquoian speakers according to Custer's theory. Applied and molded collars were considered to have been separate and unrelated styles (Ritchie 1965). This technological distinction provides some corroboration for the Minguannan/Algonkian migration hypothesis, since it implies both a different style and manufacturing technique in the southern and northern areas.

3.14.8 Ceramic Manufacture and Use

Critics have recently argued that ceramic distribution analyses based on stylistic classifications alone place too much emphasis on decorative motifs, while the "technological and social contexts of ceramic manufacture and use" are ignored (Chilton 1998: 132). The processes and techniques used in ceramic manufacture may also provide important information about the group producing a particular ware. Moreover, manufacturing technology may be less likely than decoration to change over short time intervals (Chilton 1998). Therefore, attributes of the production process such as surface treatment may be more indicative of group affiliation than decorative motifs, which are not present on all vessels and may tend to change more rapidly.

Surface Treatment—Cordage Twist

The patterning of cord and fabric impressions on ceramic sherds is one form of surface treatment that may be examined. Variation in cordage impressions was recognized as early as 1884, when W.H. Holmes made cast impressions of ceramic sherds and identified different cord construction techniques (Hurley 1979). Later researchers have quantified and

more fully described the different techniques used to construct cordage and fabrics. Cordage twist has been a recognized attribute in pottery description in the Middle Atlantic region for some time (Holland 1970; Falk 1981). Cordage patterns can be consistent within groups, and have been referred to as a constant and highly standardized trait which is "population specific among Native American groups" (Johnson 1989:2). Other explanations for differences in cordage patterns within and between sites includes interaction within learning pools, spatial overlap of settlement systems, ceremonial aggregation between distinct social groups (Carr and Maslowski 1995:315). Changes observed in an assemblage may signal systemic behavioral alterations, such as group movement or overwhelming influences from outside sources (Maslowski 1996).

Cordage can be constructed in a variety of ways ranging from simple to complex. Each ply or element that produces the cord may have different twists at a given stage. While the variety of twist patterns may be difficult to identify due to the often weathered condition of ceramic sherds (Hurley 1979), the final twist is often identifiable and has become widely noted in ceramic descriptions. Twist patterns are typically described as a “Z” or “S” twist, which denotes the slant of the lapped segments: upper right to lower left (“Z”) or upper left to lower right (“S”) (Hurley 1979). Ceramic assemblages are usually dominated by final cordage twist in a single direction. However, varying percentages of final S and Z twist ceramics in a contemporaneous assemblage could indicate the presence of distinct social groups.

The sample sizes from the Sandom Branch sites were small, but there was some indication of a change in twist direction over time. Final cordage twist was identifiable on four of the ten vessel lots. The Coulbourn and Mockley wares exhibited cordage with a final “S” twist, while on the Minguannan (MI1) and Sand-tempered vessel lots a final “Z” twist was identified. The results from this admittedly small sample parallel the findings reported by other researchers in which a shift from final “S” twist to final “Z” twist is recognized in Delaware in the period around AD 1000, the transition between the Middle Woodland, represented by Coulbourn and Mockley, and the Late Woodland, represented by Minguannan and the sand-tempered wares (Custer 1989; Custer et al. 1990b). While migration of a new people into a region is certainly a possibility, as some have suggested, we could also see stylistic drift caused by the incorporation of new members into existing social groups.

Temper—Petrographic Analysis

Clay is a mutable substance, and so it is well-suited for the construction of containers using simple design and manufacturing technology. It is malleable and can be easily molded into a desired shape, but it hardens when exposed to heat, producing a rigid form that is relatively light-weight and water-tight. Yet clay is not a good conductor of heat, and thus vessels are susceptible to thermal stress, both during manufacture and later if used in a heat related activity. To reduce this stress, tempering materials may be added to the clay to help transfer heat evenly throughout the vessel (Rice 1987:408; Sinopoli 1991). The characteristics of ceramic paste and its reaction to heat can, in fact, be complex. Common temper materials, such as quartz and other crushed rock, tend to expand more rapidly than clay, resulting in stress within the vessel during heating, yet they serve to increase the durability of the vessel to abrasion and sudden shocks. Pores in the paste have a tendency to slow cracking and

spalling from repeated heating, but may undermine the overall strength of a vessel (Orton et al. 1993).

Tempering agents identified among the ceramics from the Sandom Branch Site Complex included steatite, grog (crushed clay), shell, quartz, gneiss or hornblende, and undifferentiated sand or grit. To more accurately characterize these materials, as well as to provide additional information about natural inclusions in the clay used in the ceramics, petrographic analysis of a sample of sherds was undertaken. Ten sherds were thin-sectioned according to procedures outlined in Section 5.0 (Methods), and each was examined microscopically. In addition, three experimental tiles made from clays collected from the banks of Blackbird Creek and one tile from a similar study conducted at the Hickory Bluff site, on the St. Jones River south of Dover, were subjected to the same thin-sectioning procedures and microscopic analysis. The petrographic analysis was a blind test, since neither the ceramic type designations nor information about the temper identifications made archaeologically were supplied to the analyst.

The results of the analysis are summarized in Table 8-7. Detailed explanations of the petrographic identifications for each of the archaeological samples are included in the ceramic lot descriptions in Appendix G. Petrographic identifications of the experimental tiles follow.

Table 8-7. Results of Petrographic Analysis of Ceramic Temper Samples.

Sample Number	Matrix type	Temper type	% Matrix	Constituents (frequency)									
				Temper	Voids	Quartz	Feldspar	Olivine	Mica	Opaques	Biotite	Amphibole	Rock frags
806-1 (NNO-001)	**8**	Steatite	38.16	25.65	13.82	0.66	3.29	6.58	8.55	3.29	--	--	n/a
413-1 (NNO-002)	**4**	Grog	53.41	19.89	16.48	--	1.70	3.41	--	5.11	--	--	--
260-2 (NNO-003)	**10**	Shell	55.00	5.00	17.38	5.63	3.75	4.37	--	4.37	4.37	--	3.13
876-5 (NNO-004)	**4**	Shell	50.00	20.37	10	2.00	8.00	2.00	--	4.67	1.33	--	1.33
588-6 (NNO-005)	**5**	Shell	49.23	Indeterminate	16.92	1.54	13.85	5.85	--	4.61	--	--	8.00
548-8 (NNO-006)	**10**	Quartz	55.13	6.00	10.90	5.77	3.24	6.41	--	3.24	3.24	--	12.18
98-1 (NNO-007)	**10**	Quartz	56.34	8.00	7.04	--	7.04	3.52	--	10.56	0.70	--	14.80
150-10 (NNO-008)	**7**	Indeterminate	44.52	Indeterminate	10.32	--	9.03	14.84	--	3.87	0.64	--	16.13
115-4 (NNO-009)	**2**	Gneiss	43.59	11.54	16.03	--	0.64		--	6.41	1.28	20.51	n/a
58-1 (NNO-010)	**10**	Indeterminate	48.19	Indeterminate	10.84	--	2.41	3.61	2.41	14.46	--	--	18.07
BB1 (KCN-35)	**5**	n/a	59.10	n/a	6.90	9.00	13.50	1.70	0.60	8.80	--	--	0.00
BB2 (KCN-36)	**4**	n/a	58.10	n/a	7.50	0.00	2.50	0.00	0.00	5.00	--	--	26.90
BB3 (KCN-37)	**7**	n/a	79.40	n/a	5.60	0.00	0.00	0.00	0.00	4.40	--	--	10.60
HB1 (KCN-38)	**10**	n/a	29.00	n/a	10.30	16.00	27.80	2.10	0.00	3.20	--	--	11.60

BB1 (KCN-35). Sample BB1 was a test tile manufactured from clay obtained from a small tributary of Blackbird Creek at a depth of 3.1 m below the terrace surface (Figure 8-16, Location A). No tempering agents were added to the clay. In thin section (Plate 8-11), the tile had a cryptocrystalline matrix (resulting from high firing temperature) and a higher percentage (34 percent) of natural inclusions than the majority of the prehistoric ceramics examined in this study. Natural inclusions were poorly sorted and consisted primarily of altered quartz and feldspar, with smaller amounts of muscovite, calcite, and iron oxide. Voids (6.9 percent) included both small, rounded pores and irregular tears or drying cracks. Fabric orientation was random.

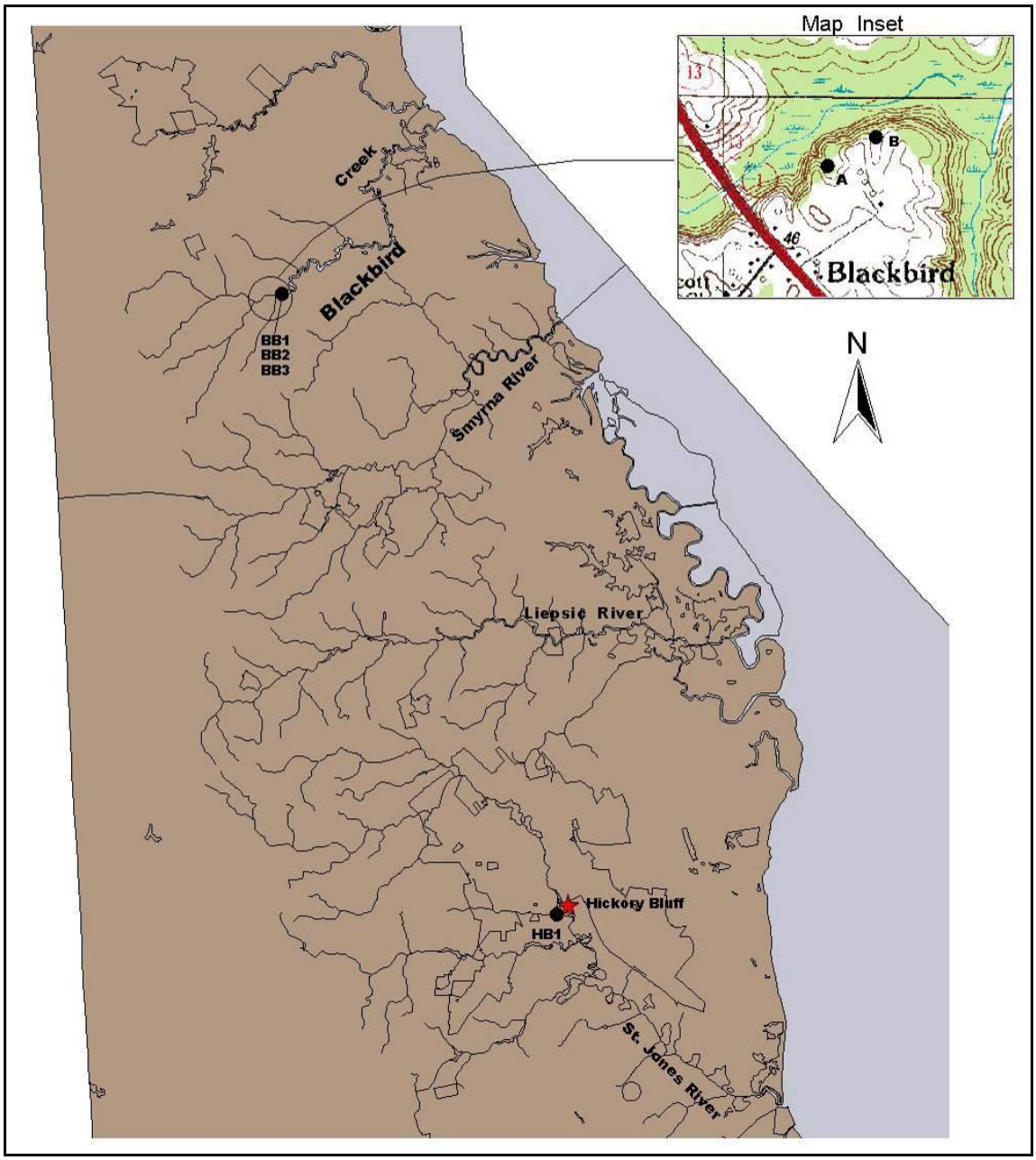


Figure 8-16. Locations of Clay Sources used for the Experimental Tiles.

