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PREHISTORIC SEDENTARY AGRICULTURALISTS IN THE APPALACHIAN SUMMIT OF NORTHWESTERN NORTH CAROLINA

by

Thomas R. Whyte

Abstract

Native American archaeological sites post-dating A.D. 1450 are rare in the Appalachian Summit of northwestern North Carolina. In addition, the only confirmed prehistoric agricultural village site yet discovered above 2,500 ft in elevation within the region is the Ward site (31WT22), a palisaded village which appears to have been occupied in the eleventh century A.D. Nearby prehistoric residential sites post-dating the Ward site are individual residences such as the Katie Griffith site (31WT330), which was occupied probably in the early fourteenth century. Considering the dates of occupation and the kinds of residence represented by these sites, it is proposed that climatic changes: (1) allowed an attempt at agricultural village life (the Ward site) above 2,500 ft after A.D. 900; (2) restricted human settlement to individual households between A.D. 1200 and 1450; and (3) discouraged permanent settlement for the remainder of prehistory. It is also observed that these residents were members of Late Woodland societies with an affinity to Dan River phase groups located in the Piedmont and foothills to the north and east.

Introduction

The Appalachian Summit Region of northwestern North Carolina, which includes Allegheny, Ashe, Avery, and Watauga counties, is characterized by significant topographic relief, ranging between 2,000 and 6,000 ft above mean sea level. Consequently, it also experiences significant intra-regional variation in mean annual temperature and rainfall (Epperson 1988). Late spring and early autumn frosts are common, and made the region a risky environment for the settlement and survival of prehistoric agriculturalists. Indeed, the region appears to have lacked human residents when it was visited by August Spangenberg in 1751 (Arthur 1915). Although archaeologists have been actively seeking and investigating sites in the area for over 30 years, no permanent residential sites predating A.D. 900 or post-dating A.D. 1450 have been discovered above 2,500 ft in elevation. And, remains of only one agricultural village, the Ward site (31WT22), are known to exist above this elevation. New radiocarbon dates for the Ward site, discussed below, indicate a permanent occupation of short duration, probably in the eleventh century. Individual household residences dating to between A.D. 1100 and 1400 are not uncommon, but only one of these, the Katie Griffith site (31WT330), has been sufficiently investigated, and it is radiocarbon-dated to the early fourteenth century.

This article discusses the evidence for agriculturalists residing in the Appalachian Summit portion of northwestern North Carolina in the Late Woodland period and the relationship of these societies to Appalachian Summit Mississippian societies residing to the south and west, and to Woodland groups to the north and east. It is proposed that a subsistence base of maize and bean agriculture was feasible at elevations above 2,500 ft only between A.D. 950 and 1300 due to lengthening growing seasons for that period (the Medieval Warm) and the adoption of Northern Flint-variety maize which was characterized by relatively fast maturation. The Little Ice Age, which began between A.D. 1300 and 1450 and lasted until 1850, brought about agricultural failures in the northern latitudes and higher elevations of Europe (Fagan 2000) and North America (Smith et al.1981), and it may have had a similar effect on southern Appalachian farmers. If so, this may explain the lack of evidence of permanent human settlement at higher altitudes in the region after about A.D. 1450.

The Ward Site (31WT22)

The Ward site is located on a relatively spacious floodplain of the Watauga River at an elevation of 2,630 ft in Watauga County, North Carolina (Figure 1). The Congaree Loam surrounding the site is the best soil in Watauga County for corn production (USDA 1958). Sections of the site were excavated between 1972 and 1982 by Harvard G. Ayers, L. Jill Loucks, and Burton L. Purrington, then of Appalachian State University (Purrington 1983). Each of them, observing a predominance of punctated, collared rims among the pottery sherds, has in various papers referred to the Ward site as a “Pisgah phase” and “Proto-Cherokee” village (e.g., Ayers 1984; Ayers et al. 1980; Purrington 1983; Senior 1981). Excavations uncovered approximately half of a palisaded village with circular structures and associated features (Figure 2). Pisgah-like pottery from the Ward site is predominantly tempered with crushed quartz or biotite schist, is plain, net impressed, or rectilinear complicated stamped (predominantly Design A-narrow [Dickens 1976]), and rimmed with

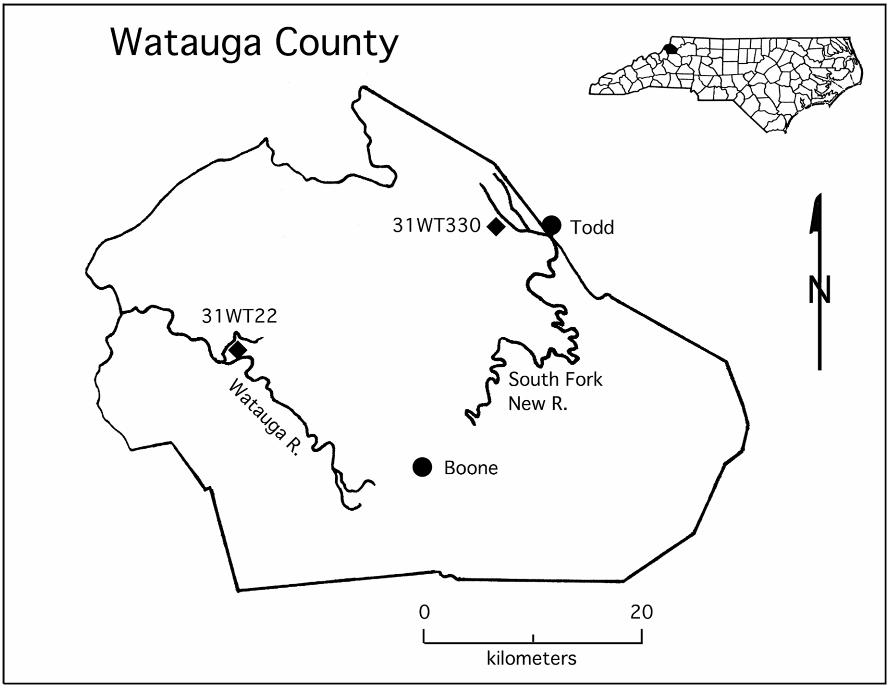

Figure 1. Locations of the Ward (31WT22) and Katie Griffith (31WT330) sites in Watauga County, North Carolina.

Pisgah-like punctated collars (Figure 3). Limestone-tempered, net-impressed pottery is also abundant (Senior 1981).

Thus far, six radiocarbon dates have been obtained for the Ward site (Table 1). Two dated samples were composed of unidentified charcoal from sub-plowzone features, three were composed of mixed charcoal from various depths within the site's midden, and one was composed of carbonized residues adhering to pottery sherds. The latter sample (Beta-155566) was scraped from the exterior of a series of conjoining sherds recovered from Feature 37, referenced in the site's field notes as a "fire pit" extending to approximately 15 cm below the plowzone. The combined fragments form a part of the wall of a large vessel tempered with crushed biotite schist and exhibiting a rectilinear-stamped (Dickens' [1976] Design A-narrow) exterior and a scraped interior (Figure 4). The resulting calibrated intercept derived from the residue is A.D. 1030 (Table 1).

Samples of wood charcoal collected from three 10-cm levels within the site's midden provided dates of A.D. 1280 (Level 1: Beta-155567),

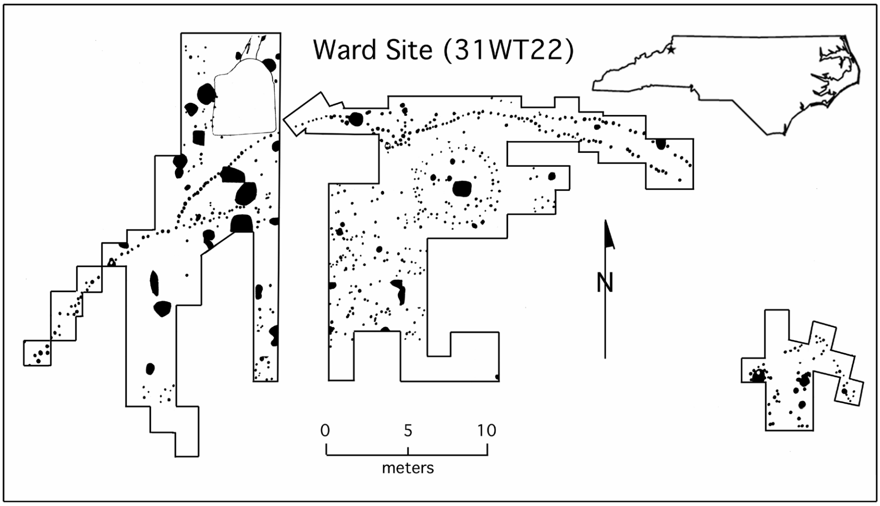

Figure 2. Archaeological evidence of structures and other features at the Ward site (31WT22), Watauga County, North Carolina.

Figure 3. Assorted pottery rim fragments from the Ward site (31WT22), Watauga County, North Carolina.

Table 1. Radiocarbon Dates from the Ward (31WT22) and Katie Griffith (31WT330) Sites.

Provenience	Sample	1-Sigma Calibrated	Intercept Calibrated
Ward Site (31WT22)			
Feature 37 Pottery Residue	(Beta-155566)	AD 1010 – 1040	AD 1030
Midden Level 1	(Beta-155567)	AD 1260 – 1300	AD 1280
Midden Level 2	(Beta-155568)	AD 980 – 1040	AD 1010
Midden Level 3	(Beta-155569)	AD 1030 – 1200	AD 1160
Feature 21	(UGa-683)	AD 1305 – 1441	AD 1406
Feature 13	(UGa-684)	AD 1436 – 1954	AD 1638
Katie Griffith Site (31WT330)			
Feature 10	(Beta-147981)	BC 1420 – 1300	BC 1390
Feature 6 Post Hole/Mold	(Beta-155570)	AD 1380 – 1420	AD 1400
Feature 6 Post Mold	(Beta-155571)	AD 1280 – 1320	AD 1300
Pottery Residue	(Beta-142033)	AD 1300 – 1400	AD 1360 (median)
Feature 5	(Beta-134674)	AD 1660 – 1950	AD 1805 (median)
Feature 5	(Beta-QA-361)	AD 1695 – 1955	AD 1950

A.D. 1010 (Level 2: Beta-155568), and A.D. 1160 (Level 3: Beta-155569) (Table 1). The one-sigma calibrated ranges indicate that the portion of the midden remaining below the plow zone accumulated between A.D. 980 and 1260 (Table 1). In the 1970's, charcoal recovered from Feature 21, a corncob-filled pit containing quartz-tempered, net-impressed pottery, yielded a date of A.D. 1406 (UGa-683), indicating possibly a later occupation of the Ward site (Table 1). At the same time, another sample of charcoal (UGa-684) obtained from Feature 13, a disturbance intruding post molds of the site's palisade, produced a date of A.D. 1638 (calibrated range of A.D. 1436–1954) and may identify historic-period human activity on the site. However, in light of evidence of University of Georgia Radiocarbon Laboratory inconsistencies prior to 1985 (cf. Cridlebaugh 1981), the two latter assays may be as much as 400 years too recent. Radiocarbon dates and typological evidence, when taken together, suggest that the primary village occupation of the Ward site took place sometime between A.D. 980 and 1300 and that the site was often visited at earlier and later dates.

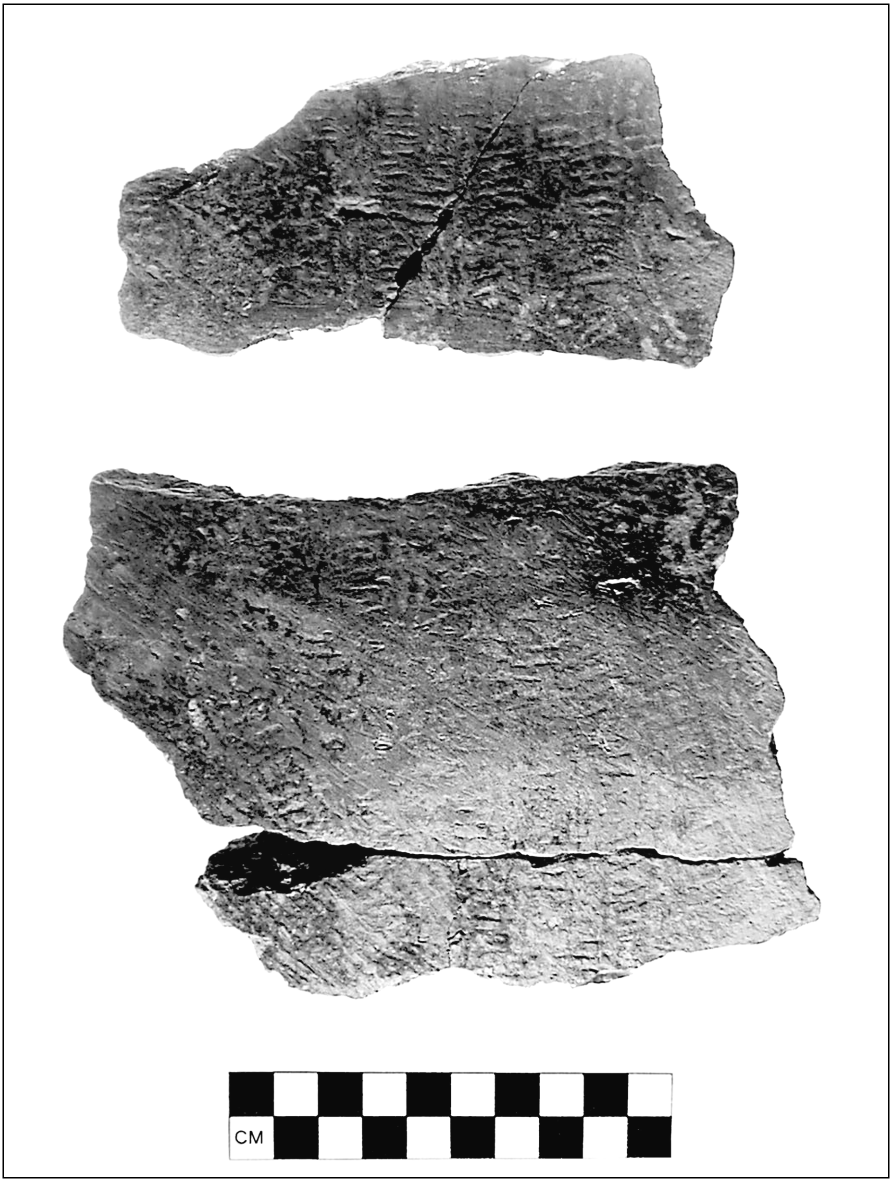

Figure 4. Cross-mended, rectilinear-stamped, biotite schist-tempered pottery fragments from Feature 37 at the Ward site (31WT22), Watauga County, North Carolina.

The Katie Griffith Site (31WT330)

In spring, 1998, landowners discovered prehistoric artifacts while digging the foundation footers for a barn near Todd, North Carolina. This site—the Katie Griffith site (31WT330)—is situated at an elevation of 3,300 ft on a northeast-facing alluvial fan adjacent to Pine Orchard Creek which flows into the South Fork of the New River at Todd, North Carolina (Figure 1). Three seasons (Spring, 1998, 1999, and 2001) of salvage excavations by Appalachian State University within and immediately west of the barn revealed the burned remains of a late prehistoric structure and artifacts dating from the Early Archaic through Historic periods (Figure 5). Although only partly uncovered, the structural remains include postmolds, concentrations of fired daub, scatters of wood charcoal, patches of carbonized bark and wood, and an assortment of cultural features. The structure appears to have been roughly circular and may have had a partial daub ceiling and a bark-covered roof. These structural remains lay above and below various thicknesses of midden. At the base of the midden, beneath the structural remains, were pottery sherds and stone artifacts dating mostly to the Archaic through Early and Middle Woodland periods. The Late Woodland component of the site represents an isolated residence which may have been associated with a dispersed settlement.

Ceramic artifacts from among the structural remains were dominated by crushed quartz or crushed soapstone-tempered pottery with net-impressed or rectilinear complicated-stamped exteriors and Pisgah-like, punctated, thickened or collared rims (Figure 6). Small triangular and serrated arrow points, lithic debitage, and pieces of carbonized wood were also abundant. Only small pieces of animal bones which had been calcined remain preserved on the site.

Six radiocarbon assays have been obtained for the Katie Griffith site: one on wood charcoal from a pit feature (Feature 10), two on wood charcoal from a large post hole-and-mold (Feature 6), one on carbonized residues recovered from rim punctations of conjoinable pottery sherds, and two on carbonized bark initially assumed to have been associated with the burned structure (Table 1).

Feature 10, located within the confines of the structure, was a deep elliptical pit containing soil, rocks, artifacts, and carbonized wood. The surface of Feature 10 was observed at the base of the site's midden where several Swannanoa-type potsherds lay flat near the feature's margin. The deeper sediments of the feature contained Early Woodland Swannanoa pottery, while net-impressed, quartz-tempered potsherds were found in a

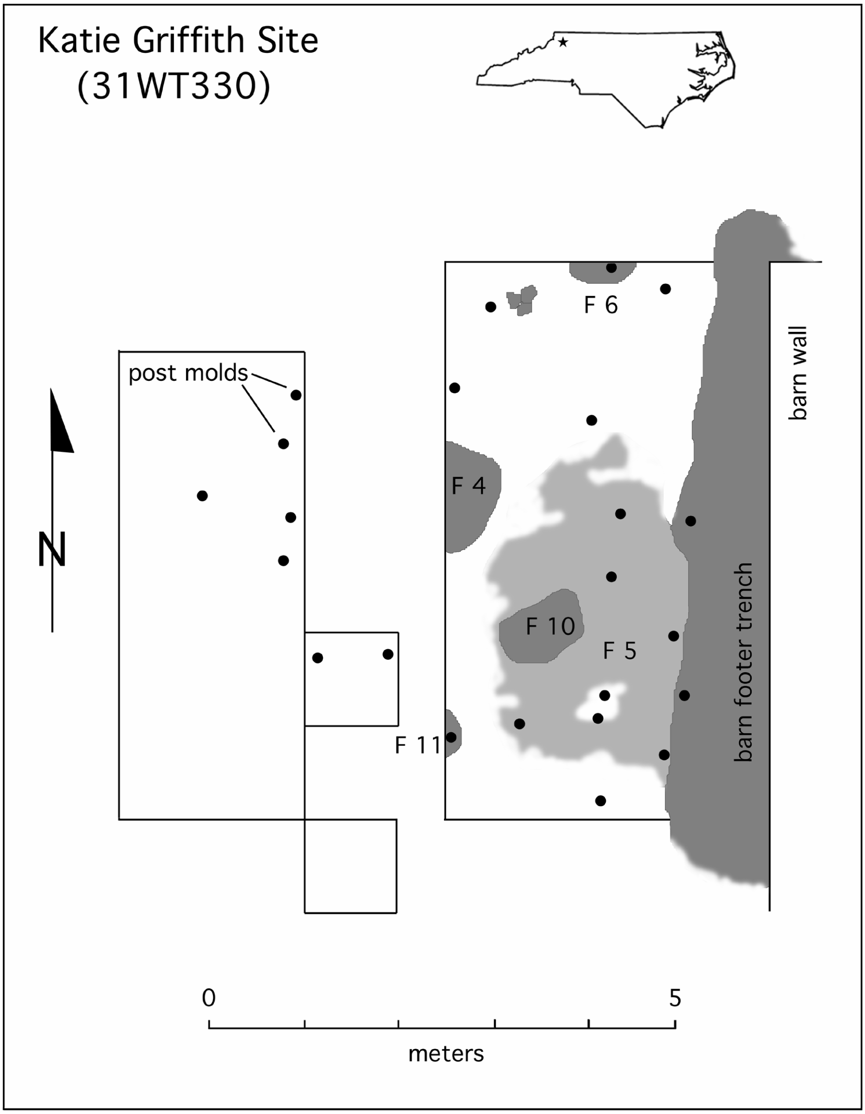

Figure 5. Archaeological evidence of structures and other features at the Katie Griffith site (31WT330), Watauga County, North Carolina.

Figure 6. Assorted pottery rim fragments from the Katie Griffith site (31WT330), Watauga County, North Carolina.

zone of slump at its surface. Carbonized black locust wood (Beta-147981) from the deeper fill of Feature 10 yielded a date of 1390 B.C. (Table 1), identifying an Early Woodland period (probably Swannanoa phase) occupation of the site.

Feature 6 was a very large post hole-and-mold located immediately north of the structure (Figure 5). Average diameter of the post mold at the base of the feature was 18 cm. The post hole measured 66 cm in diameter and was 84 cm in depth below the plow zone. The squared end of the post had settled 9 cm beneath the base of the post hole. Large, uneroded potsherds with crushed soapstone temper, rectilinear complicated stamped exteriors, and scraped interiors were recovered from the base of the post mold. Wood charcoal from the post hole-and-mold (Beta-155570) provided a date of A.D. 1400 (Table 1). Wood charcoal from the base of the post mold (Beta-155571) provided a date of A.D. 1300 (Table 1). The one-sigma calibration ranges for these samples (A.D. 1380–1420 and A.D. 1280–1320, respectively) do not overlap. It is probable that the former sample, which provided the later date, included some more recent charcoal

Figure 7. Conjoinable, net-impressed, quartz-tempered pottery from the Katie Griffith site (31WT330), Watauga County, North Carolina.

from an unobserved zone of slump at the feature's surface. Therefore, the earlier date of A.D. 1300 is regarded as the more likely age of Feature 6.

A set of conjoinable sherds exhibiting looped-net marking of the exterior, interior scraping, and a thickened, punctated, Pisgah-like rim provided a unique opportunity for radiocarbon dating (Figure 7). Although these sherds were recovered from various contexts on the site, each exhibited carbonized residue accumulations in rim punctations. These residues were removed for radiocarbon dating, and the resulting calibrated assay (Beta-142033) yielded three intercepts of A.D. 1310, 1360, and 1385, and a one-sigma range of A.D. 1300–1400.

Radiometric dating on a sample (Beta-134674) of the carbonized bark yielded one-sigma calibrated intercepts of A.D. 1660–1705, A.D. 1715–1885, and A.D. 1910–1950 (Table 1). Accelerator dating of part of the same sample (Beta-QA-361) yielded one-sigma calibrated intercepts of A.D. 1695–1725, A.D. 1818–1920, and A.D. 1950–1955 (Table 1). The recent age of this bark calls into question its relationship with the other structural remains and associated artifacts. The recovery of one early, machine-headed, cut nail from the midden identifies early to mid-nineteenth century activity on the site, possibly its initial clearing and settlement in historical times, which may have resulted in the carbonized bark as well.

The dates obtained for the Feature 6 post mold and for the pottery residues establish the age of the structure and associated pottery between A.D. 1280 and 1400, and, considering the overlap between the earliest intercepts for these two samples, this occupation of the site probably dates to the early fourteenth century A.D. The Katie Griffith site, then, dates to the middle of the Pisgah phase and is roughly contemporaneous with the Brunk site (31BN151) in Buncombe County, North Carolina (Moore 1981) and 44LE17 in Lee County, Virginia (Holland 1970). It appears to immediately post-date the Ward site village occupation.

Reconsidering the Existence of the Pisgah Phase in Northwestern North Carolina

If the Ward and Katie Griffith sites, as well as other nearby sites characterized by punctated, collared vessel rims, are manifestations of the Pisgah phase, then the occupants were in some way affiliated with Mississippian chiefdoms in the Pisgah heartland at the headwaters of the French Broad River to the southwest. Pisgah pottery was first described by William Henry Holmes (1884), formally defined as a type by Patricia Padgett Holden (1966), and further described and refined by Roy S. Dickens, Jr. (1976), the latter based primarily on assemblages from the Warren Wilson and Garden Creek sites in southwestern North Carolina. Dickens described Pisgah pottery as a sand or grit-tempered ware with primarily rectilinear complicated-stamped exteriors, smooth interiors, and punctuated, collared rims with an assortment of appliques (Dickens 1976). The Pisgah phase is also characterized by floodplain village sites with palisades, square houses, and substructure mounds, although isolated Pisgah phase houses have been discovered on upland toe slopes in recent surveys (Moore 1981). Radiocarbon dates on Pisgah in that area fall between A.D. 1000 and A.D. 1450 (Eastman 1994). Dickens (1976) cites the geographic distribution of Pisgah as including central-western North Carolina, northwestern South Carolina, southwestern Virginia, and extreme eastern Tennessee. Northwestern North Carolina is excluded.

Considering the ceramic, architectural, and settlement traits which have been used to define the Pisgah phase, the Katie Griffith and Ward sites and their artifact assemblages simply do not fit the pattern. Some of the pottery is Pisgah-like in that it includes jar and bowl forms, exhibits punctated rim collars, and is sometimes rectilinear stamped. Excepting these vessel forms, which may be found in a number of wares of the same period, these Pisgah-like traits are primarily decorative. Ceramics from the Katie Griffith and Ward sites exhibit mechanical/ technological traits which are not typical of Pisgah as defined by Dickens. These include crushed quartz, crushed soapstone, and crushed schist tempering, and heavily scraped interior surfaces. Moreover, most sherd exteriors are net impressed. In these traits, they resemble a number of neighboring late prehistoric ceramic types. Crushed rock tempering, net impressed exteriors, and heavily scraped interiors are common to the early Dan River series to the east and north. Crushed soapstone tempering is characteristic of the Smyth series to the north and the Burke series to the south. At the Katie Griffith site, Pisgah-style rims are associated with tempering of crushed quartz, crushed soapstone, and a mix of the two. They are also associated with rectilinear complicated stamping, net impressing, and rectilinear complicated stamping over net impressing (Figure 8). Moreover, it is evident that the majority of the net-impressed or rectilinear-stamped pottery recovered from the Katie Griffith site was manufactured at or near the site; amphibolite grains, abundant in local clay deposits, are readily visible within the paste of most sherds. In other words, the mix of Late Woodland and Mississippian traits discussed above are on locally made rather than imported ceramics.

David Braun (1983:113) offers the insight that “ceramic typologies and seriation models that combine both decorative and mechanical criteria, without prior consideration of their different cultural meanings, are at best inappropriate for studies of cultural process.” The fundamental technological characteristics of the late ceramics at Katie Griffith—that is, the traits which express the way in which raw materials were prepared and the vessel blanks were formed—include crushed rock tempering, bold interior scraping, and, I argue, exterior net impressing. I include the latter because the net impressions *show through* the rectilinear stamping on some sherds, implying that the final stamping was primarily decorative and intended to obscure the underlying net impressions. Net impressions on some vessels also were smoothed or brushed over. Net impressing was evidently part of the process of forming the vessel blank, whether it was facilitative (e.g., molding vessels in net-lined pits or vessel molds [cf. Harrington 2002]) or simply part of the necessary traditional protocol of vessel manufacture.

These technological characteristics—tempering, interior scraping, and net impressing—constitute aspects of a ceramic *tradition* which in all ways is identical to that represented by the contemporaneous Dan River and

Figure 8. Rectilinear complicated-stamped pottery (top row) and net impressions showing through rectilinear stamping on pottery (bottom row) from the Katie Griffith site (31WT330), Watauga County, North Carolina.

related series generally concentrated on the North Carolina and Virginia Piedmont. Rim punctation and rectilinear complicated stamping, although they may to some extent have had a mechanical function (e.g., the punctation of thickened rims permits the release of moisture), are "add-ons," likely resulting from influence by or interaction with Mississippian groups to the south and west. They are "brand-name" logos copied onto locally-made, generic products and, because they are so visible and distinctive, they have prevailed over more fundamental, mechanical attributes in the assignment of artifacts to type categories.

In sum, the Ward site, Katie Griffith site, and sites with similar ceramic assemblages dating between A.D. 900 and 1450 in the Appalachian Summit of northwestern North Carolina are assignable to the Late Woodland (not Mississippian) period. The Pisgah-like pottery common to the northwestern mountains of North Carolina is not Pisgah. It should be defined as a type of its own or, as Mathis and Moore (1984) have suggested, be accommodated into the Dan River series, perhaps as the "Watauga variety." Furthermore, these ceramics are associated with evidence (e.g., circular houses, sites without mounds, and mortuary equality) of an egalitarian rather than a chiefdom level of social organization and thus fit the Woodland Pattern as originally defined by W. C. McKern (1939). In all probability, the narrow floodplains, acidic soils, and winter extremes of the higher Appalachian Summit were unsuitable to the development or establishment of Mississippian chiefdom-level societies with larger populations dependent upon maize-and-bean agriculture.

Climate and Human Settlement in the Appalachian Summit

Reconstructions of Holocene paleoclimate in the Appalachian Summit region have been based primarily on pollen records from Tuskegee Pond in eastern Tennessee and Horse Cove Bog in western North Carolina (Delcourt and Delcourt 1998). These studies also reveal impacts on the environment potentially due to human-caused fires (Delcourt et al. 1998). Regrettably, these palynological data do not appear to have the sensitivity to chronicle temperature or moisture fluctuations potentially associated with late Holocene events such as the Medieval Warm period or the Little Ice Age. The studies conducted thus far reveal a significant increase in fire-tolerant oaks and chestnuts along with maize and ragweed in the Late Woodland-Mississippian periods (A.D. 800–1500). A concomitant increase in charcoal particles in bog sediments is interpreted as evidence of human-set fires (Delcourt and Delcourt 1998). It remains to be determined, however, if reductions in annual rainfall during this period may have influenced the frequency of natural fires in the region.

Dendroclimatological data from the broader southeastern region indicate several prolonged droughts between A.D. 1000 and 1300 (the Medieval Warm period), followed by relatively wet conditions from A.D. 1300–1600 (the Little Ice Age) (Stahle et al. 1988; Stahle and Cleaveland 1994). These variations in moisture appear to coincide with periods of food surplus or shortfall among Mississippian societies in the lower elevations of the Southeast (Anderson et al. 1995) and likely affected human settlement and the successes of agricultural societies residing above 2,500 ft. In addition, prolonged droughts during the Medieval Warm period may have been responsible in part for increased evidence of conflagrations after A.D. 1000.

Archaeological evidence of human settlement in the southern Appalachian region above 2,500 ft prior to the Late Woodland period

(A.D. 900) indicates only seasonal visitation, probably in the fall when food resources, especially those providing protein, are at a maximum. It is probably no coincidence that the Ward site (31WT22), the only known prehistoric village site above 2,500 ft in the Appalachian Summit, appears to have been constructed between A.D. 900 and 1000, shortly after the introduction to eastern North America of eight-row, Northern Flint-variety (Eastern Complex) maize (Smith 1989; Yarnell 1964) and the onset of the Medieval Warm period (Stahle et al. 1988). The Little Ice Age, which lasted from about A.D. 1300 to 1850 (Fagan 2000), may explain the general lack of evidence of permanent habitation of the region above 2,500 ft after A.D. 1450. Prehistoric maize and bean crops would have required a minimum of 120 frost-free days for successful production (Yarnell 1964), yet the current average number of frost-free days in Watauga County is 161 (North Carolina Crop & Livestock Reporting Service 1986). A minor constriction of the growing season brought on by the Little Ice age may have been devastating to high-altitude agriculturalists or horticulturalists. The inability of farmers to predict late and early frosts and thus successfully produce and harvest a maize-bean crop within two or more years due to constricted growing seasons may have led to the relocation of households to lower elevations.

Campbell and Campbell (1989) argue that these late Holocene climatic events affected human settlement and subsistence at the northern frontier of maize-and-bean horticulture in southern Ontario. Moreover, evidence of agricultural successes and failures has been observed at agricultural frontiers in North America in historic Little-Ice-Age times (Kurita 1988; Parry 1981). In late eighteenth-century Maine, for example, a significant but brief warming trend, in part, encouraged farmers to move into Kennebec County, southern Maine, and invest themselves in the production of grain crops, including maize (Smith et al. 1981). Indeed, "the most usual remark during this period was that Indian corn (maize) was an assured crop, although it had been a marginal one at this latitude earlier" (Smith et al. 1981:455–456). A subsequent trend of cool summers followed by wet falls resulted in devastating crop failures: "By 1838 several (newspaper) editors observed that for the past 7 years the Indian corn crop of most farmers had been severely curtailed, if not destroyed" (Smith et al. 1981:457). While these historic farmers in Maine practiced agriculture at a *latitudinal* frontier, those of the prehistoric Appalachian Summit region attempted the same at an *altitudinal* frontier and thus faced the same risks imposed by only minor climatic fluctuations—ones which may have had little impact on farmers at lower altitudes or latitudes.

Conclusion

Reconsideration of ceramic attributes and architectural data from northwestern North Carolina indicate a closer affinity to archaeological evidence of contemporary, Woodland-period, Dan River-phase groups to the north and east rather than to Mississippian groups to the south and west. These traits include circular-house floor plans and pottery with sand or crushed rock tempering, net-impressed exterior treatment, and scraped interiors. Ceramic traits borrowed from Mississippian neighbors to the south and west include punctated thickened or collared vessel rims and rectilinear stamping.

Thus far, it appears that these sedentary agriculturalists resided above 2,500 ft only between A.D. 900 and 1450, a time which corresponds with the Medieval Warm period and the introduction of Northern Flint maize. Although the Ward site village was probably abandoned by A.D. 1200, residents may have continued to survive in the upland valleys into the fourteenth century by fissioning into independent family units and establishing farmsteads such as the Katie Griffith site where their dependence upon high-risk cultigens was reduced. With the proposed onset of the Little Ice Age in the fourteenth century, crop failures resulting from early and late frosts may have influenced the abandonment of the higher elevations by permanent residents for the remainder of prehistory. The potential influences of climatic variations on late Holocene human settlement in the region must be explored further through more goal-oriented interdisciplinary research involving dendroclimatological, palynological, sedimentological, and archaeological investigations.