Experimental Tile BB1

Thin Section

Plate 8-11. Experimental Ceramic Tile BB1.

BB2 (KCN-36). Sample BB2 was a test tile manufactured from clay obtained from a second small tributary of Blackbird Creek at a depth of 2.0 m below the terrace surface (Figure 8-16, Location B). No tempering agents were added to the clay. In thin section (Plate 8-12), the tile had a fine-grained, micaceous matrix with a higher percentage (34.4%) of natural inclusions than the majority of the prehistoric ceramics examined in this study. Natural inclusions were very poorly sorted and consisted primarily of rock fragments (quartz and an altered mafic rock), with smaller amounts of feldspar and iron oxide. Voids (7.5%) included both small rounded pores and irregular tears around the rock fragments. Fabric orientation was generally parallel to the long axis, but exhibited tight spirals or swirls around the rock fragments.

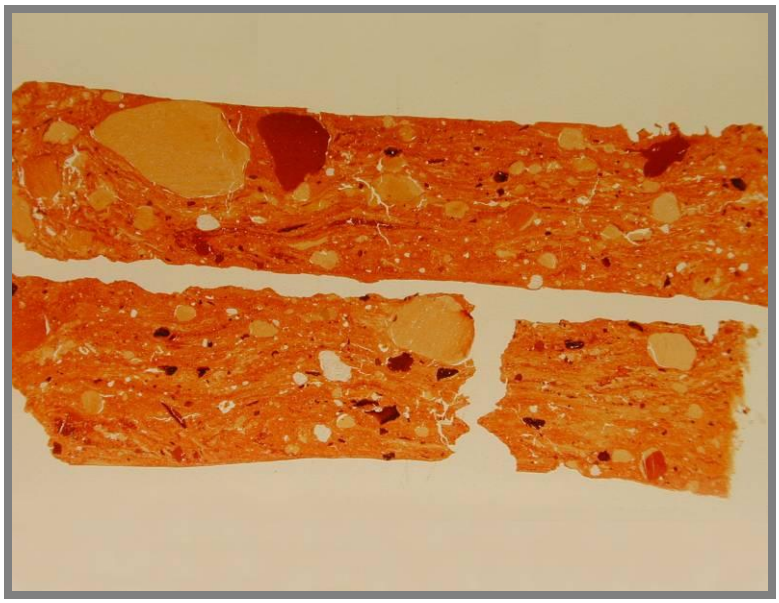
BB3 (KCN-37). Sample BB3 was a test tile manufactured from clay collected from a second small tributary of Blackbird Creek at a depth of 2.36 m below the terrace surface (Figure 8-16, Location B). No tempering agents were added to the clay. In thin section (Plate 8-13), the tile had a fine-grained matrix that consisted in part of tiny quartz and feldspar grains. Natural inclusions (15%) were poorly sorted and consisted primarily of quartz fragments, with a smaller quantity of iron oxide. Voids (5.6%) included both small, rounded pores and irregular tears or drying cracks. Fabric orientation was parallel to the long axis of the sherd.

HB1 (KCN-38). Sample HB1 was a test tile manufactured from clay obtained west of the Hickory Bluff site, at the confluence of Puncheon Run and the St. Jones River (Figure 8-16). No tempering agents were added to the clay. In thin section (Plate 8-14), the tile had a cryptocrystalline matrix and the highest percentage (60.7%) of natural inclusions observed in the thin sections examined in this study. Natural inclusions were very poorly sorted and consisted primarily of altered quartz, feldspar, and chert fragments, with smaller amounts of calcite and iron oxide. Voids (10.3%) included both small rounded pores and infrequent large tears or drying cracks. Fabric orientation was random.

Analysis of Clay Matrix and Inclusions

The existing database of petrographic thin sections in the Middle Atlantic is small. A recent study conducted at the Hickory Bluff site (Petraglia et al. 2002) using the same methods as the current study provided results that could be compared to the findings from the Sandom Branch Site Complex. In the Hickory Bluff study, the ceramics were grouped into ten matrix-type clusters, recognized on the basis of similarities in paste and surface appearance. Six of the matrix clusters were represented in the sherds from Sandom Branch (Table 8-8). Details of these six matrix types are listed in Table 8-8.

Experimental Tile BB2



Thin Section

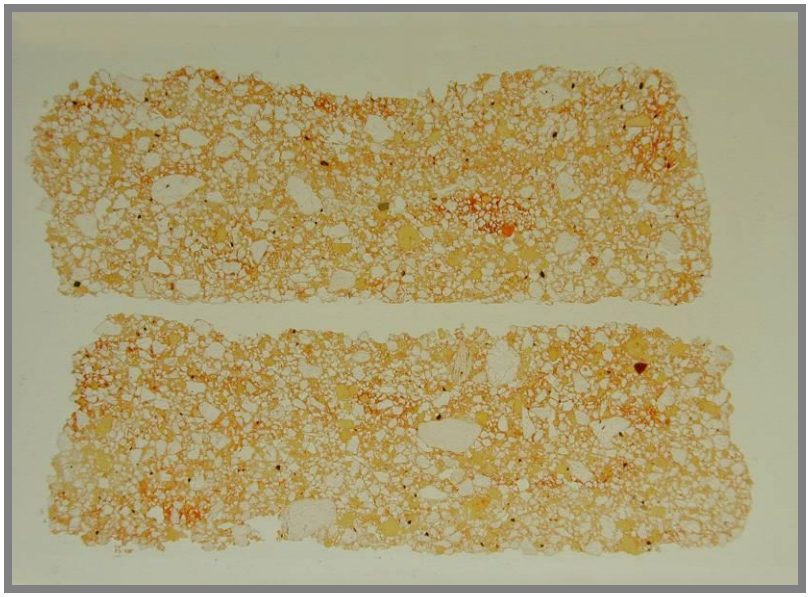
Plate 8-12. Experimental Ceramic Tile BB2.

Experimental Tile BB3

Thin Section

Plate 8-13. Experimental Ceramic Tile BB3.

Experimental Tile HB1



Thin Section

Plate 8-14. Experimental Ceramic Tile HB1.

Table 8-8. Comparison of Ceramic Matrices.

Matrix Cluster	Color	Texture	Natural Inclusions	Test Tile Similarity
2	Brown to black	Cryptocrystalline	Moderate density inclusions; poorly to moderately well sorted; slightly micaceous matrix; includes quartz, feldspars, pyroxene, & iron oxides.	--
4	Reddish black	Cryptocrystalline; Fabric has spirals/ swirls	Lower density of inclusions; poorly sorted; slightly micaceous matrix; includes quartz, feldspar, olivine, & iron oxides.	BB2
5	Cloudy, light brown	Fine-grained	Low to moderate density inclusions; poorly sorted; includes quartz, feldspar, olivine, & iron oxide	BB1
7	Red to reddish brown	Cryptocrystalline	Low to moderate density inclusions; poorly sorted; low density of voids in tempered sherds, high density of drying cracks in untempered sherds; includes hematite – both sherds from Sandom Creek also included abundant olivine.	BB3
8	Reddish brown	Fine-grained	Moderate to high density inclusions; very poorly sorted; extremely micaceous matrix; includes quartz, feldspar, olivine, mica, & iron oxide.	--
10	Medium brown to reddish brown	Fine grained to cryptocrystalline	Moderate to high density of natural inclusions; poorly sorted; generally opaque matrix; includes quartz, feldspar, olivine, biotite, rock fragments, & iron oxide.	HB1

The development of the matrix types in the Hickory Bluff analysis was based on texture, color in plane light, and the density and type of natural inclusions observed. Tempering agents were not included in the defining attributes, apart from the recognition that prehistoric potters would likely have used tempers with consistent firing properties for a given clay type and set of firing conditions (e.g., grog and steatite fragments may have been interchangeable in terms of size and angularity, while sand and steatite would not have been interchangeable). Firing conditions, such as temperature, duration, fuel type, and the amount of oxygen present, can affect the appearance and texture of the clay matrix in a ceramic vessel. Consequently, it was difficult to ascertain with certainty whether slight differences in color and texture between matrix-type clusters were related to different clay sources or to different firing conditions.

General observations included the presence of olivine as a common constituent in all of the sherds from the Sandom Branch sites. Olivine was not noted in sherds from Hickory Bluff. In contrast, muscovite was common in Hickory Bluff sherds, a finding that may have been related to the frequent occurrence of steatite-tempered wares at this site. Voids, in the form of thin drying cracks, were also much more prevalent in the Sandom Branch sample; this may have been related to variations in the amount of tempering agents in many of the sherds, or to different manufacture methods. The Sandom Branch sherds also exhibited considerably less weathering and leaching of minerals as compared with the samples from Hickory Bluff, a postdepositional phenomenon associated with the relative ages of the sherds, as well as the chemistry and drainage characteristics of the soils at the sites.

The matrix-type clusters were compared with the matrices observed in the four experimental tiles, in an attempt to correlate one or more clusters with an identified clay source. The

correlation of Matrix Cluster 4 with the clay source represented by tile BB2, from Blackbird Creek, was considered to be fairly strong, based on diagnostic swirls and spirals in the paste. The correlation of Matrix Clusters 5, 7, and 10 with the clay sources represented by BB1, BB3, and HB1, respectively, were more tentative when just the Hickory Bluff samples were considered, but were strengthened by the addition of the Sandom Branch samples.

Matrix Clusters 4 and 5 showed the strongest relationships with the Sandom Branch samples. At the Hickory Bluff site, Matrix Cluster 4 consisted entirely of clay-tempered ceramics, while the grog-tempered Coulbourn sherd from 7NC-J-228 was also placed in this group as a result of the blind test. As noted above, attributes of Cluster 4 also correlated with the experimental clay tile BB2. The additional correlation of the cluster with sherds from the Hickory Bluff site highlighted the general nature of the relationship that was demonstrated between the ceramic sherds and the clay sources. Yet, the findings in the current analysis suggested that the Coulbourn vessel from 7NC-J-228 could have been produced in the vicinity of the Sandom Branch sites, as its natural inclusions, temper material, and matrix were consistent with clay found locally.

One of the Townsend sherds in the Sandom Branch sample, from 7NC-J-227, Lot Town2, was placed in Matrix Cluster 5. This group was also considered similar to experimental clay tile BB1. In the original analysis at the Hickory Bluff site, Matrix Cluster 5 included sherds from both clay-tempered and Townsend lots. As with Cluster 4 above, the findings suggested the general nature of the relationship between the matrix clusters and specific sherds or wares, but also implied the possibility that the ceramics in the Townsend lot could have been manufactured from locally derived clay.

A Minguannan sherd recovered from 7NC-J-227, Lot MI3, was included in Matrix Cluster 7. This group also included experimental tile BB3, suggesting that the Minguannan vessel represented by the sherds could have been manufactured from locally procured clay. In the Hickory Bluff analysis, sherds from Dames Quarter and Marcey Creek lots were associated with Cluster 7.

The steatite-tempered Marcey Creek sherd from 7NC-J-228 was included in Matrix Cluster 8, as were all but two Marcey Creek sherds from the Hickory Bluff site. Matrix Cluster 8 did not show similarity to any of the experimental clay tiles. Considering that known steatite quarries are located hundreds of miles from the Sandom Branch sites, this finding suggested that the vessel had not been manufactured locally, but had been brought to the site from another location.

Several sherds from 7NC-J-227 were included in Matrix Cluster 10, a group that also displayed a relationship with attributes of the experimental tile from the Hickory Bluff site, HB1. The wide range of types from the Sandom Branch sites that were placed in this cluster, including Mockley, Minguannan, and an untyped sand-tempered ware, as well as the inclusion of the tile from the clay source on the St. Jones River, implied that the defining characteristics of the matrix cluster were too general to be useful for this analysis.

Smudging

Patterns of use wear on vessels may have resulted from manufacturing processes or vessel function. Discoloration or soot may develop on the base and/or bodies of vessels used repeatedly for heating or cooking purposes. Similar differences in body color may also result from the initial firing process (Orton et al. 1993). Among the ceramics from the Sandom Branch sites, smudged exterior surfaces, resulting from a thin build-up of soot caused by exposure to an open fire, were observed on 10 Minguannan sherds. All ten sherds—nine body fragments and one rim—were from lot MI1. Soot accumulation on the rim sherd suggested that the smudging may have been part of the firing process, when the vessel was completely surrounded by the fire. Smudging also was identified on the interior surfaces of two sherds, both untyped sand-tempered sherds that were not given lot designations. None of the sherds displayed organic residues suitable for constituent analysis or dating.

3.14.9 Subsistence Practices

Direct evidence for past subsistence practices at the Sandom Branch Site Complex proved elusive. Prior research indicated that the area was dominated by an oak-hickory forest during the main periods that the American Indians were present at the Sandom Branch Site Complex. The nuts and acorns were considered an important food source and were also primary seasonal forage for key game species such as deer, turkey, and squirrel. Minor quantities of hickory nuts and acorns were recovered at the Sandom Branch Site Complex. Few faunal remains were recovered. Clearly, preservation of organic remains was an issue. We will return to the issue of organic preservation when we consider the issue of paleoenvironmental reconstruction below.

Indirect evidence for subsistence practices was more plentiful, consisting of chipped stone tools, ceramic vessel fragments, and thermally altered stone features—at least some of which were associated with cooking fires. While we may not know precisely what types of plants or animals were sought out in the Sandom Branch area, we do know that a full range of processing and cooking activities took place here, including hunting, cutting, scraping, and grinding/crushing. There is also a suggestion that some gathered plant remains were stored at least temporarily on site. Features 7, 38, and 43 at 7NC-J-228 apparently were originally used as temporary storage features.

3.15 Scales of Social Organization

3.15.1 Agency and Gender

Finding the individual and discerning gender distinctions in the archaeological record can be challenging. One strategy that can help address this challenge is to focus on unique items, rather than mass analyses of more ubiquitous materials. One artifact in particular has the greatest potential for examining both agency and gender from the archaeological record at the Sandom Branch Site Complex. This is the ground slate semi-lunar object recovered from 7NC-J-227 that was reworked with a rounded cutting edge. This object might represent a fragment of a gorget—but one unlike any documented in the Middle Atlantic region—or could represent a semi-lunar knife, sometimes referred to as an ulu, which is Inuit for "woman's knife." This object may have been retained for a period as a symbolic item, after it could no longer meet its functional purpose. Functional interpretations of semi-lunar slate

knives are based on observations of groups that have used them in historic times. Banks (1998) outlined ethnographic descriptions by Swan (1870), Osgood (1940), and Birket-Smith (1959) among others, of groups from the Northwest Coast, Alaska, the Arctic Bay area, and Greenland, where the slate semi-lunar knife was used primarily for cleaning and preparing fish. Where it has been recorded in historic times, the slate semi-lunar form has been used almost exclusively by women, while men used more dagger-like knife forms. Closer attention to such unique finds at other sites can further an understanding of agency and gender in the archaeological record.

3.15.2 Site Structure and Settlement Patterns

The sites of the Sandom Branch Complex are located near the transition between the Mid-Peninsular Drainage Divide and Mid-Drainage physiographic zones as defined for the Delmarva Peninsula (Custer 1989:29-31). The Mid-Peninsular Drainage Divide comprises the headwaters of the major stream systems that drain the peninsula. The region consists of a wide upland ridge that separates streams flowing westward to the Chesapeake Bay and eastward to the Delaware Bay and Atlantic Ocean (Figure 8-16). The zone is characterized by well-drained, sandy ridges and swampy depressional areas associated with bay/basin features. The second region, the Mid-Drainage zone, straddles the foot slopes of the drainage divide and the upper estuary environments that form the tidal limits of slow-moving coastal streams. Encompassing the intermingling of brackish and freshwater habitats, the Mid-Drainage zone is a transitional area or ecotone that contains a rich variety of natural resources in a relatively confined area (Butzer 1982:15).

The Sandom Branch Site Complex contained evidence of a variety of activities by American Indian groups, including: the processing of raw materials through indirect boiling; the production and use of informal flake tools; formal biface manufacture; processing tasks that required cutting and scraping tools; hunt preparation; short-term caching or storage, as evidenced by several pit features at 7NC-J-228; and, probably, associated ceremonial activities. These activities were examined to determine if they represented short-term versus long-term site use. The length of an occupation may be judged by the range of activities undertaken: short-term site use would typically be focused and include specific activities that would not tend to overlap spatially, while longer-term use would encompass a greater amount of activity that would be more varied and could include zones that would overlap horizontally.

Activity area analyses conducted at the Sandom Branch Site Complex involved grouping artifacts and features on the basis of functional interpretations, and the amount and intensity of activity was gauged by analyses of general spatial data. The majority of the thermally altered stone features at the Sandom Branch sites were interpreted as the remnants of activities that involved stone-boiling. During the Middle Woodland period, the distribution of thermally altered stone fragments across the Sandom Branch landscape implied a relatively complex site structure, probably including well-defined work areas that were located away from the excavation blocks, either off-site or in non-sampled parts of the Sandom Branch Site Complex area. Most of the thermally altered stone was transported from the original work areas to other locations for disposal, probably in containers of some sort. Ruling out the effects of non-cultural processes on the forms of the features, scatters

such as Feature 23 (7NC-J-228) or the southern part of Feature 30 (7NC-J-227) appeared to represent material strewn across the Sandom Branch landscape, in contrast to clustered rock features such as Feature 21 (7NC-J-228) or Feature 35 (7NC-J-227), which appeared to represent piled debris. The compound shape of Feature 30—with both concentrated and dispersed areas—may have resulted from the sorting of thermally altered stone from a pile after its initial deposition, with large pieces removed for reuse and some of the less desirable pieces scattered away from the main cluster.

In some areas, the thermally altered stone distributions were separate from distributions of chipped stone artifacts. In others, there was considerable overlap. Features 1 and 9, at 7NC-J-228, together may have represented a specialized processing locale, the heavily fractured stone in Feature 1 being the remnants of rock used to heat the contents of a lined pit, Feature 9. Associated evidence consisted of several points and small fragments of flaking debris typical of tool maintenance. Given the relative lack of debris around Feature 1, this feature may have been part of ceremonial activities, such as purification or sweat lodge rituals, although material evidence for these forms of activity is often difficult to identify. Feature 5 was located in part of 7NC-J-227 that contained an extensive amount of flaking debris, but there was little distinctive temporal evidence that could be used to relate the feature with the artifacts. Based on its form, the feature may have functioned as a pit oven. A third feature, Feature 40, located in the southeastern corner of Blocks GHI (7NC-J-227) occurred in an area of concentrated and overlapping activities, based on the amount and character of the artifacts that surrounded it. The material included points and ceramic sherds, lithic tool maintenance debris, more generalized lithic reduction debris, and a fragment of ground slate that appeared to have been part of a cutting tool.

3.15.3 Settlement Patterning

Settlement models have been proposed in most parts of the Middle Atlantic to explain the varieties of American Indian landscape use since the initial settling of this region over ten millennia ago. In these models, individual sites are assigned type designations, determined largely on the basis of site size, the forms of artifacts and features present, and the activities considered to have been conducted by American Indian groups of varying sizes. Interactions between the American Indians who created the various sites assigned to the types are then proposed and are referred to as the settlement systems. While a variety of site types have been suggested, they generally parallel the base camp/work camp dichotomy proposed by Binford (1966) on the basis of ethnographic observations. Base camps are presumed to have been the scene of maintenance activities. They housed relatively large groups, and their locations were chosen on the basis of space and shelter requirements, and centrality in terms of the targeted resource(s). Work camps, in contrast, were focused on extractive activities performed by small task groups, and were located according to the distribution of specific resources. While these are useful categories for the archaeologist, they impose a rigidity on the archaeological record that may not match the fluid nature of American Indian social groups who pursued a flexible strategy to meet their varying short- and long-term needs.