Notes

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MULTIDISCIPLINARY LANDSCAPE RESEARCH AT TANNENBAUM HISTORIC PARK, GUILFORD COUNTY, NORTH CAROLINA

by
Linda France Stine, Roy S. Stine, and Kristen S. Selikoff

Abstract

Interdisciplinary research demonstrates that the extant Hoskins log cabin (31GF413**), at Tannenbaum Historic Park in Greensboro, North Carolina, is located on or near an eighteenth-century house site. The Park is part of the Guilford Courthouse Battlefield National Historic Landmark and is believed to be the location where General Cornwallis formed the first British line of attack which proceeded into the current Guilford Courthouse National Military Park. Archaeology and Geography faculty and students from the University of North Carolina at Greensboro used a landscape perspective, geographic information systems, and historical archaeology to explore the occupation of this farm from the American Revolution to the present.

Background

Over the past 15 years the city of Greensboro has undergone dramatic urban development. This has threatened the cultural integrity of the Guilford Courthouse National Military Park (GUCO) and associated Tannenbaum Historic Park (THP) and Country Park. These parklands are the only protected lands that remain of the Battle of Guilford Courthouse, an important turning point in the American Revolution.

Throughout 1999–2003, several related multidisciplinary research projects have been undertaken by Geography and Anthropology faculty and students at the University of North Carolina at Greensboro (UNCG) in conjunction with staff from Guilford Courthouse National Military Park, the National Park Service's Southeast Archeological Center (SEAC), and other specialists (dendrochronologist, historians) working for Tannenbaum Historic Park. In particular, UNCG geographers were asked to develop a Geographic Information System (GIS) to guide management and protection of historic, cultural, and environmental resources in and around the Guilford Courthouse National Military Park. UNCG archaeologists were asked to assess and integrate results of a previous archaeological testing project at Tannenbaum Historic Park (e.g., Abbott 1984), begin a new program of archaeological research at the site, and to create an archaeological protocol for that park (Stine 2000; Stine and Selikoff 2000; Stine et al. 2001).

In 2002, UNCG archaeologists were told that grading was planned near the Hoskins House (31GF413**), the extant log structure at Tannenbaum Historic Park. As 1999 fieldwork had uncovered midden and features, a program of shovel testing was planned using UNCG students (Stine and Adamson 2003). Research results at Guilford Courthouse National Military Park are reported elsewhere (Stine et al. 1999, 2001). This paper summarizes the work related to Tannenbaum Historic Park.

The Battle of Guilford Courthouse

In early 1781, American commander Nathaniel Greene chose Guilford Courthouse and environs as the place to make his stand against British forces commanded by Lord Cornwallis. Guilford Courthouse, constructed in 1771, was a well-known regional landmark. The building was located on high ground overlooking the intersection of two important transportation routes (Salisbury [New Garden] Road and Retreat [Reedy Fork] Road). A small Colonial settlement was established in the immediate vicinity of the courthouse (GUCO 1998; Hatch 1970, 1971; Ward 1976). This settlement, later renamed Martinville, served as the county seat. The nearby farmlands of Joseph Hoskins were used as a staging ground for the British troops. Hoskins' open fields were found on either side of the main road, in the uplands overlooking Horse Pen Creek (Figure 1). This map, attributed to British engineer Henry Haldane, depicts two structures south of the Old Salisbury Road, now New Garden Road (Stine and Selikoff 2000:30). Based on extensive historic research, the smaller and larger building symbols have been interpreted as Hoskins' farmhouse and an outbuilding (e.g., Hatch 1970:77–79; see also Tarleton [1787] battle map reprinted in Hatch 1970:Plate 1).

On March 15, 1781, the Battle of Guilford Courthouse began. General Greene placed his first line of defense in the wooded elevations further to the east, behind a split-rail fence. After a sharp series of exchanges, British forces broke the first line and drove forward through the forest to engage the Continental Army's second line. The British eventually pressed and broke the American third and last line in the open fields surrounding Guilford Courthouse.

The British were the victors of the two-hour battle, but the victory was bittersweet. Greene was able to escape with his men to the north, and Cornwallis lost too many men and supplies to retain an effective fighting

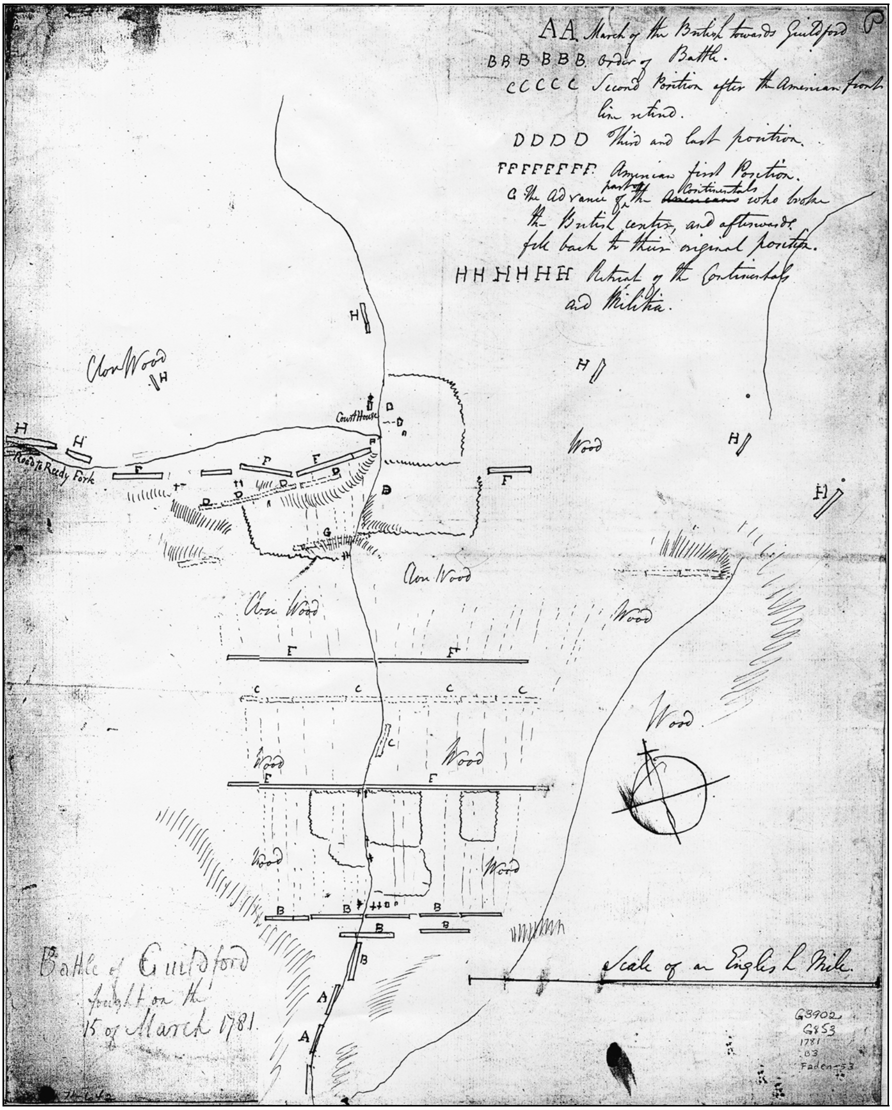


Figure 1. 1781 sketch map of the Battle of Guilford Courthouse (Library of Congress G3902.G853.1881.03.Faden-53).

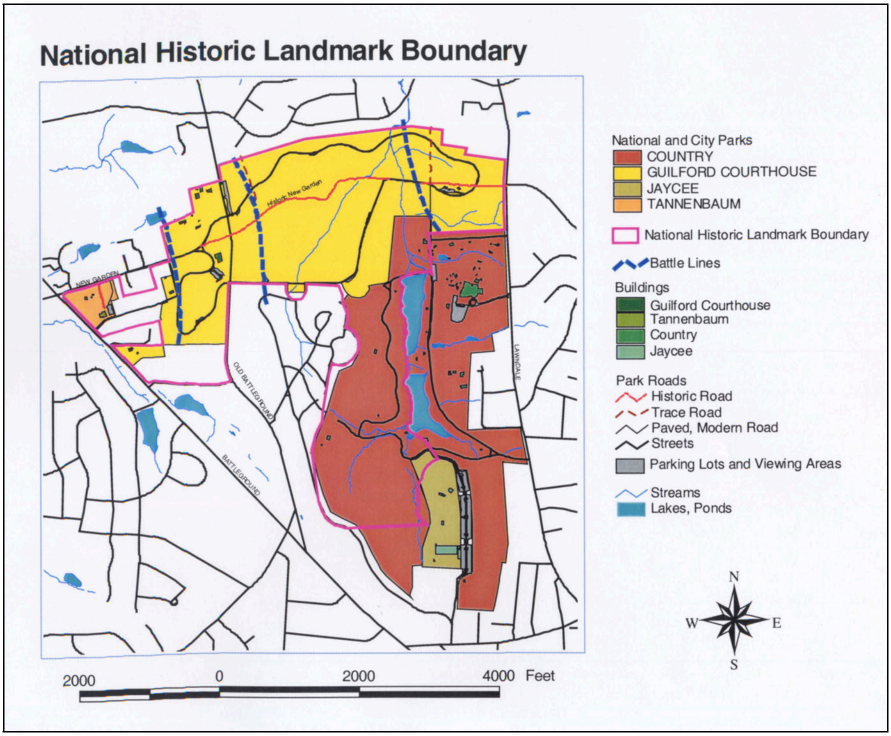


Figure 2. Guilford Courthouse Battlefield National Historic Landmark boundary.

force in the Carolinas. Afterward, Cornwallis returned to Wilmington and eventually removed his forces to Yorktown, Virginia, where he met ultimate defeat in 1781 (Lautzenheiser:1990:29–34; Newlin 1977; Powell 1989; Stine et al. 2001).

Tannembaum Historic Park

The core of Joseph Hoskins' original 150-acre farmstead was purchased by the nonprofit Guilford Battleground Company in 1984 with help from the Tannenbaum-Sternberger Foundation and local government funding. They deeded the 7.69 acres to Greensboro Parks and Recreation Department in 1988 and the park was named Tannenbaum Historic Park (Figure 2). Approximately sixty percent of the preserved battlefield is found in Greensboro's Country Park, also managed by the Parks and Recreation Department (Schlosser 2000:B1–B2; Stine and Selikoff 2000; Stine et al. 2001). A total of 220 acres covered by the engagement have been incorporated into the Guilford Courthouse National Military Park. These entities were awarded National Landmark status in 2001, based in part on the results of related multidisciplinary research projects at Tannenbaum Historic Park and Guilford Courthouse National Military Park (Piedmont Land Conservancy 2002; Schlosser 2001).

In 1999, the Tannenbaum-Sternberger Foundation awarded a grant to the Guilford Battleground Company, a nonprofit citizen's group supporting the preservation and interpretation of the battlefield. Part of the grant was awarded in turn to Tannenbaum Historic Park to enhance the park's exhibits and interpretive programs using new data collected from historic, archaeological, and architectural research (Stine and Selikoff 2000:1, 3).

Archaeological and GIS Research Design

UNCG archaeologists' research design was grounded in landscape archaeology, the study of "how people shaped and were shaped by the land within a dynamic cultural and natural context" (Zierden and Stine 1997:xi). Investigations focused on identifying the major sequence of landscape change at Tannenbaum Historic Park. Researchers created comparative data sets based on archaeological, documentary, and other kinds of data sources. A geographic information systems (GIS) database was created for the park to help analyze collected maps, aerial photographs, and digital data using a landscape perspective. Understanding land-use patterns from initial colonial settlement through the twentieth century, for example, helped in the interpretation of archaeological remains. Archaeological evidence concerning Hoskins' colonial piedmont farmstead was important since little comparative data were present in the region (Stine and Selikoff 2000:23-27). More prosaic questions to be addressed included: (1) determining if diachronic changes in the landscape had obliterated evidence of previous occupations; (2) dating the assemblage; and (3) determining the function(s) of the site.

Research Results

Deed Research Results

At this project's outset, researchers were given access to a partial chain-of-title for the Tannenbaum Historic Park property. A research priority was to verify the sequence of landowners and to expand it as necessary. Project historians concentrated on the eighteenth-century documentary evidence. The results of their study are found in separate

Table 1. Tannenbaum Historic Park Deed Research Results.

Date	Grantor	Grantee	Acreage	Notes
12-01-1753	J.E. Granville	R. Donnall	560	Rowan County
11-14-1774	R. and M. Mitchell	James Ross	150	both sides of road Horsepen Creek
05-18-1778	J. and M. Ross	J. Hoskins	150	both sides of road Horsepen Creek
07-01-1869	Ellis Hoskins	J.E. Hoskins	170	mentions road
05-02-1878	L.M. Scott	Naomi Ward	170	to pay debts of J.E. Hoskins (admin.)
11-10-1890	Naomi Ward	Theo. Hoskins	170	
02-16-1901	Theo. Hoskins	Susie Hoskins	145	lands near the battle
04-22-1925	S.B. Hoskins	S.F. White	54	
08-18-1961	E.P. Bradley	Burke Davis	?	Center Grove Twp.
09-15-1971	W.B. Davis	F.D. Wyrick	?	

reports (Stebbens 1998, 2000; Stebbins and Hiatt 2000). This project focused on collecting information on the sequence of property owners over time and concomitant transformations in the size of the deeded holdings. Methods used and the full sequence are provided elsewhere (Stine and Selikoff 2000:39-47). Some of the results of this study are detailed in Table 1.

The first major division of the Granville Grant land occurred in 1774, with the Mitchell-Ross transaction. James Ross bought 150 acres "on Horsepen Creek and both sides of the main road" (Guilford County Deed Book [GCDB] 1:285). Joseph Hoskins bought this tract in 1778 from Ross (GCDB 1:439), and he was the owner of the property during the 1781 Battle of Guilford Courthouse.

The 1778 Joseph Hoskins' deed also describes the land as being 150 acres on "Horsepen Creek, and on both sides of the main road," which is modern New Garden Road. Numerous studies of the Hoskins' farm at the time of the battle have been undertaken, and there is little doubt that this property was once part of the Battle of Guilford Courthouse (e.g., Baker 1995:32; Hatch 1970). This documentation includes a review of different versions of the British map sketched immediately after the battle (e.g., Figure 1).

Joseph Hoskins' land was then divided between his sons according to his 1799 will. Son John Hoskins received 100 acres of land located south of the 150-acre farmstead which were near, but not contiguous to, the

Hoskins' farm. The other two sons, Joseph and Ellis, received the parcel of land where their father had lived, equally divided between them. The actual amount of land given to sons Joseph and Ellis is not stated. One presumes that each received 75 acres. Hoskins stipulated that son Joseph have the section containing the house (Guilford County Records, File #.0166; Stebbens and Hiatt 2000; Webster 1979:28). This is the only mention of a structure on the property.

Hoskins and wife Hannah had eight children at the time of his death: daughters Elizabeth, Hannah, Ann, and Mary; and sons John, Eli, Joseph, and Ellis. Joseph provided his wife with the rights of the farmstead, including a mare and saddle and bed and furniture. His daughters received material goods such as spinning wheels, cooking pots, bedsteads, livestock, and sometimes money. His younger son Eli received money and was placed in a trade while the remaining sons received land (Stebbens 2000; Webster 1979:28). By 1803 a neighbor was placed as executor of the estate and guardians of the children, now described as orphans (Stebbens 2000).

It is interesting that although there is a ninety-one year period between the Joseph Hoskins' deed and the next, when his son Ellis transferred three tracts to his son J.E. Hoskins of Woodford County, KY, these lands remain in the Hoskins' family hands. It remains unclear how Ellis seemingly ended up with all of the original Joseph Hoskins' farmlands. It is known that Joseph Hoskins (Ellis' brother) purchased adjoining lands in 1828 (Hatch 1970:77, footnote 4). This unbroken chain of title continues until the early twentieth century (Table 1) with one exception. This is when two administrators are noted as holding the property for J.E. Hoskins' debts. The land is next sold, however, to a Hoskins' descendant when the Ward tract was sold to Theodosia Hoskins in 1890. (The relationship of Naomi Ward to J. E. Hoskins is as yet undetermined, but she is listed as "administrator" as is L.M. Scott [Stebbens 2000]). Susie B. Hoskins then received most of the land from Theodosia Hoskins in 1901.

The 1925 transaction between Susie B. Hoskins and S. F. White consisted of 54 acres. An informant interview with S. F. White's daughter revealed that Mr. White bought 100 acres from Ms. Hoskins before April 22, 1925. Also, she indicated that Ms. Hoskins kept 40 to 45 acres of this land, which was eventually added to the Guilford Courthouse National Military Park (Mrs. White Woods, personal communication 1999). These deeds, not found at this time, should be located in order to clarify these points.

Maps, Photographs, and Oral History

Intensive map and deed research uncovered some rare sources such as the version of the Haldane sketch map, presented earlier (Figure 1). The original sketch of the "Battle of Guildford Courthouse," drawn in 1781, was located at the Library of Congress in Washington, DC, by the project geographer. A photocopy of the original 1781 sketch map has been obtained from the Library of Congress. This was scanned and digitally enhanced to produce Figure 1. The map was the precursor for British Lieutenant Colonel Banastre Tarleton's map of the battle (1787) which was based on the map attributed to Haldane. A Guilford Courthouse National Military Park historian had previously located another version of Haldane's map in the Clement's Library at the University of Michigan (Tom Baker, personal communication 1999).

The battlefield map has been geo-referenced to modern landscape features, including the extant Hoskins House, to help determine if New Garden Road follows the path of the Old Salisbury Road (Figure 3). Results suggest that the modern road follows the general path of the historic road and, by implication, that the historic Hoskins' cabin was once located in the same general vicinity as the standing structure at Tannenbaum Historic Park (Stine et al. 1999).

Investigations uncovered a 1937 aerial photo from the City of Greensboro Tax Record Department. This photo is the earliest known for the area and shows the property prior to the construction of Battleground Avenue (U.S. Hwy. 220) in 1941, which subsequently divided Hoskins' farm. It also shows the old Hoskins Drive intact. The 1937 photo is helpful in determining the location of large features such as roads, but structures are difficult to see. Other sources include aerial photos from 1955, 1970, and 1995. These photos, plus the 1937 image, illustrate the changing project landscape during the twentieth century (Figure 4). The 1995 photos are geo-referenced orthophotos obtained from the City of Greensboro. The 1970 photo is difficult to analyze, due to the low-resolution scan provided by the Guilford County GIS Department. The 1955 aerial photo is located at the Guilford County Soil Conservation Service. Researchers were only able to obtain a poor quality photocopy. The best quality aerial photos are the 1995 orthophotos, which were used extensively in this project. (The original negatives of the other earlier aerial photos have been located at the National Archives in College Park, MD. These may be obtained digitally, and will hopefully be obtained for future, more precise analysis.)

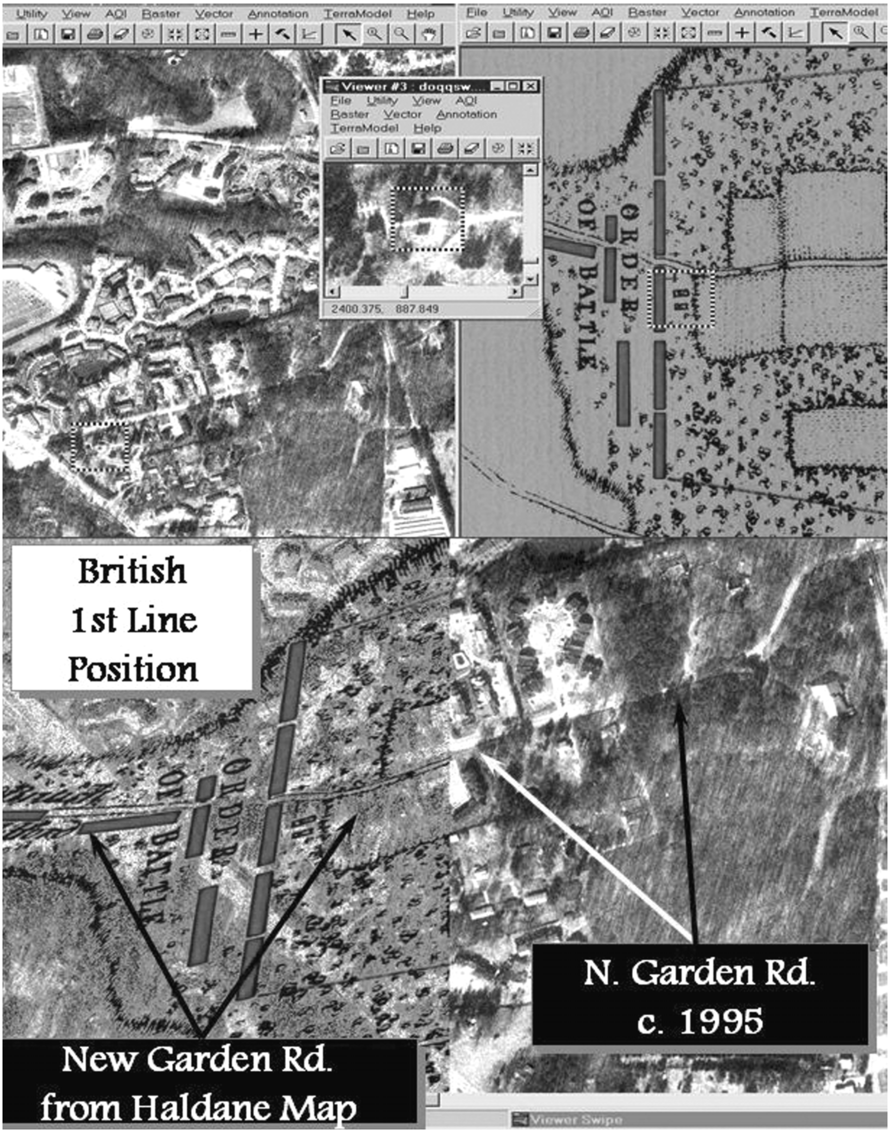


Figure 3. Haldane map overlain on 1995 orthophoto.

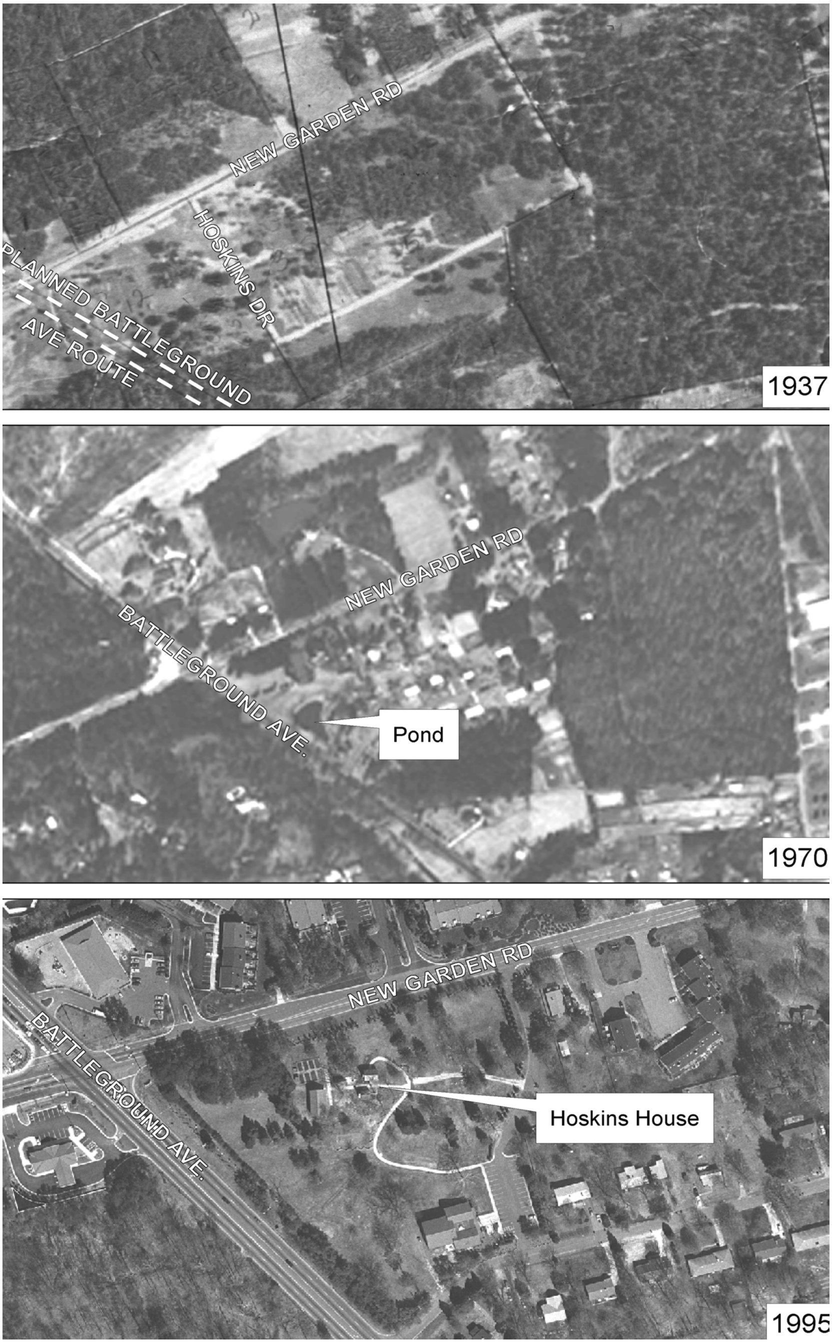


Figure 4. 1937, 1970, and 1995 aerial photos showing identifiable features/roads.

The 1937 photo shows the property before the construction of U.S. 220. New Garden Road (then called Guilford College-Battleground Road) is clearly evident. Looking at the southwestern area of the photo, it is seen that the planned route of the highway would cut through an existing driveway leading south from New Garden Road. This (as well as the deed research) indicates that the property extended much farther to the west than it does today. It should be noted that some researchers have mentioned the possibility that in 1781 a portion of the Great Salisbury Road (New Garden) may have run just south of the Hoskins' house. This is generally discounted by members of the Hoskins family and other researchers (Hoskins 1938). A dirt drive or road remnant visible in the 1937 photograph south of the house may be the debated feature. Another driveway may be seen leading from New Garden Road running southeast to the area in which the Hoskins House should be. A structure is not discernable, but the landscaping and clearing in the trees indicate that one is present. This driveway also leads to Hoskins Drive, which is mentioned in many of the deeds and shown on the 1926 survey. This served as the western boundary of the Green Acres subdivision. Liberty Lane (now Green Acres Lane) is also clearly shown. It is obvious that the area was still relatively undeveloped. Pastured land is evident on the Hoskins property, and farmland may be seen north of New Garden Road. Many areas are still forested. The landscape is primarily agrarian.

The 1970 aerial photograph is important because it is the closest to pre-restoration uncovered to date. The quality is not very good, but large features may still be seen. By 1970 the landscape had changed drastically. New Garden Road and Battleground Avenue are still evident. But the most important feature shown here is the pond located on the property. This was filled-in before restoration in the 1980s, sometime after the 1984 Wake Forest archaeology project was conducted. There are very few accounts of the exact location of the pond in other sources. The rest of the surrounding area is much more developed, depicting a residential instead of agricultural landscape. A small airport runway may be seen to the north of New Garden Road. Also, a large pond (filled just prior to construction of Brassfield shopping center) is evident to the northwest.

The 1995 aerial photograph shows the modern landscape at Tannenbaum Historic Park. The pond has been filled. Commercial and residential development is seen encroaching upon the Park.

Historic Photographs and Interviews

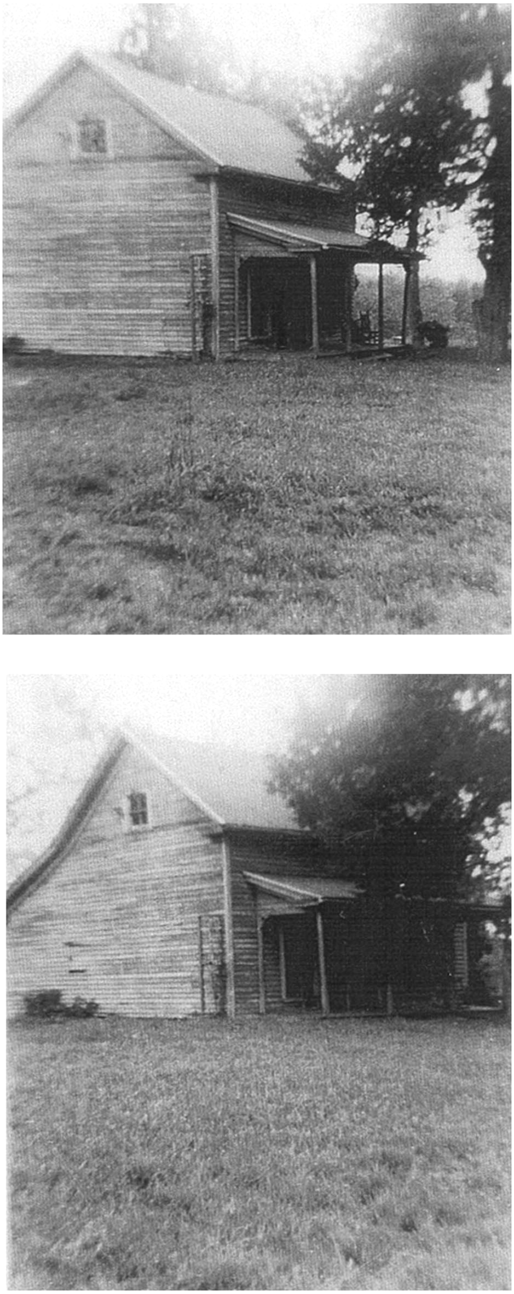
The present Hoskins House is a two-story, 18 x 24 ft, V-notched log cabin. The structure has had numerous additions and renovations over the years. Some of these changes can be observed through historic photographs (Figures 5, 6, 7, and 8). A sense of the landscape at a few key moments in time is provided through interviews with past landowners or their descendants. Information concerning the footprint of the cabin and its additions and associated room functions over time was also collected, but are detailed elsewhere (Stine and Selikoff 2000).

On May 19, 1939, Mr. W. I. Tilley (once a Hoskins' neighbor) photographed the Hoskins farmhouse (Figure 5a–b). Both photographs are views to the southwest facing the northeast corner of the house. The landscape shows grassed fields, with the house in a small stand of trees on the west and northwest. The foundation of the structure can not be ascertained. The porch appears to be about eight feet wide. The porch foundation is difficult to see, as the floor sits very close to the ground. The ground slopes significantly to the west. A small object is visible west of the house and downhill from the house's upland rise. This appears to be an arched-shaped, temporary structure.

Mrs. White Woods, daughter of former owner S.F. White, was interviewed on December 6, 1999. She stated that Susie Bell Hoskins owned the property (about 140 acres) that she had received from her grandmother, Theodosia Hoskins (GCDB142:281 records it as 145 acres in 1901). Suzie and her family gave some land for the Guilford Courthouse National Military Park (about 40 acres). Suzie's brother and his wife, and not Suzie, actually lived in the Hoskins House.

Mrs. Woods recalls that the Hoskins House had an attached kitchen. A photograph in her possession shows this addition. It depicts a single-story, vertical-boarded structure resting on brick piers. The south side of this addition has what appears to be a shed attachment. It is difficult to judge from the photograph, but it looks as if the kitchen addition somehow incorporated the Hoskins' chimney or was built directly in front of the chimney's western side.

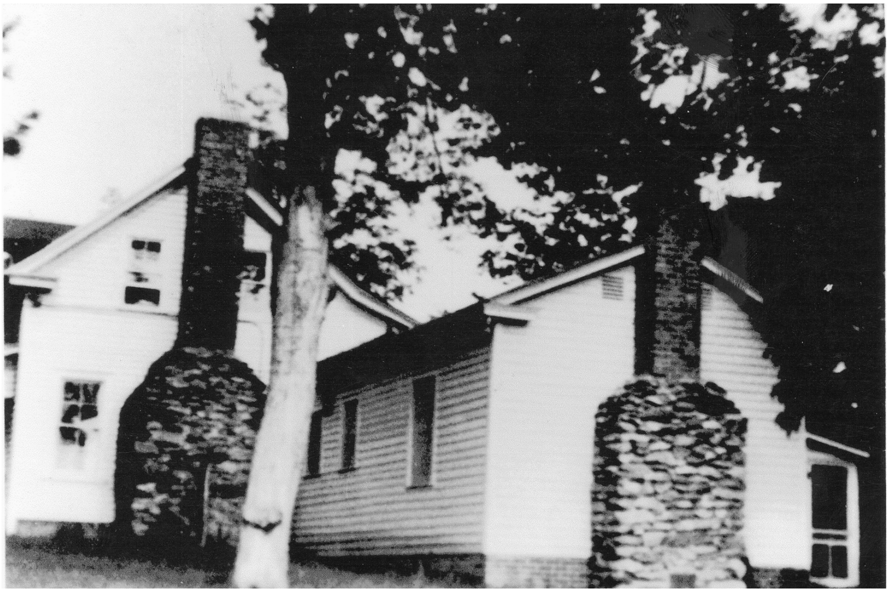
The Hoskins' farm had a garden and orchard in an elevated area near Horsepen Creek, just west of Tannenbaum Historic Park. Mrs. Woods recalls that the Hoskins' spring, located south of the extant structure, was "rocked" neatly and that seven associated springs were located nearby, under and west of modern U.S. 220 (Battleground Avenue). Mrs. Woods does not recall any barn at the Hoskins farm. She says that an old log



a.

b.