Focal models of settlement argue that base camps form the center from which people mad forays for specific resources. LeeDecker et al. (2005:265-6) recently suggested that focal settlement patterns presume a measure of sedentism that has not actually been demonstrated

for most periods of Delaware's pre-Contact history. They cite evidence from the Puncheon Run site (7K-C-51), on the St. Jones River, of short-term occupations in both spring and fall, contrary to most models that include one longer season of occupation. Storage facilities are usually considered evidence of long-term occupation, yet silo-shaped pit features at the Puncheon Run site were unrelated to the other occupations at the site, suggesting that they held cached material associated with a mobile American Indian population rather than a sedentary one. From this evidence the researchers reasoned that individual episodes of site use were neither extensive nor long-term, and they proposed that a reassessment of regional settlement data reveals little evidence of long-term occupation at other sites along the river. An important part of this assessment involves determining whether sites with abundant archaeological material were the scene of large occupations or of repeated visits by small American Indian groups.

Apparently large sites may have been instances of repeated targeting over time and discrete occupations could not be distinguished due to weak chronological controls, the reuse of land surfaces, and the compressed nature of later stratigraphic sequences. Carey Farm (7K-D-3), located several miles downstream from Puncheon Run, appeared to have had extensive occupation in the Middle Woodland period, based on the volume of artifacts recovered in archaeological excavations, but it was argued from the perspective of the Puncheon Run site that there was no clear evidence that the site use was contemporary rather than consisting of overlapping occupations. Similarly, extensive Early and Middle Woodland deposits were documented at Hickory Bluff (7K-D-411), immediately across the St. Jones River from the mouth of Puncheon Run, yet the evidence from those excavations was interpreted as repeated targeting of the terrace above the river by small American Indian groups. The Puncheon Run researchers further noted that the human element was largely missing from most analyses of land-use patterns (LeeDecker et al. 2005). They observed that individuals do not follow schematic subsistence rounds, but make decisions based on personal judgments and preferences. By recognizing this individual agency, the complexity of human actions reflected in the archaeological record is highlighted (Hodder and Hutson 2003).

The overlapping nature of the occupations at the Sandom Branch Site Complex suggested repeated occupation of this landscape that was dynamic over time, and tied to activities taking place within the immediate region. Essentially, in the southwest part of Block A, at 7NC-J-228, the amount of debris and range of tasks implied by the recognized tool forms suggested that multiple, overlapping activity areas were present, potentially signaling longer-term use by American Indian groups than was seen in other areas of the Sandom Branch landscape. In the southern part of Blocks GHI, at 7NC-J-227, multiple activities were also noted based on the character and distribution of artifacts around Feature 40. Less material evidence occurred in this part of the site than in Block A, implying a shorter period of use. In the area of Feature 1 and Feature 9, in the northeastern part of Block A, very little debris was recovered. The analysis of this material suggested short-term use. The data from Blocks GHI suggested repeated use during the Middle Woodland period, with an apparent long hiatus, followed by limited Late Woodland activity. The data associated with Feature 1 and Feature 9—two points indicative of Early-to-Middle Woodland occupation—again suggested short-term use.

3.15.4 Chronological Components

The Sandom Branch Site Complex contained evidence of occupations in sub-periods defined by Custer in terms of the Carey, Webb, and Minguannan cultural complexes, corresponding with the early and late portions of the Middle Woodland period and the full span of the Late Woodland period, in that order (Table 8-9).

Table 8-9. Woodland Period Regional Complexes in Delmarva Highlighting Periods Represented by Artifacts at the Sandom Branch Sites.

	EASTERN CHRONOLOGY	DELMARVA CHRONOLOGY	DELMARVA WOODLAND COMPLEXES		
			LOWER COASTAL PLAIN	UPPER COASTAL PLAIN	PIEDMIONT/ FALL LINE
1600	LATE WOODLAND	WOODLAND II	SLAUGHTER CREEK	SLAUGHTER CREEK	MINGUANAN
1000	MIDDLE WOODLAND	WOODLAND I	LATE CAREY COMPLEX	WEBB COMPLEX	DELAWARE PARK COMPLEX
500			CAREY COMPLEX		BLACK ROCK II COMPLEX
AD / BC	EARLY WOODLAND		WOLFE NECK COMPLEX	DELMARVA ADENA COMPLEX	BLACK ROCK I COMPLEX
500			BARKER'S LANDING III COMPLEX		CLYDE FARM III COMPLEX
1000	LATE ARCHAIC		BARKER'S LANDING II COMPLEX		CLYDE FARM II COMPLEX
1500					
2000			BARKER'S LANDING I COMPLEX		CLYDE FARM I COMPLEX
2500					
3000					

Evidence of American Indian use of the Sandom Branch landscape prior to the Middle Woodland period was ephemeral and challenging to interpret. Artifacts associated with the Early Woodland, in the form of Lackawaxen stemmed points and a fragment of Marcey Creek ceramic, were recovered from 7NC-J-228. They resembled material from assemblages attributed to the Barker's Landing Complex that encompassed the transition from the Late Archaic to the Early Woodland on the High Coastal Plain. Yet evidence from the site was not extensive enough for statements to be advanced about the size or nature of occupations from this period that might have been represented.

A single sherd of clay-tempered ceramic, sometimes referred to as Coulbourn, was recovered at 7NC-J-228. Coulbourn ceramics were part of the characteristic artifact assemblage of Delmarva Adena, the Early Woodland cultural complex recognized in a relatively confined region in the central part of the state, mostly in the St. Jones and Murderkill valleys, well to

the south of Sandom Branch (Custer 1989:252). Yet none of the other artifact types generally associated with Delmarva Adena, such as Adena points, exotic lithic raw materials, or grave goods were recovered from either 7NC-J-227 or 7NC-J-228.

Most of the diagnostic evidence at Sandom Branch indicated Middle and Late Woodland site use. The earliest of these artifacts appeared to have been related to the Carey Complex, as defined at several sites in central and northern Delaware, including Carey Farm (7K-D-3). Characteristic artifacts of the Carey Complex included Mockley ceramics, and Rossville and Fox Creek points (the latter particularly prevalent in the southern Delmarva). Evidence from several sites in central Delaware, including Carey Farm, Puncheon Run (7K-D-51), and Hickory Bluff (7K-D-411), suggest that additional elements of this Middle Woodland artifact assemblage were the small, stemmed points labeled Woodland I stemmed, that were common at the Sandom Branch sites.

The single Jack's Reef point recovered in Block N at 7NC-J-227, when accompanied by Hell Island ceramics, is considered to help define the Webb Complex. First described at the Island Field site (7K-F-17) by Thomas and Warren (1970), the Webb Complex is considered the major late Middle Woodland period cultural manifestation in the High Coastal Plain of Delaware. Mortuary ceremonialism at Island Field and other Webb Complex sites has been cited as evidence of contacts with extra-regional groups (Thomas and Warren 1970; Custer et al. 1990). Yet little other evidence of distinctively Webb Complex material was recovered at the sites beside the single pentagonal point.

Extensive material remains at 7NC-J-227 were characteristic of assemblages from the Late Woodland period Minguannan and, possibly, Slaughter Creek complexes. The Minguannan Complex was originally proposed by Witthoft (in Wilkins 1976, 1978), based on data from the Minguannan site (36CH3), in southeastern Pennsylvania. The complex was more formally defined for northern, Piedmont-Fall Line regions of Delaware following analysis of the material from the Minguannan site and from the nearby Webb site (36CH51) (Custer 1985). Characteristic artifacts included sand-tempered Minguannan ceramics and triangle points. The Slaughter Creek Complex is considered to have represented a coastal material culture, distributed across the southern portion of the Low Coastal Plain, and was characterized by thin-walled, shell-tempered, and often highly decorated Townsend ceramics. As with the northern Minguannan Complex, diagnostic lithic artifacts consisted of a series of triangle points.

Detailed analysis of the vertical and horizontal proveniences of these diagnostic artifacts, along with contextual analysis of features and sediment strata, allowed the spatial discrimination of several relatively distinct components related to these complexes. In brief review, at 7NC-J-227, a Late Woodland component, associated with the Minguannan and possibly Slaughter Creek complexes was identified, along with an early Middle Woodland component related to the Carey Complex. At 7NC-J-228, an Early-to-Middle Woodland component, possibly related to the Carey Complex, was identified in the upper stratum, while the lowest levels contained an earlier component that lacked confidently associated chronological data. Plates 8-15 through 8-19 illustrate artifact assemblages from these

components, including diagnostic artifacts and a selection of bifaces, cores, and groundstone implements.

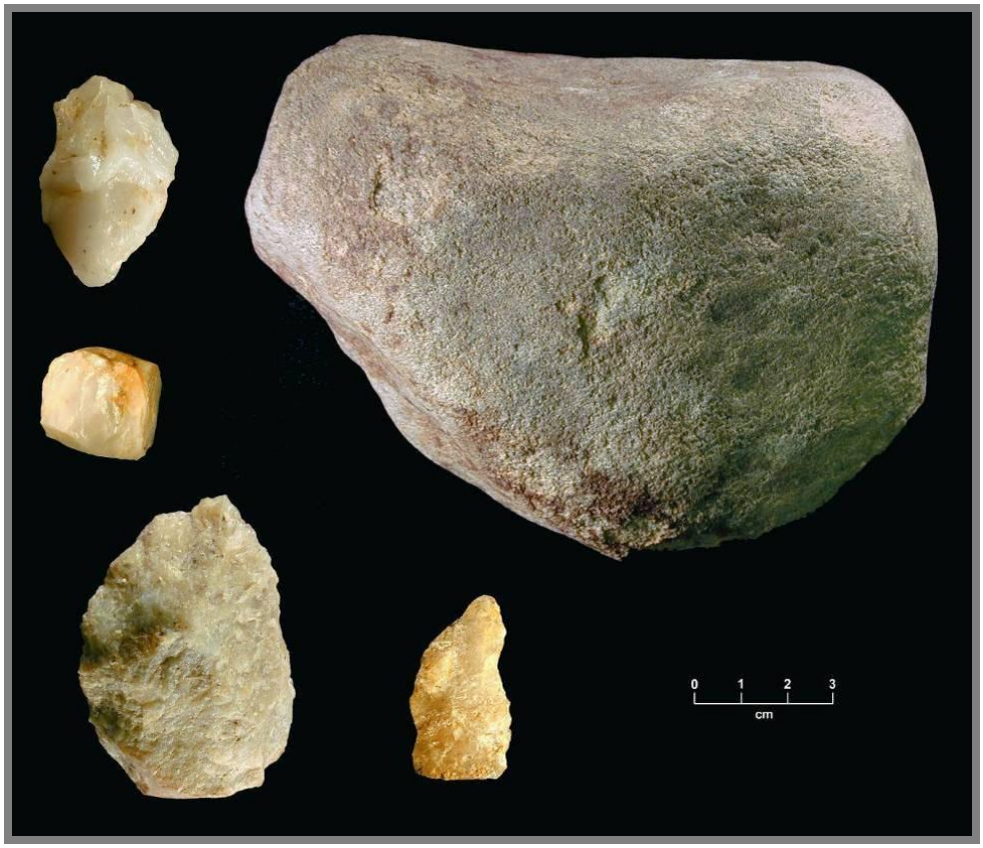


Plate 8-15. Artifacts in the Early Component, Block A, 7NC-J-228.