Figure 5. Two photos of the Hoskins House in 1939 (view to southwest).



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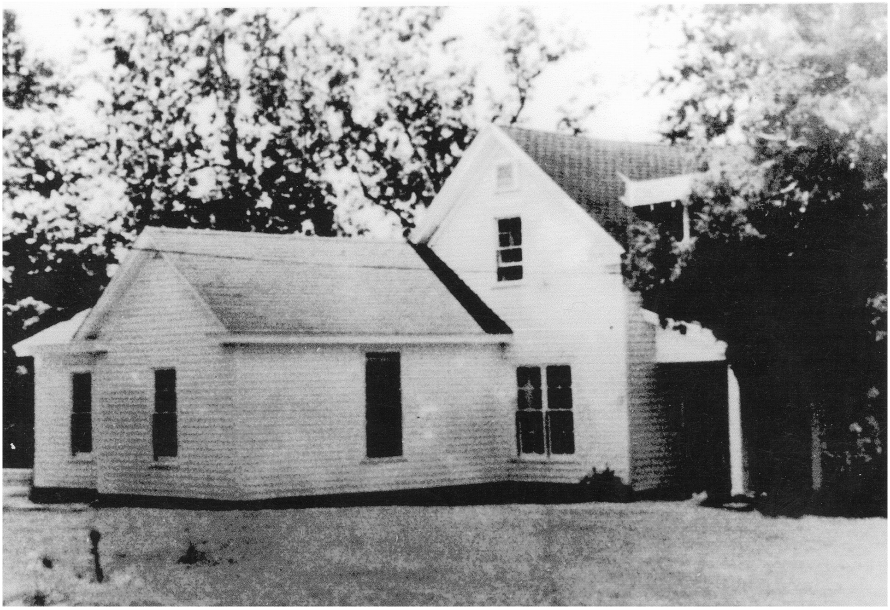

b

Figure 6. Photographs taken in 1954 of (*a*) the west addition (looking east-southeast) and (*b*) the east addition (looking south-southwest).

Figure 7. Photograph taken in 1983 of the Hoskins House with bricked northern façade.

house once stood in the southwest portion of the Hoskins' property. This log home was later used as a barn. (It is not yet clear if the Hoskins moved the previous owners out of this house and later used it for a barn, or if Mrs. Woods' parents were the ones who did so.) (Note: Baker [1995:59] discusses the Guilford Courthouse National Military Park's December 18, 1956 purchase of a house on a 0.69 acre lot on Liberty Lane/Green Acres Drive for the Park historian, a position that was not filled until some years later. This may be the same place.)

Mrs. Woods' parents, S. F. and Mary White, purchased 100 acres of farmland from Susie B. Hoskins in the early 1920s. This included the extant cabin and springs that are now part of Tannenbaum Historic Park. Her father, S. F. White, decided to subdivide part of the farmland. He developed plans for Green Acres, a development which led to a significant alteration of the landscape in the immediate project area. Mr. White arranged new financing for the development with Susie B. Hoskins using 54 of these acres as collateral (GCDB 484:501). Before he began the Green Acres development he sold Mr. Tilley some land just west of the Hoskins House. Mr. Tilley constructed a frame bungalow there in the 1920s. Mrs. White has photographs of the Tilley house, a western view

a

b

Figure 8. Photographs of the Hoskins House during the 1980s restoration, showing (*a*) the south face and (*b*) the north face.

taken from the Hoskins cabin. It shows that the area was mostly open field.

The original Hoskins' driveway west of the cabin was expanded and lengthened to become Hoskins Drive. Renters of Mr. S. F. White lived in the Hoskins House before Mr. White sold the land to his son, Wilmer in 1937 (GCDB 995:68). The attached kitchen was "tore away" sometime after Mrs. Woods' brother, Wilmer White, sold the Hoskins place. Her brother left the Hoskins homestead in 1942.

Two photographs (Figure 6a–b) are presented to illustrate the condition of the Hoskins House in 1954 (North Carolina Department of Cultural Resources, Archives and History, accession #N.84.2.939.940). The first figure depicts the western or chimney façade. The frame house and addition have matching stone chimney foundations with brick stacks. The addition or west wing has a contiguous brick foundation. The foundation to the original building looks contiguous as well. A screen porch is visible south of the western addition. The second photograph shows the house from the opposite angle, with a view to the northeast. The front porch looks like it could be the same as the porch in the 1939 Tilley photographs. The house foundation is hard to see but appears to be a solid unit of brick or stone. The northeast corner of both the house and the eastern addition are very close to the ground. This illustrates the yard's slope.

Past owner Burke Davis was contacted by phone on December 16, 1999. Mr. Davis says that the remaining original Hoskins' acreage consisted of the one front acre when he purchased the cabin in 1951 (GCDB 1402:625). He later added about two acres of corner land. He also was able to purchase a narrow strip of land south of the house and parallel to U.S. 220 (Battleground Avenue). Mr. Davis and his wife soon owned about five acres.

When Mr. Davis purchased the house, the only outbuilding on the property was a three-sided shed near the property line by the spring, maybe 30 ft from the house. This shed was open to the east. The south or back of the Hoskins House had a shed attached. He thought that the shed dated to around 1800 because of the large locust timbers and mortise-and-tenon joints used in its construction. In 1952, he added two wings to the house. On the eastern side was a one-story bedroom addition and on the west an addition to the right of the chimney. This room crowded the stone chimney, but it did not cover it. On the rear or southern elevation, there was a green porch with a sloped concrete floor. This was maybe 12 ft wide.

In 1955 Mr. Davis decided to construct a brick façade around the original board-covered log house in order to better preserve and protect the historic structure. He also modified the plan by building a new east wing and by changing the western wing.

Mr. Davis put in a well for the house, since the water supply had previously been by way of a ¾-inch pipe connected to a neighbor's house. The new well was placed close to the western side of the house, maybe 12–16 ft due west of the chimney. To the west of the house were a retaining wall and a large tennis court.

David Wyrick bought the Burke Davis tract in 1971. The greatest expansion of the Hoskins complex occurred under his residency in the 1970s and 1980s. Mr. Wyrick added an office complex attached to the south room in the east wing and a large master bedroom complex to the southwest room of the west wing (Figure 7). The house utilities (e.g., hot water heater) were located in the basement. Wyrick constructed a covered, separate entrance to those facilities in the southwest corner of the back (south) shed porch in the 1970s. He later built a large carport with a storage area on the eastern side, detached from the new office addition.

The landscape during the Wyrick occupation (ca. 1971–1984) was primarily residential. The family had a few horses and kept much of the back acreage in pasture. There was an impermanent structure for the horses, like an open shed, located west of the old tennis court area in a stand of pines and cedars. The tennis court asphalt was removed and the area re-seeded and fenced. A wooden fence demarcated the front yard. Mr. Wyrick and Mr. Moore (neighbor to the east) shared their driveway (Hoskins Drive remnant) but had separate, short drives off that main driveway. Mr. Wyrick had a small metal shed just at his turn. He had his car "turn-around" graveled. There was a curved brick retaining wall demarcating the parking area. The Moore house, there for at least 25 years before 1971, was located close to the Wyrick car park.

Mr. Wyrick has many pictures of the general landscape. Brick steps led up to the patio, and there was a stone retaining wall at their base. The septic tank was just southeast of this area, under the west colonnade to the office. Mr. Wyrick graveled over the septic tank area. The septic field was to the southwest, downhill from the house.

Wyrick sold the land to the Guilford Battleground Company in 1985. The Battleground Company also bought the George Moore and Jess Ferrill properties at the same time. The chain-of-title for the Ferrill property is not clear and needs to be clarified through more research. The George Moore property, however, is known to have been part of the Green Acres subdivision. His name was also mentioned many times in informant interviews and in deeds since the 1950s. His house, along with the Ferrill house and outbuildings, was demolished during restoration of the Park. All of these tracts were then sold to the City of Greensboro in 1988 to eventually form Tannenbaum Historic Park.

Mr. Si Rothrock was the Hoskins House preservationist/restorer for the project in 1986–1987. He was interviewed at Tannenbaum Historic Park on October 19, 1999. Mr. Rothrock stated that two men had taken down most of the twentieth-century additions to the house before he became involved with the project. The brick patio rubble was still visible (Figure 8a). Mr. Rothrock also stated that the original stone and brick chimney was not disturbed during renovations. This is clear from one of the photographs, which shows ivy still clinging to the masonry (Figure 8b). Ed Deaton (personal communication 1999) of Greensboro Parks and Recreation had sterile, yellow sandy fill brought in to some parts of the site to cover muddy soils. Mr. Rothrock said that remaining fill and brick rubble was hauled off-site, not spread or dumped on the property.

Over the years, Tannenbaum Historic Park personnel have worked on the grounds by adding topsoil, grading, and seeding. They have also added sidewalks, picnic tables, and other conveniences for the public. Major structural changes include building a visitor's center southeast of the Hoskins House, building a typical log kitchen south of the historic log house, and relocating a log barn from southern Guilford County to the Park.

Wake Forest Archaeology at Tannenbaum Historic Park

During project discussions, it was revealed that Wake Forest archaeologists had been hired by the Guilford Battleground Company in May of 1984 to search for one or two purported mass British graves stemming from the March 15, 1781 Battle of Guilford Courthouse (Abbott 1984). Dr. Ned Woodall served as the principal director, and the fieldwork was directed by Lea Abbott. The results of the Wake Forest work are detailed elsewhere (Abbott 1984; Stine and Selikoff 2000). This is a brief summary. Although no graves were found, the Wake Forest investigations uncovered cultural features, artifacts, and fill episodes. Materials included a few non-diagnositic, prehistoric lithic artifacts manufactured of local material (metavolcanic); eighteenth- and early nineteenth- century ceramics such as creamware and pearlware, wrought nails, and olive glass; and greater amounts of nineteenth- and twentieth-century ceramics, glass, and marbles (Stine and Selikoff 2000:Appendix B). The frequency of artifacts by functional group (following South 1977:Table 4) supports the interpretation that this was an historic farmstead or plantation site (Stine and Selikoff 2000:66). A total of 773 historic artifacts and six prehistoric lithic artifacts were recovered during this work.

Five trenches (designated Trenches F, I, K, M, and N) revealed important subsurface assemblages or features. All five are located behind (south) of the Hoskins House complex (Stine and Selikoff 2000:Figure 7). For example, at about 13–20 cm below the ground surface in Trench N, archaeologists discovered a layer of artifacts and gravel. This appears to be the remains of a walkway, perhaps of the path leading to the spring. The two-meter-wide feature is located about eight meters northeast of the southwest end of the trench (Abbott 1984:50). A total of 195 artifacts were collected at this provenience. It appears that all were found in association with the walkway feature (Abbott 1984:52–53). Another example is found in Trench I, located near the Moore house, where evidence for an 11–15 cm thick gravel roadbed was uncovered. This was most likely part of Hoskins Drive or perhaps the Tilley driveway. No artifacts were recovered from the trench's feature fill.

GIS at Tannenbaum Historic Park

There were some questions that could be answered using GIS methods, such as; Where were the Wyrick-Davis house additions located in regards to the modern landscape? Where were the Wake Forest project trenches and auger tests located? Have physical and natural features changed? If they have changed, where are they located? Major obstacles had to be overcome. None of the maps have the same scale, and features did change through the years. For these reasons, an accurate base map had to be created in order to obtain the standards of accuracy wanted for geographical analysis.

A recent geo-referenced, or spatially corrected, orthophoto was chosen as the base map for the project. This 1:2400 or 1"=200' scale aerial photo, acquired from the City of Greensboro, was flown in 1995 and was the most recent image available. The aerial orthophotos are accurate to ± 4 ft. They are referenced in the State Plane Coordinate system for North Carolina, zone 3200 using the North American Datum of 1983 (NAD 83). The spheriod used is GRS80 and the measuring unit is in feet (City of Greensboro, GIS Division). Planimetric maps, such as road centerlines and edges, were also obtained from the City of Greensboro GIS Division. These digital maps included tax property boundaries for the Park, as well as roads, paved areas, and building footprints, and they contain a higher accuracy rating than the aerial photographs. Figure 9 shows the Park boundaries, roads, and buildings on the orthophoto. The orthophotos and planimetric maps serve as the foundation map upon which all subsequent geographic analysis and georectification and/or registration was based.

GIS Methods. A variety of hardcopy maps were chosen for analysis according to historic content and accuracy. These maps were scanned and geo-referenced to the base map. In the georectification process, the analyst takes known points from an accurate map (in this case the orthophotos and planimetric maps), locates the same points on the historic maps and uses mathematical models within the computer software (ESRI, Inc. and Leica ERDAS, Inc.) to create geographically accurate maps.[1]

To locate the footprint of the Wyrick-Davis house additions and concomitant roads and tax parcel lines, the 1986 Wilson survey of Liberty Park and the 1926 survey of "Green Acres" were scanned. These maps contained surveyed coordinates of all the above features. Fortunately, several of the surrounding property boundaries had not changed from the 1926, 1986, and 1995 plat maps. These geographic locations, in conjunction with other features such as roads, allowed for the georectification of the historic maps to the 1995 base maps. This process proved highly accurate, with the 1926 and 1986 tax plats matching precisely with the 1995 tax plats. From the historic maps, the locations of the house additions and the old Hoskins driveway could be placed on the orthophoto (Figure 9).

One of the tasks of the 1999 archaeological investigations was to determine the location of 1984 trenches and auger holes. Wake Forest archaeologists loaned the artifacts, field notes, field maps, correspondence, and photographs from the 1984 Hoskins project to UNCG researchers. A field map showing the location of 15 trenches (11 one-meter wide trenches and three two-meter wide trenches) and 18 auger tests (3-1/2 inches wide each) was examined (Abbott 1984:23–24, Figure 4). The trenches had been excavated using a monitored backhoe and a combination of shovel and trowel hand excavations (Abbott 1984:23). An attempt was made to correlate the published site map with a modern survey map of Tannenbaum Historic Park. This was difficult because the 1984 archaeology map used a stylized representation of the existing house complex depicting a rectangular structure instead of the ca. 1971–1984 three-sided outline. It was clear from the report that the southeast corner of the extant structure was used as an arbitrary datum. It was not clear which southeast corner was indicated: that of the cabin, the southeast office wing, or of the carport. The original field director of the 1984 project, Lea Abbott, was contacted.

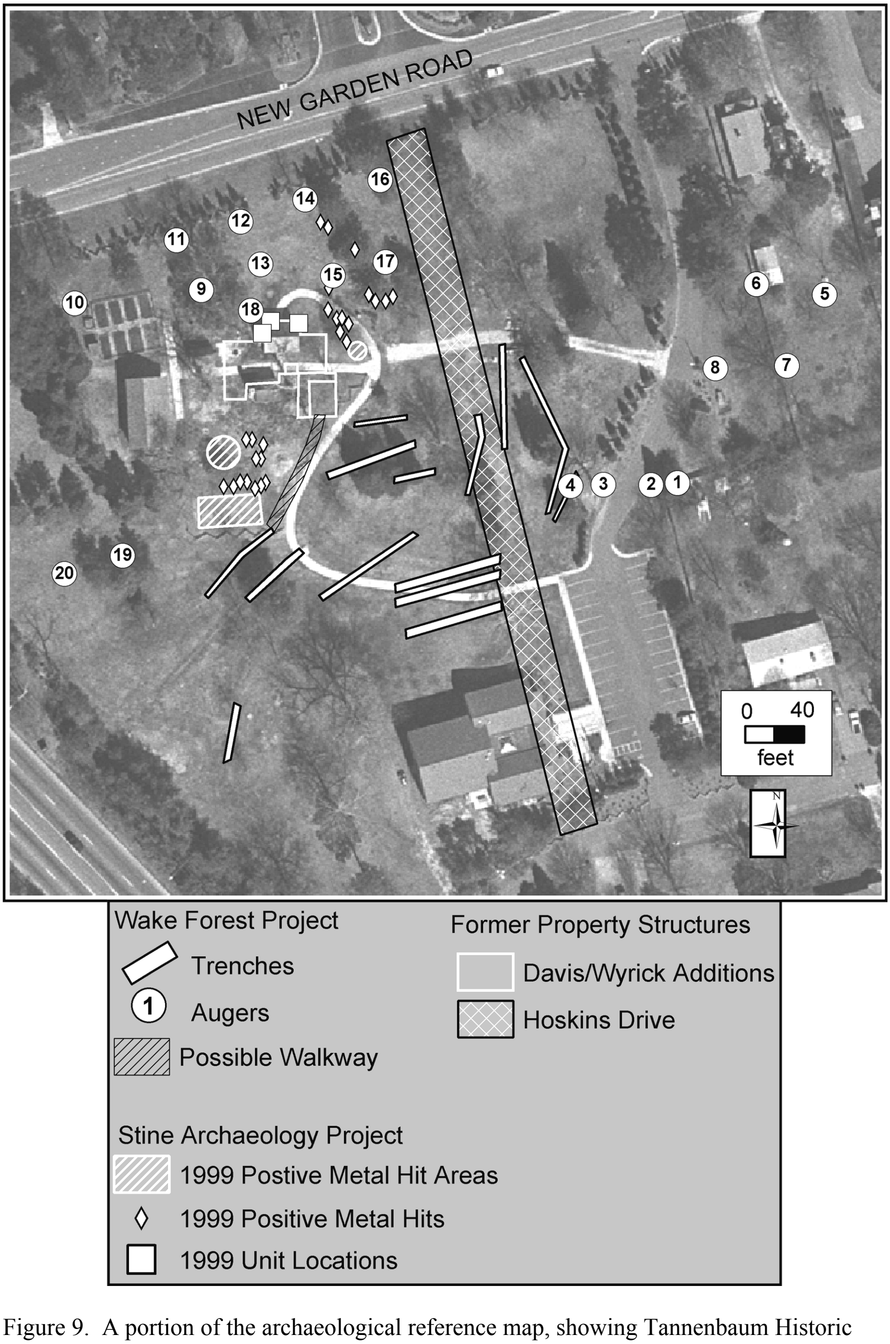

Figure 9. A portion of the archaeological reference map, showing Tannenbaum Historic Park.