(clockwise from upper right: anvil, late stage biface, early stage biface, bipolar core, bipolar core)

Plate 8-16. Artifacts in the Upper Component, Block A, 7NC-J-228.

(first row: Lackawaxen, Rossville/Piscataway, Woodland I stemmed, triangle points; second row: late stage and early stage bifaces; third row: early stage bifaces and bipolar cores; fourth row: bipolar cores and hammerstones)

Plate 8-17. Artifacts in the Middle Woodland Component, Southern Portion of Blocks GHI, 7NC-J-227.

(first row: Woodland I stemmed points, Mockley ceramics; second row: ground slate fragment, third row late stage biface; fourth row bipolar core and multidirectional core)

Plate 8-18. Artifacts in the Late Woodland Component, Block GHI 7NC-J-227.

(first and second rows: triangle points; third row late stage bifaces, Minguannan ceramic [top], Townsend ceramic [bottom]; fourth row early stage bifaces; fifth row bipolar cores and multidirectional core)

Plate 8-19. Artifacts in the Late Woodland Component, Block N, 7NC-J-227.

(first row: triangle points; second row: Townsend ceramic [body], Minguannan ceramic [rim, body]; third row early stage biface, late stage biface, uniface; fourth row: bipolar cores, hammerstone; fifth row: bipolar core, multidirectional core, anvil)

3.15.5 Regional Site Distribution

To assess the regional context of the Sandom Branch sites, locational data for known pre-Contact American Indian site components in the area were plotted on maps of the southern part of New Castle County. Because modern political boundaries may have little relevance to past settlement patterns, major watersheds were the used as geographic boundaries. The Blackbird Creek watershed, within which the Sandom Branch Site Complex was situated, was the central focus, while data for sites in watersheds to the north (the Appoquinimink River) and to the south (the northern half of the Smyrna River) were added for comparative analysis. Cultural Resource Survey (CRS) data were obtained from the DESHPO, which provided site locations in a digital database. Site attribute data were taken from hard copy site forms in the DESHPO site files. The attribute data were correlated for spatial analysis through CRS numbers. Watershed maps used in the study were obtained from the Watershed Delineation Project, posted by the Spatial Analysis Lab of the University of Delaware (Mackenzie 1999). The hydrology dataset used was comprised of hydrographic linear features originating from USGS 1:24,000-scale hydrography digital line graphs for the State of Delaware, obtained through the Delaware Data Mapping and Integration Laboratory, also located at the University of Delaware (UDEL 2002).

In total, 444 prehistoric sites were recorded in the database within the portions of the three watersheds used in the study. Late Woodland components could be isolated in the chronological data, and a total of 41 sites were identified, as noted in Table 8-10 and plotted in Figure 8-17. Differentiating Early and Middle Woodland period components was not practical because the chronological reporting in the site files was not consistent. The Delmarva chronology, which does not distinguish sub-periods between the start of the Late Archaic and the end of the Middle Woodland, was employed throughout on site forms. Regional complexes, such as Barker's Landing and Webb, which subdivided the Woodland I, were not reported with regularity. Therefore, the more comprehensive Later Archaic-to-Middle Woodland period Woodland I totals are presented in the table and used in the distribution plot in Figure 8-18.

Table 8-10. Distribution of Prehistoric Site Components in the Major Watersheds near the Sandom Branch Sites.

Watershed	Prehistoric sites	Archaic-Middle Woodland sites	Late Woodland sites
Blackbird Creek	243	62	14
Smyrna River (north)	88	10	7
Appoquinimink River	93	23	20
total	424	95	41

The most obvious difference in the distributions was the seemingly lower frequency of sites containing Late Woodland components in comparison with Woodland I site components. This may relate to how the data were grouped, because the data represent very different time scales. The Woodland I distribution represents occupations spanning three sub-periods—the Late Archaic, Early Woodland, and Middle Woodland—and a range of as much as 2,500 years. The Late Woodland data, in contrast, represent a single sub-period comprising the last 600-700 years of regional prehistory, less than one-quarter of the time encompassed by the

Figure 8-17. Distribution of Sites with Woodland I Components in Portions of the Blackbird Creek, and Appoquinimink and Smyrna River Watersheds.

Figure 8-18. Distribution of Sites with Late Woodland Components in Portions of the Blackbird Creek, and Appoquinimink and Smyrna River Watersheds.

Woodland I. Other variations that were noted in the distributions included differences in the numbers of site components between the three watersheds or between tidal and non-tidal zones. These appeared to be as much a factor of sampling bias as of actual spatial patterning, because survey coverage of the regions has not necessarily been systematic.

Geographic data available for use in comparative analyses were limited. The major environmental variable that could be mapped consistently was surface water. Using the USGS hydrology data noted above, the distance to water was calculated for each site component in the Woodland I and Late Woodland groups, and the results were plotted as cumulative frequency distributions (Figure 8-19). If the data are representative of actual settlement patterns, there was little difference where American Indians chose to settle or in the landscapes on which the focused their subsistence efforts, although components tended to have been situated closer to water sources more frequently in later periods. The proportion of sites that occurred within 50 m, 100 m, and 200 m of water was greater for Late Woodland components in the sample than for earlier, Woodland I components. The proportions were closer at 300 m, and all of the sites were located within 650 m of water. The trend in distance to water was not statistically significant—a conclusion implied by the difference in the number of sites in each category across the entire distribution (*chi-sq*=2.73; *df*=4; *p*=0.604).

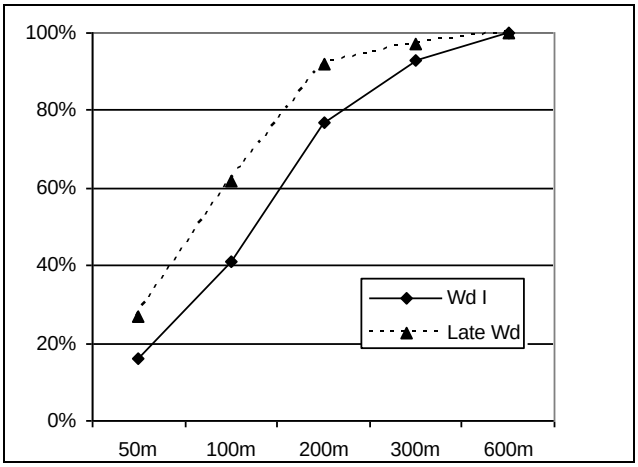


Figure 8-19. Cumulative Frequency Distributions for Distance to Water among Woodland I and Late Woodland Components.

As noted above, the Sandom Branch sites were located in the Mid-Drainage physiographic zone, an area that straddles tidal and non-tidal environments. Both sites occurred above the tidal zone of Blackbird Creek, but within 50 m of water. To determine whether the presence

of estuary environments accounted for variation in site distribution, the same spatial analysis was conducted for subsets of the settlement data based on the tidal limits of regional streams.

In tidal areas, Woodland I and Late Woodland components were proportionately distributed in terms of distance to water (Figure 8-20). The frequency curves showed little variation at any distance interval, the difference being generally less than 10 percent. Site components in tidal areas displayed a greater degree of variation (Figure 8-21). The frequency of Late Woodland sites was slightly higher in the interval nearest water, but dropped off in the mid-range, between 200 m and 300 m. The analysis suggested that in tidal areas the focus of settlement was primarily on streams and their immediate resource bases. In non-tidal areas, by contrast, water may have been less of a consistent factor in site location selection. More often, specific resources may have provided the motivation for American Indian selection of specific landscapes. Thus, a variety of factors may have influenced the shape of the curves in the chart in Figure 8-21, with time period and proximity to water being only one set. Further analyses conducted with larger, probabilistic samples might be able to elicit trends in the data and determine sources of variation. Consideration of other variables, such as site size, artifact assemblage characteristics, or landform attributes, would provide additional context for interpretation of the analytical results.

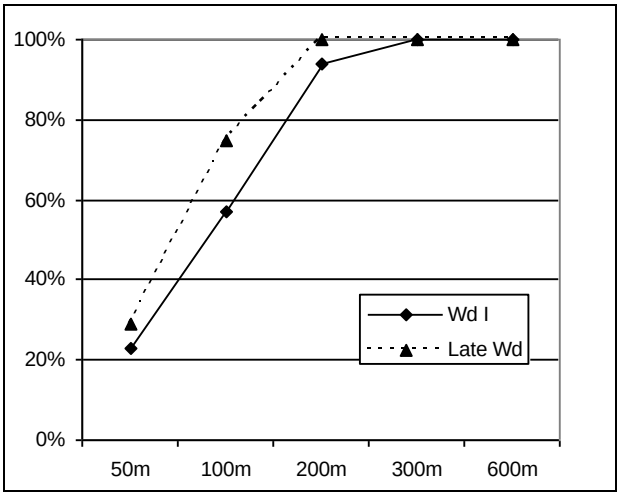


Figure 8-20. Cumulative Frequency Distributions for Distance to Water among Woodland I and Late Woodland Components in Tidal Areas.