Although the project occurred a while ago, he believes that the 1984 Wake datum was the southeast corner of the southeast wing of the house complex, and not the car port or the Hoskins' log house (which was still bricked) (Lea Abbott, personal communication 1999).

The accurate footprint of the Wyrick-Davis house generated from the Wilson survey of Liberty Park and the survey of "Green Acres," from above, gave the researchers the datum used by Wake Forest archaeologists. The original Wake Forest field map was constructed using an alidade and metric tapes. This map was converted to North Carolina State Plane in feet. Wake Forest archaeologists had mapped contour lines as well as a variety of features on the landscape, such as Sycamore and Osage orange trees. These cultural and natural landscape features were used to register the Wake Forest map to the 1995 orthophoto. This allowed the team to place the trench lines and auger tests on the current map. This process was not as geometrically accurate as using surveyed boundary lines, but it does give a close approximation of the locations of the excavations (Figure 9). Combining the maps and the historic aerial photographs gave clues to the changes in the natural and physical landscape.

By combining the different spatial datasets, past landscapes and topographic contours were compared to current landscapes and contours. It was clear that substantial filling had occurred in the middle and western portions of the project area. The one-acre pond has been filled in since the 1984 project, and a drainage system has been installed which extends from near the extant parking lot westward and down slope to the vicinity of the filled pond. This drainage system, with its large subterranean culverts, also changed the slope of the land. In addition, the tennis court had been covered with fill in about 1988 (Stine and Selikoff 2000). Mr. Jim Kirkpatrick, former president of the Guilford Battleground Company, visited Tannenbaum Historic Park on October 11, 1999. He walked the grounds and showed the general locations of the Wake Forest trenches to the 1999 researchers. The majority of trenches were not placed near the extant Hoskins House, but rather were located down slope and south of the main house. This also helped to verify the trench locations as derived from the GIS analysis.

The resulting illustration (Figure 9) demonstrates that all of the trenches were located south of the Hoskins House. Although most were located on what was Wyrick property, a few trenches were placed on what were Moore lands (east of old Hoskins Drive), and a few were excavated just north of what used to be the Ferrill house. Ten auger tests were completed in the front yard of the Hoskins House, between the house and

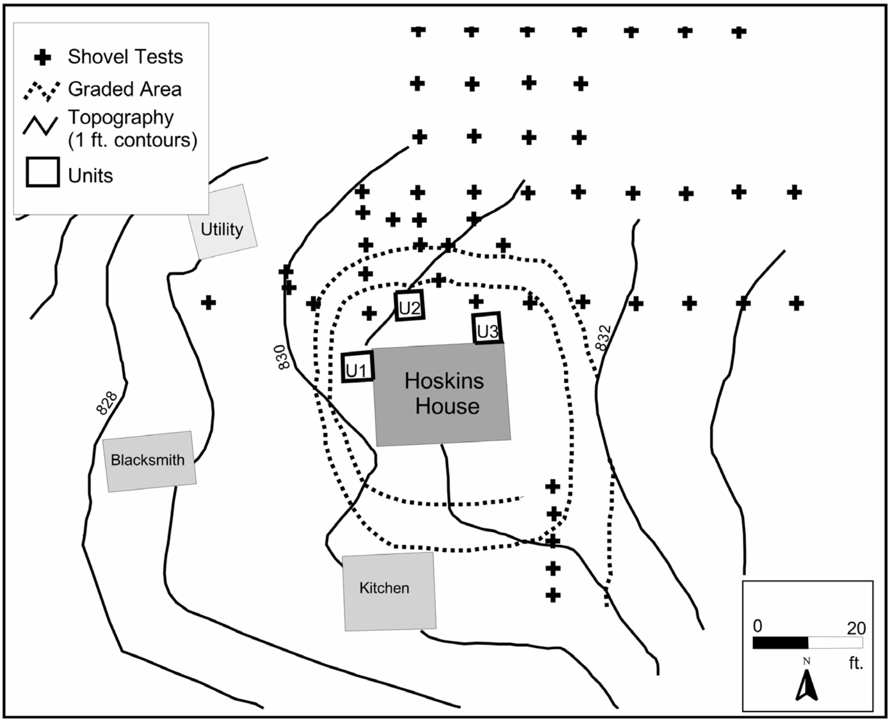

Figure 10. Map of the Hoskins House site showing excavation units, shovel tests, and graded area.

New Garden Road, and two auger tests were dug down slope from the tennis court, about halfway to the horse pond. The remaining auger tests were placed a good distance west of the Hoskins House, east and south of the Moore house.

Archaeological Fieldwork Results at Tannenbaum Historic Park

Three 5 x 5 ft units were excavated in 1999 as part of initial research at the Hoskins House site (31GF413**) (Figure 10). This occurred after training sessions with Tannenbaum Historic Park staff and volunteers. The week-long work provided a test case to see if the site retained clarity or integrity after years of construction, occupation, and destruction (Glassow 1977). The site proved to contain intact features and a typical midden associated with a homestead (Stine and Selikoff 2000).

In 2002, the site director contacted UNCG to propose ways to mitigate planned earth-moving activities near the Hoskins' cabin. This was done, but grading to improve drainage and remove mid- to late-1980s fill was well underway before the archaeological contract was signed or the archaeologist contacted (Stine and Adamson 2003). The situation was salvaged through volunteering and revamping the proposal. Bulldozing was monitored and both graded and soon-to-be graded areas were shovel-tested. Most of the northern yard was shovel-tested as part of this program to document fills, natural soils, and check artifact distributions by date and function (Figure 10). Some shovel tests were excavated concurrent to monitoring operations while others were excavated in a separate session of fieldwork in the fall, primarily in the northern yard (Figure 10). A total of 479 artifacts were recovered through shovel testing.

Specific details of Tannenbaum Historic Park fieldwork are found elsewhere (Stine and Selikoff 2000; Stine and Adamson 2003). Results are briefly summarized here. The sequence of house alterations and landscape changes over the course of about 220 years meant that more recent features, if present, may have obliterated evidence of previous features or midden soils. In 1999, Unit 1 was placed near the chimney on the cabin's west side, as archaeologists felt that this area had seen less building activity than others. The assumption was verified with upper levels of Unit 1 consisting of (from top to bottom): post-1980s Tannenbaum Historic Park occupation topsoil; a layer of sterile sand and rock fill; mottled pre-1980s topsoil and sand and rock fill; a domestic eighteenth- through twentieth-century midden; and subsoil, which was reached at about 1.0–1.3 ft below ground level. Evidence of construction and destruction of the 1954 brick façade was visible in a series of postholes and rubble, and the presence of a poured concrete foundation footing at about 1.0 ft below the ground surface. Fortunately, builders only dug a 0.8 ft wide trench near the cabin wall, leaving remaining soils intact. This footer did impact a small corner of the original stone chimney foundation. A rectangular posthole was located at the intersection of the two foundation features, beginning about 1.31 ft below the ground surface. It continued under the 1954 feature, thus predating it. Its final depth was 1.91 ft below the surface, and it contained no artifacts (Figure 11).

The other test units contained mid-twentieth century and recent foundation and utility features, as well as evidence of the destruction of the front brick porch and façade (Figure 10) (Stine and Selikoff 2000). These features obliterated most of the potential pre-mid-twentieth century features. Still, upper layer soils contained eighteenth- to twentieth-century artifacts in the disturbed fills. A portion of Unit 2 (located in the northwest yard) soils contained the type of house midden found in Unit 1 (Figure 10).

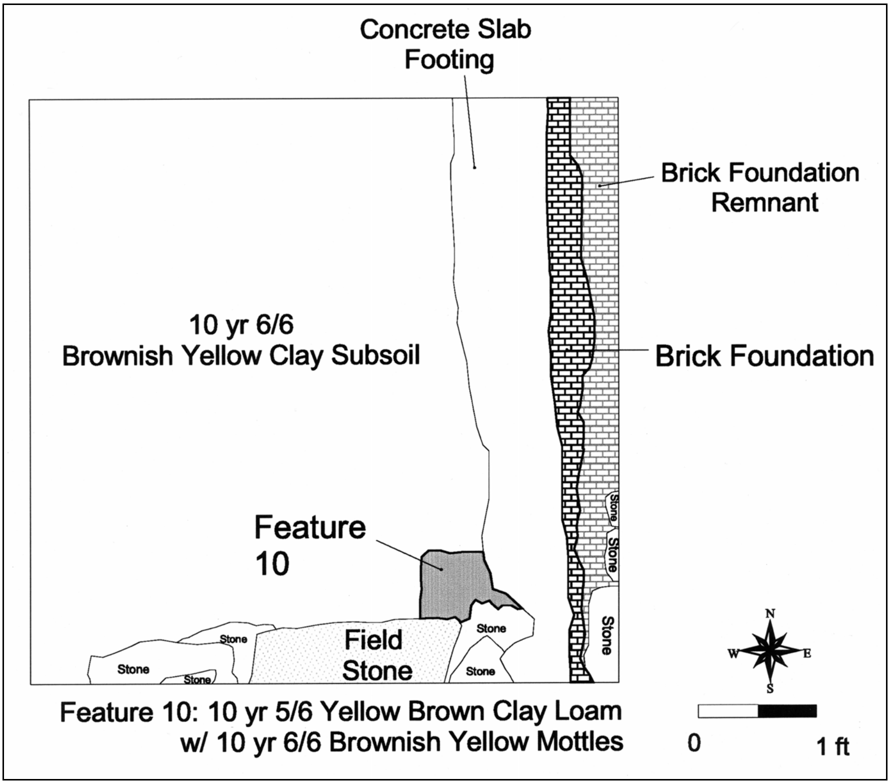

Figure 11. Excavation plan of Test Unit 1, showing Feature 10 (posthole) and foundation features.

Monitoring and shovel testing in 2002 confirmed that although portions of the Hoskins site have twentieth-century features that intrude subsoil, some evidence from earlier centuries remains (Stine and Adamson 2003). Areas of typical yard midden were noted during shovel testing in the northern yard, although utilities and some filling have impacted some sections of the front yard. Sterile sand and rock, typically found to a depth of 0.3–0.4 ft below the ground surface, extended less than 10 ft from the cabin walls. Only this fill was supposed to be originally graded to remove post-1980s soils blocking cabin vents; however, bulldozing removed from 0.4 to 1.26 ft of soil (Figure 10). The eastern and much of the northern project area was already cleared and grading underway when the archaeologist arrived.

Results of Archaeological Laboratory Analysis

Excavation of Units 1, 2, and 3 yielded a total of 1,437 artifacts. An additional 87 objects were cataloged from various surface proveniences at Tannenbaum Historic Park (Stine and Selikoff 2000:Appendix C). The accessioning system used conformed to the procedures used by the Office of State Archaeology (OSA) in Raleigh (OSA 1995), since the OSA laboratory was the ultimate curation facility for the 1999 collection. The 2002 project yielded 479 artifacts from both surface and shovel test proveniences. The following only highlights the finds; complete details and inventories are found elsewhere (Stine and Adamson 2003; Stine and Selikoff 2000).

Two 1999 artifacts were prehistoric: an undecorated coil-made potsherd and a small rhyolite thinning flake. Wake Forest's previous work produced a small collection of prehistoric tools and related metavolcanic stone debris (Abbott 1984; Stine and Selikoff 2000:Appendix B). These items and the flake discovered in 1999 testing are typical of lithic scatters found across the Carolina piedmont. In 2002 shovel testing, eight quartz items were found, including a flake and a potentially utilized flake (Stine and Adamson 2003).

The 1,435 remaining artifacts found in 1999 are historic. The potential primary function of each of these items has been determined, following the pioneering work of South (1977:Table 4). Table 2 lists the relative frequencies of artifacts by functional group. Investigations in 2002 yielded a similar distribution of functional groups (Stine and Adamson 2003:14–19).

A perusal of Table 2 reveals that items related to architecture were the most abundant, not surprising at a site where so many additions, remodeling, and tearing down of additions has occurred. All the years of building, rebuilding, and destruction left a lot of rubble, asphalt, concrete, and other building materials. Nails, for example, were common. Of all identifiable nails, wire nails comprise the majority (n=185), followed by machined cut (n=94). The former type is common in the region by 1890, the latter by the 1830s (Stine and Selikoff 2000:95). Eighteenth-century wrought nails were not found in 1999 or 2002, but the Wake Forest inventory includes wrought nails (Stine and Selikoff 2000:Appendix B).

The historic ceramics found range in date of manufacture from the eighteenth through the twentieth centuries. The Mean Ceramic Date (following South 1977) for the 1999 unit assemblage has been calculated as 1810 (Stine and Selikoff 2000:Table 5). The majority of manufacturing

Table 2. Relative Artifact Percentages by Functional Group, 31GF413**.

Artifact Group	Count	Percentage
Kitchen	373	25.99
Architecture	973	67.80
Personal	8	0.56
Clothing	6	0.42
Furniture	4	0.28
Arms	3	0.21
Activities	24	1.67
Faunal	1	0.07
Fuel/By-products	14	0.98
Miscellaneous	29	2.02
Total	1,435	100.00

dates bracket the last two decades of the eighteenth century through the first three decades of the nineteenth century. The earliest recorded date of ceramic manufacture is for a fragment of hand-painted, polychrome overglazed porcelain, produced from ca. 1745–1795 with a mean date of 1770 (South 1977:210). The latest mean date of manufacture for an excavated ceramic is 1900 (decalcomania whiteware/ironstone, 1880–1920 [Majewski and O'Brien 1987:147]). The majority of ceramics from test unit excavations are varieties of pearlware, which was produced during the last two decades of the eighteenth century through the early decades of the nineteenth century.

The 1999 excavation ceramic assemblage compares favorably with the eighteenth- through twentieth-century artifact date range of the 1984 Wake Forest collection and the dates for the 19 ceramic artifacts found during shovel testing and grading in 2002 (Stine and Selikoff 2000; Stine and Adamson 2003). It confirms historic settlement on the knoll probably as early as the last quarter of the eighteenth century through the twentieth century. This date range was verified by other artifact classes.

Most importantly, the 2002 investigations found the first definite Revolutionary War-era military artifact, an all-purpose musket tool (Figure 12). It is unfortunate that it was uncovered by a bulldozer blade. A city surveyor spotted the artifact and, under the direction of the Park director, shot in the location of the find (Stine and Adamson 2003).