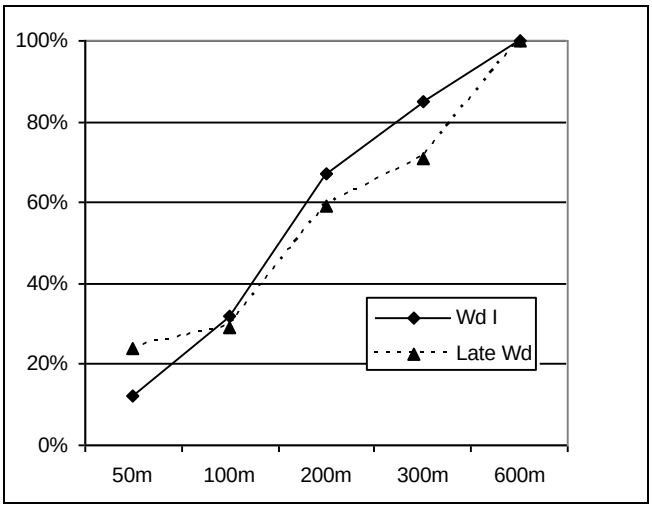


Figure 8-21. Cumulative Frequency Distributions for Distance to Water among Woodland I and Late Woodland Components in Non-Tidal Areas.

3.15.6 Regional Comparisons

Many Middle Atlantic sites have been uncritically assigned to one of three types on the basis of their size, the forms of artifacts and features present, and the activities that these attributes are thought to imply (Custer 1984, 1989, 1996; Gardner 1978, 1982; Stewart 1980; Thomas et al. 1975). The first two types are often referred to as "base camps," and are considered to have functioned as the central location for a discrete social group, from which specialized task groups may have operated. Those base camps associated with large social groups are referred to as "macroband" base camps, while smaller social groups maintained "microband" base camps. Sites that represent short-term, logistical forays to obtain specific, localized resources may be referred to as transient camps, specialized camps, short-term procurement camps, procurement/processing stations, and similar designations. The purpose of such a site typology is not simply to facilitate communication amongst archaeologists, but to provide critical insight into subsistence-settlement systems that operated during specific time periods. Some have rightly questioned the value or even the validity of typing archaeological sites in this manner (Yellen 1977; Petraglia et al. 2002). By forcing sites into arbitrarily defined categories that may not reflect the nuances and flexibility of past social groups, we run the risk of diminishing what we can learn from the archaeological record. Social relationships were likely flexible and altered to meet the tasks and challenges at hand, resulting in a variety of expressions in the archaeological record that will not be categories by "site types." However, because these types are used in the regional literature, it is important to consider them here.

Most Middle and Late Woodland period sites reported in detail in Delaware were situated in floodplain or low terrace settings, rather than in upland areas. This appears to large represent sampling bias, rather than actual site distribution; most excavation work in the region has been conducted at large sites in connection with federal compliance-level undertakings associated with road construction. Site information that was available for the Blackbird Creek area is summarized as follows.

A particularly well-documented site with data comparable to the Sandom Branch Site Complex was the Drawyer Creek South site (7NC-G-143), a transient camp that was occupied sporadically, beginning in the Late Archaic period and reaching its highest occupational intensity in the early part of the Late Woodland (Wall et al. 2001). The site was situated on a low terrace within the tidal reaches of Drawyer Creek, near its confluence with the Appoquinimink River. Several small thermally altered stone features were identified at the site. They were generally attributed to the start of the Late Woodland period, and were interpreted as small cooking facilities.

A series of five sites, 7NC-G-59, 7NC-G-60, 7NC-G-62, 7NC-G-63, and 7NC-G-64, were encountered in similar, low-elevation settings downstream from Drawyer Creek South (Custer and Bachman 1985). Minguannan ceramics were identified at each location, but testing was limited and no further data regarding the occupations have been reported. Also in the vicinity was 7NC-G-15, assigned to the Minguannan Complex on the basis of a triangle point (Custer and Bachman 1985). At each of these locations, Woodland I material was also reported, but without differentiation as to the regional complexes identified.

The Hell Island Site (7NC-F-7) was a large occupational site located on an island in the Appoquinimink River, containing artifact assemblages attributed to Early through Late Woodland period (Thomas 1966). It was the type site for Hell Island ceramics, originally defined by Wright (1962, in Custer 1989), which were part of the late Middle Woodland Delaware Park and Webb complexes. Artifact assemblages from the early Middle Woodland period Wolfe Neck Complex were also present, along with Late Woodland period Townsend ceramics, typically associated with the Slaughter Creek Complex in southern coastal regions.

The Whitby Branch site (7NC-G-151) was situated on a low terrace setting above the tidal stream flowing northward to the Appoqunimink River (Jacoby et al. 2001). Containing material evidence of occupation from the Late Archaic (Clyde Farm Complex) to the Late Woodland (Minguannan Complex), the site was seen as part of an interrelated group of locales in the southern part of the Appoquinimink watershed that fit the standard base camp/support camp model, serving as procurement or processing stations, or limited-use camps associated with the occupation of the Hell Island site, located a little over 1 km away (Jacoby et al. 2001). Late Woodland evidence at the Whitby Branch was limited. Fourteen thermally altered stone features were identified, all consisting of small scatters of stone that were interpreted as the remains of cooking fires. Few of the features were assigned dates, although two were associated with Jack's Reef points, characteristic of the late Middle Woodland period Webb Complex. Charred organic remains from a third cluster returned an early Late Woodland date.

A surface survey recorded a series of sites on the north side of the Smyrna River that were situated on terraces above tributaries in the estuary portion of the stream basin (Custer et al. 1986). Each site contained artifacts attributed to Minguannan Complex assemblages, including either grit-tempered ceramics or triangle points. Most of the sites were noted as containing thermally altered stone fragments, but the survey level of the investigation did not include feature documentation.

Sites in the Blackbird Creek watershed included 7NC-J-3, the Blackbird site, described on the basis of surface collected data as a microband base camp dated from the Late Archaic to Late Woodland, with artifacts attributed to the Clyde Farm and Minguannan complexes (Custer et al. 1984). Several nearby sites that were also surface collected, including 7NC-J-54, 7NC-J-69, and 7NC-J-71, have been placed in the Minguannan Complex based on the recovery of triangle points. These three sites occur in upland settings overlooking low-order tributaries approximately 1.5 km downstream from the Sandom Branch Site Complex. Barlow Branch is the sister stream to Sandom Branch, in the next valley to the north. Limited testing at 7NC-J-21, on a tributary of that stream, recovered a sample of Minguannan sherds indicating Late Woodland occupation (Custer et al. 1986). The Osborne Wetlands site (7NC-J-212) was located at the headwaters of Sawmill Branch, immediately south of Blackbird Creek in the Smyrna River basin. Based on the results of a full-scale site evaluation (Phase II) investigation, 7NC-J-212 was interpreted as "a procurement site or microband base camp occupied by prehistoric peoples over a period of several thousand years" (Bedell et al. 1997a:290). Diagnostic artifacts suggested site use from the Early Archaic through the Late Woodland periods.

Data recovery investigations were recently conducted at several sites in the immediate vicinity of the Sandom Branch sites. At the Blackbird Creek site (7NC-J-195D), situated at the confluence of Sandom Branch and Blackbird Creek, a series of pit features containing Early Woodland ceramics—Dames Quarter and Marcey Creek—were documented. Several triangle points from plow zone contexts indicated Late Woodland site use, as well. The Black Diamond site (7NC-J-225) was located on the edge of a small depression in the uplands south of the Sandom Branch sites. Excavations there provided evidence of intensive Late Archaic to Early Woodland use. Finally, a complex of three sites, referred to as the Frederick Lodge Site Complex (7NC-J-97, 7NC-J-98, 7NC-J-99), was located south of the Black Diamond site, also in an upland locale adjacent to large depression marshes. Evidence of occupation from the Middle Archaic through Late Woodland was recovered at these sites across a wide stretch of landscape.

In summary, documentation of the American Indian presence in the uplands in this part of Delaware is not extensive, and has often been based on evidence from surface collection. Yet, the data do indicate the general time periods represented, and demonstrate, for example, that Late Woodland period Minguannan Complex assemblages were common in the area around Sandom Branch. Yet, due to the limited nature of most investigations, the extent and nature of the American Indian occupations cannot be confidently assessed. Data from earlier periods that would provide a diachronic perspective is often difficult to isolate because of uneven reporting.

Writing of Late Woodland settlement systems from the perspective of the Piedmont Uplands, Custer (1996:287) has noted that base camps associated with the Minguannan Complex lack evidence of house patterns, storage features, or middens. Further, the sites are located in similar settings as, and often directly over, occupations from the Late Archaic through Middle Woodland. The latter is taken to imply that no significant change in landscape use occurred in the region throughout the late portions of prehistory. The lack of evidence for agriculture, a hallmark of Late Woodland subsistence in most parts of the Middle Atlantic, has been explained from an ecological perspective: that is, because no evidence of population increase has been detected during this period, the existing resource base has been considered sufficiently rich that there was no need by American Indian groups to adopt the more labor-intensive practice of food production represented by agriculture (Custer 1989:316).

In contrast to the smaller, less sedentary Minguannan settlements in the High Coastal Plain and Piedmont zones, settlement associated with the southern coastal Slaughter Creek Complex was characterized by large base camps and villages, particularly south of the Mispillion River at sites such as Mispillion (7S-A-1), Slaughter Creek (7S-G-30), and Townsend (7S-G-2). Yet the Minguannan/Slaughter Creek dichotomy may not have been particularly distinct, certainly not geographically, and possibly not in terms of material culture. Mounting evidence suggests that the Minguannan Complex was distributed throughout the High Coastal Plain and well onto the Low Coastal Plain. Distribution maps developed by Custer (1989:307,309) indicated considerable overlap in site locations the central part of the peninsula, with Minguannan reported on sites as far south as the Mispillion River, while Gunn (2001) reported artifact assemblages including Minguannan near the Isle

of Wight, wet of Ocean City in Worcester County, Maryland. Townsend ceramics, in contrast, were recorded to the north as far as the middle reaches of the St. Jones River (Custer 1989).

The site components at the Sandom Branch Site Complex appeared to correlate with several trends in settlement patterning noted above. None of the American Indian occupations appeared to have been large, extensive, or long-term. Rather, the archaeological evidence indicated short duration, special-purpose visits to the locale throughout its span of use. In each chronological period during which activity can be identified, American Indian populations took advantage of the Sandom Branch landscape either to support a larger settlement elsewhere, or as a location for an independent encampment.

Thermally altered stone appeared to have been generated largely during the Middle Woodland period, probably by a single group or successive groups with artifact assemblages characteristic of the Carey Complex. Based on the degree of fragmentation of the stone and on the horizontal distributions that were documented, most of the material likely represented the remains of stone boiling. During the Middle Woodland, therefore, the Sandom Branch sites probably functioned as procurement/processing camps aligned with larger settlements downstream, at or near the estuary.

Additional evidence from the sites indicated re-occupation of 7NC-J-227 during the Late Woodland period by American Indian groups accompanied by artifacts characteristic of the Minguannan Complex. The focus of activity during this period is not clear. Current models again suggest that the site functioned as a support facility for larger residential camps in floodplain locales in the tidal portions of the river valley. Few possibilities for large residential camps have been identified in the vicinity of Sandom Branch. The Hell Island site is a candidate and has been cited as a potential base camp for populations who created extractive sites found along the Appoqunimink River (Jacoby et al. 2001). The potential size of the catchment area for sites in this area has not been precisely estimated, but could have included locations in the Blackbird Creek watersheds.

While no thermally altered stone features could be directly linked with the Late Woodland component at Sandom Branch, there was circumstantial evidence from scattered thermally altered stone fragments that such features were present. Whether the move away from upland locales in the Late Woodland documented at the Trenton Complex sites at Abbott Farm was reflected in the data from this part of Delaware was more difficult to assess. The Sandom Branch sites, along with other sites recorded in upland areas in the region, suggested relatively broad use of the zone during the Late Woodland period.

As for the distribution of Slaughter Creek Complex components in interior settings, Townsend ceramics have been reported at both large and small inland sites, well to the north on the high Coastal Plain, including the Hell Island and Whitby Branch sites, on the Appoquinimink River, and the Sandom Branch sites. These occurrences of shell-tempered ceramics on inland sites, some of which occur in upland settings, suggest interaction between upland and coastal areas, and thus a degree of mobility perhaps not fully implied in existing Late Woodland settlement models.

Any settlement mobility that may have existed was probably not extra-regional in character. Analysis of lithic artifact assemblages from the Sandom Branch sites implied a very parochial lithic economy, with almost no evidence of raw materials, such as rhyolite or argillite, acquired from regions beyond Delmarva. This finding does parallel patterns of inwardly focused lithic industries noted by Stewart (1987). He observed the development of cobble core production in the Delaware Valley, where only local cryptocrystalline materials were used, beginning in the Middle Woodland period and continuing into the Late Woodland. Custer (1989:299) also noted the absence of non-local lithic material on Late Woodland sites in much of Delaware, suggesting that it signaled the breakdown of trade and exchange systems that distributed stone in the Late Archaic and early in the Woodland period. Sites with Woodland components north of Sandom Branch, including the Drawyer Creek South (Wall et al. 2001) and Whitby Branch (Jacoby et al. 2001) sites, displayed low frequencies of rhyolite and argillite, implying that the Sandom Branch and other late sites in the Delaware interior may in fact correlate with regional trends.

3.16 Paleoenvironmental Studies

Delaware's indigenous social groups would have worked toward maintaining a detailed knowledge of the geographic distribution of the natural resources upon which they depended. To fully understand the evidence of settlement and subsistence practices recovered archaeologically, it is necessary to paint as broad a picture of the landscape as possible, determining what resources were available, where they were located, and when and how they were collected. To this end, paleoenvironmental data were gathered during the course the investigations at the Sandom Branch sites. A geoarchaeological study investigated site formation processes and landscape development (Appendix H). Archaeobotanical analysis of flotation samples sought data related to the plant species that were present in the site environs and that may have been used by the various occupants of the sites (Appendix I).

Paleoenvironmental studies at the sites provided information about the manner in which the archaeological sites were formed, as well as about the environmental setting in which they occurred. The tributary along which the sites were located appeared to have been a relatively recent addition to the landscape, developing as groundwater seepage produced sufficient runoff to begin the incision of a small channel. Evidence was recorded of the addition of wind-blown sediments to the soil profile in the Early Woodland period, although not in sufficient amounts to produce distinct stratigraphic breaks or to bury previous deposits. Archaeobotanical remains mirrored the composition of the hardwood forest environment known to have been present regionally, and suggested that open, grassy areas, perhaps the fringes of wetlands, were also present.

3.16.1 Geoarchaeological Studies

Regional geological research has identified deposits of fine sediments in the upper portion of the Columbia formation, the Pleistocene age outwash gravels that underlie most of the Delmarva Peninsula (Foss et al. 1978; Ramsey 1998; Wagner 2000). Ascribed to wind-blown or aeolian deposition, the deposits appear to be at least 10-12,000 years in age (Webb et al. 1994; Ramsey 1998), earlier than most evidence of a human presence in Delaware. Archaeological researchers have inferred somewhat less extensive aeolian deposits that are younger in age, associated with the burial of Archaic period sites in upland settings. Curry

(1980) first reported the phenomenon on the Western Shore of the Chesapeake Bay, while Ward and Bachman (1987) noted similar occurrences in Delmarva, including deposits along Drawyer Creek in the Appoquinimink watershed north of Sandom Branch. These episodes have been linked with the so-called mid-postglacial xerothermic climatic period, a warm and dry interval beginning around 2500 BC, near the start of the Sub-Boreal climatic episode (Carbone 1976). In theory, regional deforestation resulted from dry conditions, leading to the exposure of sandy surface sediments which were subject to widespread erosion and redeposition. Stratigraphic unconformities, or abrupt breaks in stratigraphic sequences, at a number of archaeological sites on the peninsula have been cited as evidence of erosion associated with this process (Custer 1989:180-1). Estimates based on archaeological data are that these episodes may have continued up to 1500 years ago (Curry and Custer 1982). While no evidence of site burial during this period was noted at Sandom Branch, finding upward sequences high in several profiles did suggest a short period of localized aeolian deposition, probably sometime after 1000 BC (Appendix H). Little record exists of regional drought conditions sufficient to result in deforestation and the exposure of surface sediments at this time, and so human activity may have been responsible: e.g., forest burn-off to clear understory as an aid in mast harvest, or to create clearings to drive game (Swanton 1946:313-17; Day 1953).

A feature of the subsurface hydrology of the Delaware Coastal Plain with significance to the development of the landscape around the Sandom Branch sites is groundwater perched in the gravels that form the base of the surface deposits. Where the gravels are near ground surface, water may emerge in the form of seeps and springs. The geoarchaeological study (Appendix H) indicated that the tributary along which the two archaeological sites were located began to be incised around 4000 BP as a result of spring-fed discharge. Lag deposits of coarse sand and gravel found below Woodland period artifact debris in the southern part of 7NC-J-227 suggested the possibility that the early channel of the stream may have meandered somewhat prior to occupation of the terrace. Sandom Branch probably was located between 20 and 30 m closer to the archaeological sites during much of the Woodland period. Dates returned on organic material from gravels in the historical floodplain of the stream provided evidence of flood scouring in the valley around 700 years ago, followed by a westward migration of the channel, away from the archaeological sites to its present position. No data were encountered to indicate serious erosional events across the sites associated with this flooding.

Archaeobotanical research at the sites provided further information about site formation processes (Appendix I). Fresh rootlets and the egg cases and body fragments of insects were common in 12 samples that were analyzed from both pit features and thermally altered stone clusters. Most of the latter originally were located on open surfaces and thus were more typical of the general sediments than were the excavated and refilled pits. The amount of biological activity implied by these findings provided direct evidence of the active nature of the uppermost parts of the soil column, corroborating other data that implied a strong degree of vertical mixing of chronological components.

An important factor in analyzing the cultural stratigraphy at these sites was the apparent intermingling of temporal components, which made separating non-diagnostic artifacts by component a challenging task. The artifact-bearing portion of the soil column exhibited little

vertical dimension: most of the cultural material occurred in the first 40 cm of the profile. The zone of cultural activity was compressed in that sediment accretion appeared to have been slow over the span of the occupations. The slow rate of site burial would have allowed the artifact assemblages that represented individual episodes of site use to become intermixed. If, for example, the Middle Woodland thermally altered stone features had been partially visible on the ground during later occupations, 1) they would have been accessible as sources of material for use in new features, 2) they may have been incidentally incorporated into those features, or 3) they may have been disturbed during site maintenance activities. Additionally, the cultural deposits from each occupation remained near ground surface even after burial, where they were subject to disturbance from a variety of biological agents, including root growth and burrowing animals.

Direct field observations and data from archaeobotanical samples provided evidence of the ongoing nature of this activity. Thus, while the horizontal integrity of the cultural deposits may have been preserved to a certain degree, vertical integrity was more poorly maintained. Depositional contexts, originally thinly separated, had become mixed as the soil profile was slowly overturned through natural processes. Analyses were conducted to determine which areas of each site's temporal components might be most distinct and might offer suitable data for behavioral studies. In areas such as in the northern part of Blocks GHI, at 7NC-J-227, for example, artifact densities were high and chronologically diagnostic artifacts from more than one Woodland sub-period were present in several excavation levels. Activity areas appeared to be blended beyond the ability to discriminate debris from specific occupations. Conversely, in areas such as Block N or the southern half of Block GHI, where artifact densities were lower and artifacts from only one sub-period were present, activity areas were easier to define.

Recognizing the processes leading to the formation of archaeological features and understanding their implications in terms of assessing depositional contexts was another goal during the analyses of the Sandom Branch Site Complex. Schiffer (1972) made an important distinction between systemic and archaeological contexts: artifacts that were in use as part of a ongoing behavioral system are considered to have been in a systemic context, while artifacts that were abandoned, discarded, or lost are regarded as entering an archaeological context (Schiffer 1972). As applied to features, systemic form can be seen as the appearance or structure of a feature that resulted from its original use and abandonment. In contrast, the archaeological form of a feature comprises its appearance as it is exposed in excavation, the form that results from a combination of the original, systemic form and postdepositional, or taphonomic effects. Distinguishing between these forms is critical to interpretation of archaeological deposits. A wide range of disturbance processes may operate in the biologically active, near-surface sedimentary environment in which archaeological features at most sites in Delaware reside. How these processes influenced the archaeological form of the features must be assessed before behavioral interpretation can proceed. Scattering due to natural processes would be a taphonomic or postdepositional phenomenon, which would be of interest as a part of contextual analysis; in contrast, scattering due to cultural processes such as sorting or trampling is a behavioral phenomenon.

Close examination of how feature boundaries are defined in the field is critical. Whether outlying scatters are included as integral elements of a thermally altered stone concentration, for example, can significantly alter the results of analytical studies conducted in association with the deposits. Substantial differences were observed in the attributes of features at Sandom Branch depending on how feature boundaries were drawn. Feature 30, at 7NC-J-227, for example, and Feature 45, at 7NC-J-228, exhibited both concentrated areas and widely scattered outer areas. The boundaries of each feature were defined in the field in terms of the broadest area that was apparent. Using both the concentrated and scattered portions of each feature, several density figures were calculated, and the results were found to vary dramatically. As would be expected, the widely scattered artifact distributions were not as densely concentrated as the clustered distributions, but the analysis did demonstrate the necessity of explicitly defining the protocols used to expose and define the features in the field.