The potential of these archaeological deposits to shed light on the dates of site occupation and diachronic land-use, combined with Tannenbaum Historic Park's inclusion in the National Historic Landmark

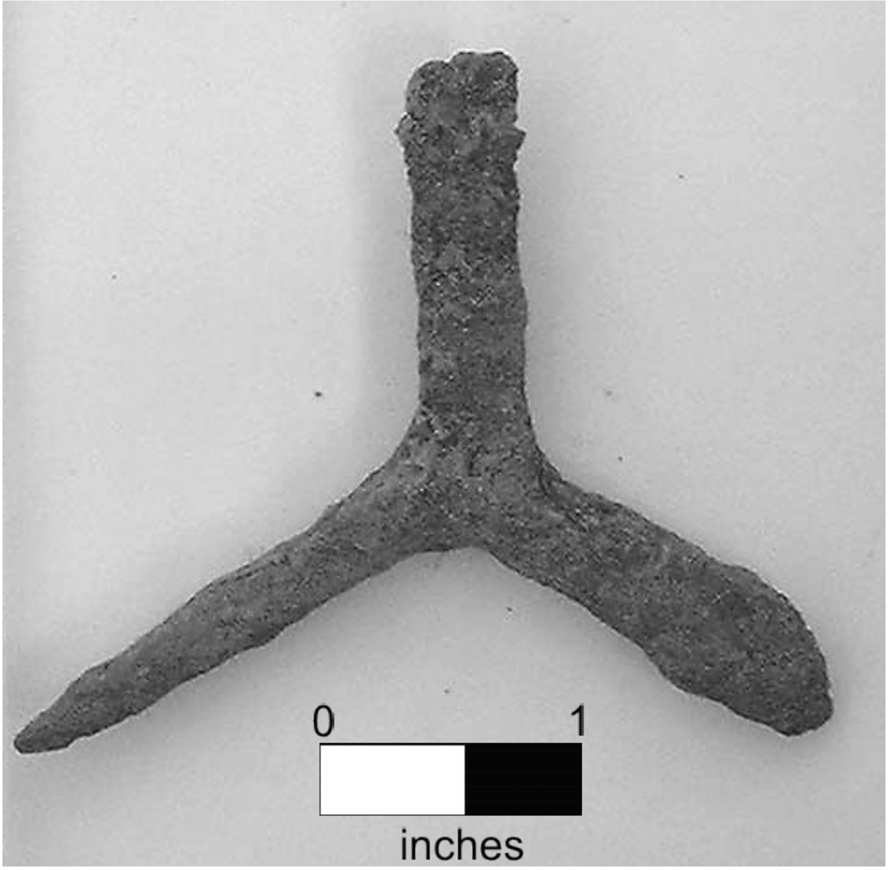

Figure 12. Musket tool found at the Hoskins House site. Courtesy of Harold Gunn, Tannenbaum Historic Park.

for the Battle of Guilford Courthouse, underlines the importance of protecting site 31GF413**. This was reiterated in a site protocol provided by UNCG archaeology to the Tannenbaum Historic Park (Stine 2000; see also Stine and Selikoff 2000).

The Hoskins' Farmstead

Historical archaeological research and GIS analysis at Tannenbaum Historic Park demonstrate changes in the historic landscape. The Hoskins cabin is sited on a knoll facing an historic road. Once, it was the location of a substantial eighteenth- and nineteenth-century farmstead. By the early twentieth-century the farm no longer encompassed the majority of the Hoskins family's initial holdings. The twentieth century saw the neighborhood develop into an increasingly urbanized residential area, and ultimately the core of the farmstead became a city park.

Dendrochronology results report an 1857 date for the chestnut logs of the extant Hoskins House (Heikkenen and Egan 2000). This may prove to be the case, although the report states "The year of best fit for the oak key-year pattern was highly significant when aligned with the area oak key-year pattern for the Chesapeake Bay" (Heikkenen and Egan 2000:abstract and p. 6). It is unknown if these data were checked against regional North Carolina sequences. On the other hand, Park service historians did report that in 1938 some Hoskins descendants stated that the extant cabin was the original Hoskins cabin built during the Colonial era. Other relatives believed that the original cabin had been taken down in the last two or three decades of the nineteenth century and that a new cabin was "erected on the same site" (as quoted in Hatch 1970:78).

Archaeological results do indicate an eighteenth- through mid-nineteenth-century farmstead presence on the knoll, continuing until the later decades of the twentieth century. Geographical and historical research results have revealed that portions of the site have seen major landscape alterations. Continuing multidisciplinary research, including an intensive shovel testing program, should reveal more details about the changing site settlement pattern over time.

Notes

[1] Software names are given not as an endorsement but to indicate the software used.

Acknowledgments. Archaeological and GIS research at Tannenbaum has been supported by the Tannenbuam-Sternburger Foundation, the Guilford Battleground Company, and Tannenbaum Historic Park, City of Greensboro, North Carolina. GIS research at Guilford Courthouse National Military Park has been sponsored by the National Park Service, Guilford Courthouse National Military Park. We would like to acknowledge the volunteers from UNCG, from Tannenbaum Historic Park, and from Guilford Courthouse National Military Park who participated in these projects. Past Guilford Courthouse National Military Park Superintendent Robert Vogel, and Tannenbaum Historic Park Director Adrienne Byrd have been steadfast in their support of this research.

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HORSES GRAZING: POINT FUNCTION AND SHAPE

by

Joel D. Gunn and Irwin Rovner

Abstract

The Horses Grazing site was located in the Sandhills near wetlands of the lower Little Crane Creek in eastern Moore County, North Carolina. It contained a full Holocene cultural sequence from Late Paleoindian-Early Archaic to Late Woodland. Of special interest is a component at the base of the cultural deposits that contains Big Sandy-Rowan projectile points. Rowan is one of at least three Big Sandy projectile point variants that occurs along the Atlantic Slope. We suggest that the variants may reflect a long-term northward movement of medium game hunters after the collapse of the megafauna ecology. They may have been following the northward movement of an isotherm associated with elk or bison. Forty-seven projectile points from the site provided limited samples of all of the usual types. A study of variation in the Guilford type indicated that they are scattered through the profile from Early Archaic to Early Woodland. Only the Guilford points with refined workmanship and round bases showed promise of being confined to the Middle Archaic. Projectile points were measured using an automated and bias-free system and analyzed to examine variations in outline shape. As has been found to be the case before, Palmer Corner-Notched and Kirk Corner-Notched were ambiguous in their distributions, but the Big Sandy variants were generally distinguishable.

Introduction

The Horses Grazing Site (31MR205) is located in eastern Moore County, North Carolina, northeast of Vass. It is on a sandy ridge that extends into wetlands along Little Crane Creek, a tributary of the Little River. The site was excavated during the winter of 2002–2003 under the sponsorship of the North Carolina Department of Transportation and in anticipation of rerouting Highway 1 from Sanford to Southern Pines around Cameron and Vass (Figure 1). More than 20,000 artifacts were recovered in 163 square meters. The assemblage included 47 mainly Archaic points, the primary topic of this article. This article is based on research initiated during the testing (Pertersen and Mohler 2002) and excavation (Gunn et al. 2003) of Horses Grazing, and has since been expanded by further analysis of artifacts and interpretations by the authors not presented in the technical reports.

Figure 1. Setting the datum at the Horses Grazing site (view to west).

Like many Sandhills sites, Horses Grazing initially veiled itself from archaeological eyes. In 1991, shovel testing during an early survey of the highway corridor produced only three rhyolite flakes (Lautzenheiser 1990). A subsequent visit by Robinson (1995) provided additional flakes. Finally, in 2001, after a decade, the site began to yield its secret. Excavation of a series of shovel tests at 20 meter spacing, and opening of six square meter units discovered both ceramic and Archaic horizons stratified to about 50 cm below the surface (NCDOT 2002; Petersen 2001; Petersen and Mohler 2002:105). Geochemical analysis of columns of sediment showed that there were phosphate residues from the Early Archaic and Woodland periods.

Benson (2000) explains the tentativeness of North Carolina Sandhills sites as a function of typical artifact density. As one follows artifact distributions in the Coastal Plain and Sandhills from Georgia to North Carolina, the overall site artifact densities tend to decline. One can excavate a 30-cm shovel test almost anywhere in a typical Georgia site and detect its presence; however, as one moves northeast through South and North Carolina, artifacts become clustered in concentrations frequently little more than a meter across. In a survey of the Fayetteville Outer Loop, this artifact density pattern presented itself in a powerful demonstration. Berry Williams, a surveyor for New South Associates, Inc., excavated a survey shovel test and was surprised to find nearly 100 flakes. Upon returning to test the site (31CD965), the excavation of two one-meter squares showed that the site consisted of over 700 artifacts from the working of a single rhyolite core within a meter of the original shovel test. If the lucky surveyor had placed his shovel test a meter away in any direction, he would have missed the site (Gunn and Sanborn 2002).

At the Horses Grazing site, Benson's pattern also held true. Before the excavations began, a grid was laid out over a 64,000 square meter area (16 acres). Over 150 square meters were excavated, mostly in 5 x 5 m blocks. One one-meter square had as few as a four artifacts. In the northwest part of the site, a pattern of shovel tests placed 10 m apart turned up a concentration of 40 quartz flakes. When excavated, it proved to have over 2,500 artifacts in a small area no larger than two meters in diameter. Along with the many quartz and rhyolite flakes were cores, tools, and evidence of a fire and the collecting of hickory nuts (Gunn et al. 2003).

In the following sections of this article, we will discuss the excavation and stratigraphy of the Horses Grazing site. Then, the projectile points that were found will be evaluated in their functional and morphological dimensions. In a previous issue of *North Carolina Archaeology*, Drye (1998) pointed out that the study of point typology in the region has developed beyond the early impressions of shape or morphological consistency that Coe (1964) thought to be the case in his pioneering work on point typology in the Piedmont. The overlapping of point types reported by Drye in her analysis of point shapes and stratigraphy at Lowder's Ferry suggested to us that point function might be a key factor in understanding point typology of shapes. Some shapes are better suited to certain functions than others.

About 50 projectile points were recovered from Horses Gazing. This is not a large number compared to the many points found at Doerschuk (Coe 1964) or Lowder's Ferry (Drye 1998). On the other hand, sites densely packed with artifacts are not always the best places to study artifact function. As the senior author and colleagues have pointed out in another article (Gunn et al. 2002), artifact-scarce sites often open up the relationships between artifact types. In a more open distribution of artifacts, associations can be made between different functional types such as points, scrapers, burins, gravers, and utilized flakes. Also, as we shall see, there are efficient morphological ways to classify artifacts by function within types.

Setting

A citizen of North Carolina whose family has resided in the state since Colonial times once reported to the senior author that highways numbered less than 100 were old Indian trails. While this has yet to be verified in writing, Brooks (personal communication 1998) has discovered that Paleoindian sites in South Carolina tend to occur around pocosins near present-day interstate highways. This suggests that our current road system has ancient roots. In Moore County, North Carolina, U.S. Highway 1 passes over the first continuous, elevated pathway along the Sandhills that avoids the quagmires of wetlands typical of the Coastal Plain. Moore and Irwin (2002) have detected associations between Sandhills ridges and Early Archaic base camp sites. How does Horses Grazing fit into this picture? It is on a sandy ridge extending east from U.S. Highway 1. This ridge would have been a side road extending out into the food-rich wetlands of the lower Little River basin. The discovery of fish and turtle remains in the site support this inference.

The sandy ridge-end on which the site is located provides other amenities besides a food supply (Figure 2). Underneath the sand cap is a clay-rich, impermeable layer that supports a perched water table. Seramur reports the details of this geology in another article in this volume. The combination of springs seeping out from under the sand at the waterline around the low side of the ridge, and the dry, comfortable sand cap on which to camp, would have been additional, necessary features of the location for ancient inhabitants. Also present downstream a few hundred yards is a large quartz quarry that was once commercially exploited (J. Barnes, personal communication 2003). Seventy-eight percent of the Horses Grazing assemblage was quartz chipping debris (n=16,338).

While surveying sites on the Fayetteville Outer Loop, it became apparent that prehistoric people preferred to camp at places that were neither too steep nor too flat. This was probably because flat places would have been seasonal wetlands, even on the tops of hills, and steep places have obvious liabilities for living comforts (Gunn and Sanborn 2002). Examination of the microtopography of the Horses Grazing ridge revealed two areas that were likely resting places for the site's residents. One is on the ridge top (Ridge), and the other is on the north slope just above the spring (Platform). In these areas, the slope is about 2–4 degrees. The south side of the hill seems not to have been inhabited in spite of the presence of an inviting spring at the base of the moderate slope. This is probably because the southwest side of the hill was exposed to winds as is evidenced by a hollowed out area (Blowout).

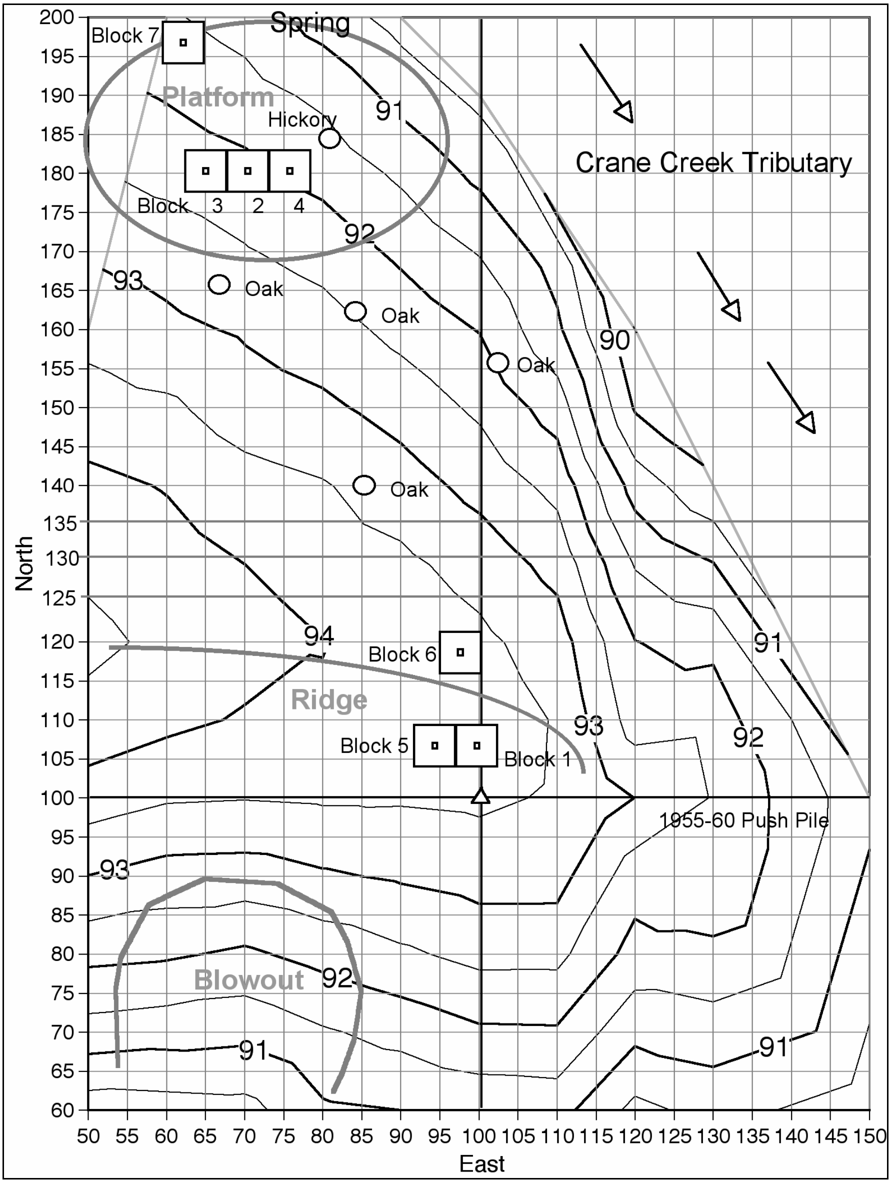

Figure 2. Contour map of the Horses Grazing site.

Excavating Horses Grazing

The excavation of Horses Grazing proceeded in six five-meter blocks (see Figure 2). The blocks were distributed to provide equal sampling of the two occupation-favorable areas of slope (i.e., three blocks in each). Additional microtopographic parameters were considered in the placement of the blocks within the Ridge and Platform areas. The design was intended to test a feedback relationship between the natural slope, or angle of repose, and human occupation. It became clear that human occupation tended to reduce slope angle by retarding wind, water, and human-induced erosion, and by introducing sediments in the form of lithic and food debris. The vertical geochemical characterization of the site begun by Petersen and Mohler was extended into a horizontal grid by taking samples in the southwest corner of each one meter square at the depth of greatest artifact concentration in each block (NCDOT 2002; Petersen 2001; Petersen and Mohler 2002).

Analysis of artifacts showed that the Ridge was most intensively occupied (Table 1). It produced 10,701 artifacts in the three complete blocks. Three blocks on the Platform returned 7,879 artifacts. However, keeping in mind Benson's pattern, the block on the Platform that produced the most artifacts, Block 7 (n=4,167), was of comparable scope to Block 5 (n=4,553) on the Ridge. The blocks that encountered concentrations produced nearly equal volumes of artifacts. The numbers of ceramics were not great; 115 were identifiable to ware and were concentrated in Blocks 1 and 4. They were generally confined to the upper 20–30 cm of the profile. Below ceramics were Archaic-age horizons. Only two Woodland stage points were found, a Pee Dee Pentagonal and an Eared Yadkin. Forty-five Archaic points were recovered from all periods. Judging by the stratigraphy, the proportion of Woodland-to-Archaic artifacts probably does not reflect the amount of activity in the two periods. The feedback between human occupation and slope diminishment was much more intense in the Woodland than in the Archaic. A high degree of Woodland activity is not unreasonable given that the Cameron Mound (Irwin et al. 1999; MacCauley 1966) is only about three kilometers to the east. This accretional mound with Hopewell-like artifacts such as copper beads suggests that there was some amount of organization of human labor in exploitation of the eastern Moore County wetlands during the Woodland. Local tradition holds that an important Native American trail, later the Yadkin Road and plank road passed through the Little River

Table 1. Prehistoric Artifact Types by Block and Landform.