To conduct valid intersite comparative analyses, it is necessary to know exactly what is being compared. The refit study conducted at 7NC-J-227, for example, was a valuable contribution to the interpretation of the Sandom Branch sites, both in terms of evaluating depositional contexts and in assessing the types of activity that may have produced the features recorded at the sites. Refitting is labor-intensive, so the goals of a refit study must be clearly defined at the outset. In the Sandom Branch study, the main aims were to learn more about the physical characteristics of the cobbles that originally comprised the two large features at 7NC-J-227, as a potential indication of their functions, and to evaluate the spatial relationship between the features. Similar studies in the future are encouraged, since they should be able to provide additional information of value in site interpretation, particularly in terms of site formation analysis.

3.16.2 Archaeobotanical Studies

Relatively few carbonized plant remains were recovered from the Sandom Branch Site Complex, following a pattern evident at various locations throughout Delaware. Although scarce, these carbonized plant remains did provide insight into the paleoenvironment. Identified wood charcoal species consisted of a mixture that is typical of the hardwood forests that are presumed to have covered the region in late prehistory. The samples were dominated by oak, but included sweet gum, maple, poplar, ash, and walnut. Notably, most of these species may be found in both upland and wetland habitats, reflecting the neighboring environment that was comprised of upland stream terraces with occasional, localized marshes. Assuming that most of the carbonized wood resulted from human-made fires, the findings are taken as evidence of the purposeful selection of high-caloric woods for fuel. Carbonized hickory nut shell and acorn shell were also recovered, although in very low frequencies. Given the denseness and durability of nut shell, the relative absence of the material from the archaeological deposits may indicate that the harvesting and processing of mast was not a focus of the American Indian activities that produced the thermally altered stone features at the sites.

A single carbonized grass seed was recovered from 7NC-J-227 that was heavily weathered and could not be identified beyond the family level (*Poaceae*). This fragment was not necessarily a harvested item, but could have been an incidental inclusion into a fire at the

site. Its presence indicated open, grassy areas were nearby at some point, possibly representing a clearing or the open fringes of an adjacent wetland. Non-carbonized seeds of both native and non-native taxa were also present, far outnumbering the carbonized seed remains, as is typical of archaeobotanical samples from the region. The non-carbonized remains were considered contaminants, providing indication of the movement of small particles through the soil profile. Nevertheless, all of the non-carbonized remains represented plants common to disturbed environments and moist floodplain or forest edge settings, indicating that conditions during the past American Indian occupations were not unlike those of the modern landscape, with upland forests punctuated by open, marshy ground. Finally, a number of spherical carbon residues were identified in the samples. These items have been linked to the burning of plants with high silica content, possibly grasses. They were common in the samples from the sites, and may represent evidence of the collection of dried grasses for use as tinder or to produce fragrant smoke for medicinal or ritual purposes.

3.17 Landscape Approach

The geoarchaeological and archaeobotanical studies—when combined with artifact and feature distributions—provide some indication of how the American Indian inhabitants of the Sandom Branch Site Complex utilized this landscape. Both sites were located on low terraces above Sandom Branch, with 7NC-J-228 approximately two-to-three meters above this steam while 7NC-J-227 was slightly lower at one meter or less above Sandom Branch. A narrow gully flanked by wetlands separated the two sites, and the abundant resources present in these wetlands may have been a primary reason that American Indians frequented these specific landforms. Both sites appear to represent persistent places, e.g. were visited repeatedly, especially throughout the Woodland period. There may have been some temporal separation in landscape use between the two site locations: 7NC-J-228 was apparently more commonly utilized from the end of the Late Archaic into the Middle Woodland, while 7NC-J-227 was most intensively used during the Late Woodland.

As we noted earlier in this report, landscapes have socio-symbolic as well as physical dimensions. Fortunately, we can use a viewshed analysis to reach some understanding of how American Indians once visually perceived this landscape. While an abstract process that employs mathematical algorithms, the results of viewshed analyses can help approach an interpretation of past landscape use on a subjective basis, providing a means of visualizing the world as it was experienced by the people living within it.

The viewshed analysis for Sandom Branch was conducted using the ArcGIS Spatial Analyst extension with default settings. The base map employed in the study was a 10-meter digital elevation model (DEM) obtained from the University of Delaware's Spatial Analysis Lab (Mackenzie 2010). The model was generated in ArcGIS v.10 from 1/3-arc-second elevation data obtained from USGS (2010). Elevation data consisted of floating-point values expressed in meters. The coordinate system used in the model was DE State Plane NAD 1983 HARN (meters) (Mackenzie 2010). The radius used in the viewshed analysis was 5,000 meters, the effective distance to the horizon on a level and featureless terrain.

The viewshed analysis conducted at Sandom Branch suggested that the discrete locations represented by the two sites had a restricted view in certain directions (Figure 8-22). The sites were located in a small valley on the side slope of a terrace and along the east bank of Sandom Branch. The viewsheds of the two sites were similar, except that 7NC-J-227 was slightly wider because the site was situated at a somewhat higher overall elevation than 7NC-J-228. In the figure, the viewshed of 7NC-J-228 is essentially a small subset of 7NC-J-227 and thus has been superimposed over it.

Figure 8-22. Results of Viewshed Analysis Representing Areas within View of the Sandom Branch Sites.

Both sites would have commanded a view of, or could have been seen from, the terraces above Sandom Branch on the opposite or west bank and extending downstream (northwest) for a distance of about 600 meters. Upstream on the west bank (southwest) the view appeared to have been obstructed somewhat by surrounding landforms, particularly as seen from 7NC-J-228. On the east bank, or the stream bank on which the sites were located, the view appeared to be limited downstream to the northeast and east. Up the terrace slope to the east and southeast, the view may have extended to a distance of about 1,200 meters. The analysis also indicated that areas north of Blackbird Creek were within the viewshed of the people who occupied both sites. Whether any of the areas indicated by the analyses would actually have been visible when the sites were occupied would have depended largely on the presence of any obstructing vegetation. Paleoenvironmental studies have suggested that parts of the area may have had limited vegetation for periods of time (Curry 1992; Custer 1999; Webb et al. 1994). The extent to which the surrounding landscape would have been clear or treeless is not certain. Nevertheless, in general terms the viewshed analysis conducted here probably overstates the actual visibility American Indians would have had from the sites.

Matters of visibility aside, the aspect or slope orientation of the site locations would have had a bearing on how much sun each site location received. This may have been a consideration used by the people who selected these locations, particularly in terms of the cooler winter months. Analysis of aspect, also conducted using the 10-meter DEM as a base, suggested that 7NC-J-228 faced west while 7NC-J-227 faced southwest, a finding generally in accord with evidence from a detailed map of elevation contours developed in the field (Figure 8-23). 7NC-J-227 occurred on a wide knoll and extended down its southwest slope above a headwater tributary of the main stem of Sandom Branch; 7NC-J-228 was situated on a similar knoll and slope above the stream. In these settings, people working at the site locations would have received the most direct sunlight from midday through afternoon.

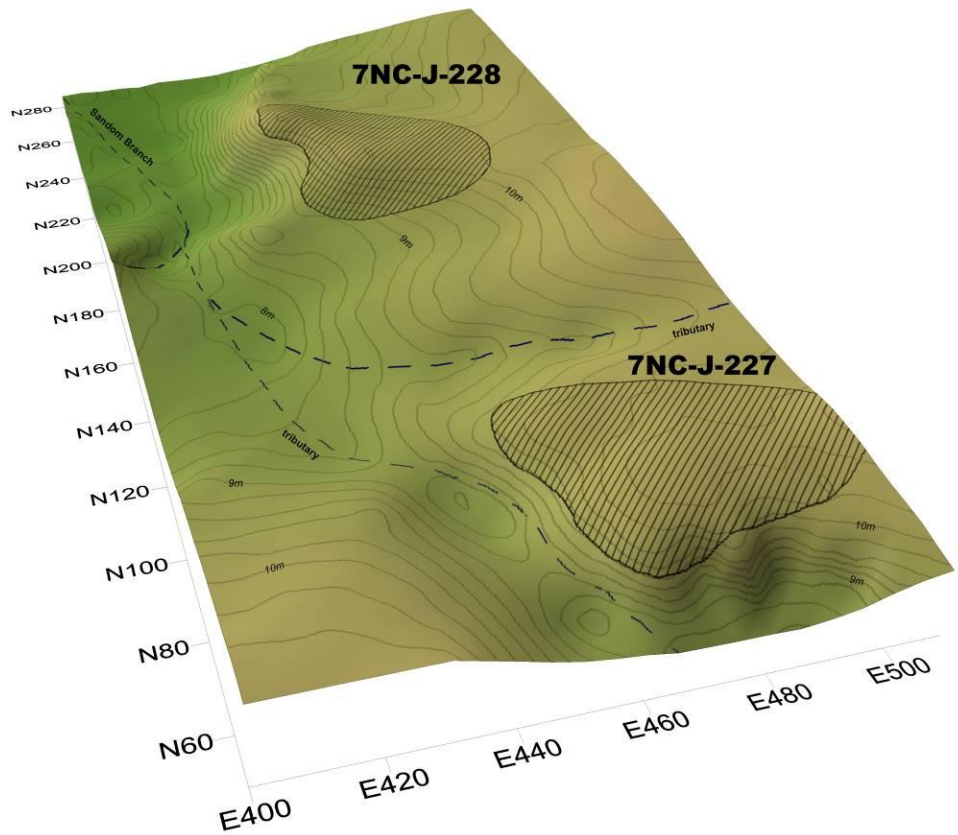


Figure 8-23. The Sandom Branch Sites and High Resolution Elevation Contours
(sites are on west and southwest facing slopes; elevation contours 20 cm).

Another facet of slope orientation concerns shelter from prevailing winds. The topographic settings at both of the Sandom Branch sites were essentially ridges or knoll-tops above gentle to moderate slopes overlooking streams to the west or southwest. While there may have been a slight degree of protection from weather from the northeast in these settings, the knoll-top locations were probably not particularly well sheltered.

Overall, our analyses suggest that neither the views from the sites nor their slope orientations were important factors that governed site location or landscape use. People living and working at Sandom Branch would have had relatively limited views, obscured by the landforms making up the surrounding stream valleys as well as by vegetation. Moreover, being situated on low knolls, neither site would have been afforded much shelter from prevailing winds. The site locations could have been chosen primarily for the occurrence of a specific constellation of resources that were present at these locations.