Artifact Types	Blk. 1 Ridge	Blk. 5 Ridge	Blk. 6 Ridge	Blk. 9 Ridge	Blk. 2 Platform	Blk. 3 Platform
Cape Fear Series	16	7	1	3	11	0
Hanover Series	10	1	0	0	1	0
New River Series	1	3	0	0	2	0
Thom's Creek	0	0	0	0	1	0
Yadkin Series	1	1	3	0	0	0
UID Sherd	14	0	0	0	3	0
Daub	3	0	0	0	0	0
Ceramics Subtotal	45	12	4	3	18	0
Percent	32	9	3	2	13	0
Big Sandy	4	1	1	0	0	0
Eared Yadkin	1	0	0	0	0	0
Guilford Crude Round	0	1	0	0	1	0
Guilford Crude Straight	0	2	0	0	1	1
Guilford Refined Round	0	0	0	0	0	0
Guilford Refined Straight	1	0	0	0	0	0
Kirk Corner Notched	1	0	0	0	0	0
Kirk Knife	0	0	0	0	0	1
Kirk Serrated	1	0	0	0	0	0
Morrow Mountain	3	1	0	2	2	0
Pee Dee Triangular	0	1	0	0	0	0
Savannah River	1	3	0	1	1	0
Savannah River Small	1	1	0	0	0	0
Stanly	0	0	0	1	0	0
Point Subtotal	13	10	1	4	5	2
Percent	28	21	2	9	11	4
Base	2	1	1	0	0	1
Mid	2	0	0	0	0	0
Tip	6	0	1	0	2	0
Tip Knife	0	2	0	0	0	0
Tip Projectile	0	1	0	0	1	0
Point Fragment Subtotal	10	4	2	0	3	1
Percent	45	18	9	0	14	5
Burin	0	0	0	1	0	0
Burin Dihedral	0	0	1	0	0	0
Burin Spall	0	0	0	0	0	0
Drill Shaft	0	0	0	0	0	0
Flake Retouched	6	5	12	7	6	5
Flake Tertiary Utilized	5	9	6	3	3	4
Graver-Notch-Scraper	0	0	0	0	0	0
Hammerstone	8	7	1	0	0	1
Morrow Mountain Drill	0	0	0	0	0	0
Notch	2	0	2	0	2	0
Scraper	14	4	3	2	8	2
Scraper Circular	0	0	0	0	1	0

Table 1 continued.

Artifact Types	Blk. 1 Ridge	Blk. 5 Ridge	Blk. 6 Ridge	Blk. 9 Ridge	Blk. 2 Platform	Blk. 3 Platform
Scraper End	0	0	1	0	0	0
Scraper End Palaeoindian	0	0	0	0	0	1
Scraper End/Side	0	0	1	1	0	0
Scraper Paleoindian Fluted	0	0	1	0	0	0
Scraper Side	2	0	1	0	0	0
Tool Subtotal	37	25	29	14	20	13
Percent	15	10	12	6	8	5
Biface	1	0	2	0	1	1
Biface Frag	17	16	10	7	5	9
Chopper	0	1	1	0	1	0
Core Bifacial	0	0	0	0	0	0
Flake Bifacing	346	826	100	136	309	58
Flake Bifacing Burned	0	0	0	0	8	0
Biface Flaking Subtotal	364	843	113	143	324	68
Percent	11	26	3	4	10	2
Blade	1	0	0	0	0	0
Blade Flake	2	1	0	1	1	0
Core	18	29	40	6	10	5
Core Frag	14	0	6	2	2	1
Core Frag Burned	0	1	0	0	0	0
Core Micro	0	0	0	0	0	1
Core Micro Prismatic Blade	0	0	0	0	1	0
Core Prismatic	0	1	0	0	0	0
Core Rejuvenation Flake	0	2	0	0	0	1
Flake Primary	0	8	3	0	1	1
Flake Primary Utilized	0	0	0	0	0	0
Flake Secondary	22	20	3	4	15	6
Flake Secondary Burned	0	0	0	0	1	0
Flake Secondary Retouched	1	0	0	0	0	0
Flake Tertiary	775	843	629	289	576	646
Flake Tertiary Burned	0	1	0	0	14	0
Flake Tertiary Retouched	2	2	0	1	0	0
Shatter/Chunk	778	902	356	197	223	281
Core Flaking Subtotal	1,613	1,810	1,037	500	844	942
Percent	16	18	10	5	8	9
Fire Cracked Rock	314	71	3	99	48	11
Iron Concretion	264	162	112	58	12	10
Iron Concretion Burned	1	0	0	1	2	1
Unmodified Stone	993	1,614	1,183	190	227	119
Boiling Stone Subtotal	1,572	1,847	1,298	348	289	141
Percent	23	27	19	5	4	2
Diabase Fragment	1	0	0	0	0	0
Granite	1	0	0	0	0	0
Petrified Wood	2	0	0	0	0	0

Table 1 continued.

Artifact Types	Blk. 1 Ridge	Blk. 5 Ridge	Blk. 6 Ridge	Blk. 9 Ridge	Blk. 2 Platform	Blk. 3 Platform
Red Ochre	0	0	0	0	0	0
Bone	0	1	0	0	0	0
Charcoal Fragments	4	0	0	0	0	0
Fish Scale	1	0	0	0	0	0
Turtle Shell	1	0	0	0	0	0
Total	3,664	4,553	2,484	1,012	1,505	1,167
Percent	17	22	12	5	7	6

Table 1 continued.

Artifact Types	Blk. 4 Platform	Blk. 7 Platform	Blk. 8 Platform	STP Platform	Total
Cape Fear Series	26	2	0	0	66
Hanover Series	5	0	0	0	17
New River Series	0	0	0	0	6
Thom's Creek	0	0	0	0	1
Yadkin Series	18	2	0	0	25
UID Sherd	4	0	0	0	21
Daub	0	0	0	0	3
Ceramics Subtotal	53	4	0	0	139
Percent	38	3	0	0	
Big Sandy	0	0	0	0	6
Eared Yadkin	0	0	0	0	1
Guilford Crude Round	1	1	0	0	4
Guilford Crude Straight	0	0	1	0	5
Guilford Refined Round	2	0	0	0	2
Guilford Refined Straight	0	2	1	0	4
Kirk Corner Notched	0	0	0	0	1
Kirk Knife	0	0	0	0	1
Kirk Serrated	0	1	0	0	2
Morrow Mountain	0	2	0	0	10
Pee Dee Triangular	0	0	0	0	1
Savannah River	0	0	0	0	6
Savannah River Small	0	0	0	0	2
Stanly	1	0	0	0	2
Point Subtotal	4	6	2	0	47
Percent	9	13	4	0	
Base	0	0	0	0	5

Table 1 continued.

Artifact Types	Blk. 4 Platform	Blk. 7 Platform	Blk. 8 Platform	STP Platform	Total
Mid	0	0	0	0	2
Tip	0	2	0	0	11
Tip Knife	0	0	0	0	2
Tip Projectile	0	0	0	0	2
Point Fragment Subtotal	0	2	0	0	22
Percent	0	9	0	0	
Burin	1	0	0	0	2
Burin Dihedral	0	0	0	0	1
Burin Spall	0	3	0	0	3
Drill Shaft	1	0	0	0	1
Flake Retouched	3	34	5	1	84
Flake Tertiary Utilized	10	16	2	0	58
Graver-Notch-Scraper	0	1	0	0	1
Hammerstone	0	1	0	0	18
Morrow Mountain Drill	0	1	0	0	1
Notch	0	2	1	0	9
Scraper	5	11	0	1	50
Scraper Circular	0	0	0	0	1
Scraper End	0	0	0	0	1
Scraper End Palaeoindian	0	1	0	0	2
Scraper End/Side	0	1	0	0	3
Scraper Paleoindian Fluted	0	0	0	0	1
Scraper Side	0	4	0	0	7
Tool Subtotal	20	75	8	2	243
Percent	8	31	3	1	
Biface	2	0	0	0	7
Biface Frag	10	28	4	0	106
Chopper	0	0	0	0	3
Core Bifacial	0	1	0	0	1
Flake Bifacing	637	665	36	13	3,126
Flake Bifacing Burned	0	0	0	0	8
Biface Flaking Subtotal	649	694	40	13	3,251
Percent	20	21	1	0	
Blade	0	0	0	0	1
Blade Flake	0	3	0	0	8
Core	27	31	0	2	168
Core Frag	0	13	1	0	39
Core Frag Burned	0	0	0	0	1
Core Micro	0	1	0	0	2
Core Micro Prismatic Blade	0	0	0	0	1
Core Prismatic	0	0	0	0	1
Core Rejuvenation Flake	0	1	0	0	4
Flake Primary	18	3	1	0	35
Flake Primary Utilized	0	1	0	0	1

Table 1 continued.

Artifact Types	Blk. 4 Platform	Blk. 7 Platform	Blk. 8 Platform	STP Platform	Total
Flake Secondary	12	12	6	1	101
Flake Secondary Burned	0	0	0	0	1
Flake Secondary Retouched	1	1	0	0	3
Flake Tertiary	271	2,295	94	26	6,444
Flake Tertiary Burned	7	1	0	0	23
Flake Tertiary Retouched	0	5	1	1	12
Shatter/Chunk	325	383	9	18	3,472
Core Flaking Subtotal	661	2,750	112	48	10,317
Percent	6	27	1	0	
Fire Cracked Rock	26	28	7	0	607
Iron Concretion	48	51	1	0	718
Iron Concretion Burned	1	0	0	0	6
Unmodified Stone	743	459	30	1	5,559
Boiling Stone Subtotal	818	538	38	1	6,890
Percent	12	8	1	0	
Diabase Frag	0	0	0	0	1
Granite	0	0	0	0	1
Petrified Wood	0	0	0	0	2
Red Ochre	0	1	0	0	1
Bone	0	0	0	0	1
Charcoal Fragments	0	43	0	0	47
Fish Scale	0	0	0	0	1
Turtle Shell	0	0	0	0	1
Total	2,207	4,167	200	64	20,964
Percent	11	20	1	0	

basin between the Cape Fear and the Yadkin-Pee Dee rivers (Oates 1981). This could account for some of the traffic through the area.

Occupation at Horses Grazing began in the Late Pleistocene (13,000–10,000 B.P.) or Early Holocene (10,000–8,000 B.P.). Six of the points were of a Big Sandy variety defined by Cooper (1970) as Rowan. Big Sandy is a side-notched point that was defined west of the Appalachians where it has a wide morphological variation (Lewis and Lewis 1961). At Stanfield-Worley Rock Shelter (Futato 1996) and Dust Cave (Driskell 1996), it appears immediately after Dalton and has a tool kit of scrapers, burins, gravers, and prismatic blades identical to Dalton. Along the Atlantic Slope, three variants have been recognized. In South Carolina south of the Santee River, the Taylor type is identified (Charles 2003; Michie 1971; 1996). At the Big Pine Tree site (38AL143) in Allendale

County, Taylors are stratified with or above Dalton, and at the Topper site (38AL23) they occur directly over Clovis (Goodyear 2001, 2003). North of the Santee River the Rowan variant is found through the Sandhills from the upper Pee Dee River (Charles 2003) to the southern tier of counties in Virginia where it has a distinctly "intrusive" cultural character (McAvoy and McAvoy 1997:183). Cooper (1970) used Rowan projectile points from Granville County in his type description (specimens B, C, D, and F). McAvoy (personal communication 2003) believes that Granville and Wake counties may be the area of greatest concentration of Rowan points. Cooper's specimens A and E are from Rowan County in the upper Piedmont. Robinson (personal communication 2003) has also found Rowan points in the upper Yadkin River drainage in the Wake Forest University Museum collections. As will be discussed in the section on point morphology, Rowan points are frequently classified as Kirk Corner-Notched in North Carolina sites, as Cooper pointed out in his type definition. Along the Nottaway River in Virginia, the Rowan variant is replaced by, or slightly overlaps with, Fort Nottaway side-notched (McAvoy and McAvoy 1997:183). Like the Taylor and Big Sandy points, Fort Nottaway is associated with a Dalton-like tool kit, but unlike those types, Fort Nottaway points have been dated to after Kirk at about 8,900–8,800 B.P (McAvoy and McAvoy 1997:183).

The dating of Rowan is in question as no precise dates were found at Horses Grazing or any other excavated site. An interesting question is whether Rowan in North Carolina dates before Kirk as in South Carolina or after Kirk as in Virginia. Evidence from Horses Grazing may indicate before. On a site-wide basis, there are no distinct stratigraphic transitions from Rowan to Kirk (Table 2), which is to say they do not occur in the same Blocks. Correlating depths across blocks is a problem since the deepest levels in Block 6 are shallower than those in Block 5. However, the Rowan specimen that is most clearly in place is in Block 6, and it is associated with Paleoindian tools, while the Kirk specimens in Blocks 3 and 7 appear to be more closely allied with the Morrow Mountain strata. Daniel (2002:8) has obtained a date of 8,940 ± 70 on a level under Kirk at Barber Creek. No diagnostics have yet appeared from the level, but future developments should prove of value to the question of Rowan dating.

At the Taylor Site, Michie (1996:243) notes that the early components tend to be scattered over the entire 35 acres of the site while later ones are concentrated in distinct loci. Though a much smaller site (16 acres), Horses Grazing has a similar pattern. All of the Rowan points were found in Blocks 1 and 5 on the Ridge. Other tools characteristic of Paleoindian, however, were found in a thin but uniform distribution through all of the

Table 2. Sitewide Transition Matrix Analysis of Temporally Diagnostic Artifacts.

Period	Point	1	2	3	4	5	6	7	8	9	Total	Error	%Error
Paleo	1-Paleo	7	4	0	0	1	1	0	0	0	13	2	1.8
	2-Rowan	0	0	3	0	0	1	0	0	0	4	1	0.9
	3-Kirk	0	0	0	1	2	1	0	0	0	4	3	2.7
Archaic	4-Stanly	0	0	0	0	1	0	0	0	0	1	0	0.0
	5-MMtn	0	0	0	0	7	3	1	0	0	11	1	0.9
	6-Guilford	2	0	0	0	0	8	3	1	1	15	4	3.6
	7-Sav-Tc[a]	0	0	0	0	0	0	3	3	1	7	1	0.9
Ceramic	8-NR-CF-Arrow[b]	0	0	0	0	0	0	0	13	4	17	0	0.0
	9-Han-Arrow[c]	4	0	1	0	0	0	0	0	34	39	5	4.5
	Total										111	17	15.3

Key:

- Yellow: Transition to Same Period
- Orange: Transition to Expected Period
- Light green: Out of place (low)
- Light blue: Out of place (high)

a Savannah River-Thom's Creek
b New River-Cape Fear-Eared Yadkin
c Hanover-PeeDee Pentagonal

blocks both on the Ridge and Platform. They include formal scrapers, burins, gravers, and prismatic blade technology. One of the characteristics of the Fort Nottaway point is fluting of one side to thin the base. A biface fluted on one side was found with the Block 6 Rowan occupation. Does this suggest a linear connection with Fort Nottaway?

One would gather from Drye's analysis of point morphology distributions at the Lowder's Ferry site that the early Holocene/Early Archaic points are relatively discrete types. As the sequence progressed into Morrow Mountain, Guilford, and Savannah River, the discreteness is muddied by inter-stratification of types. This may be due to the types being used at the same time for different functions, or it may be the result of resharpening. Resharpening of Morrow Mountain or Savannah River points, for example, could yield so-called Guilfords. Guilfords are the natural catchall category for anything from "gray-area" preforms to well-worked bifaces. Both Coe (1964:43) and Drye (1998:57) point out that there is internal variation within the type that includes straight and round bases. In the Horses Grazing analysis, this shape inventory was extended

Table 3. Temporal Diagnostics for Transitional Probability Analysis.

		Depth cmbs Top									
Chronology	Type	15	20	25	30	35	40	45	50	55	Total
1	Burin	0	0	1	0	0	0	0	1	0	2
1	Burin Dihedral	0	1	0	0	0	0	0	0	0	1
1	Burin Spall	0	0	1	0	1	1	0	0	0	3
1	Core Micro	0	0	0	0	1	1	0	0	0	2
1	Core Micro Prismatic Blade	0	0	0	1	0	0	0	0	0	1
1	Core Prismatic	0	1	0	0	0	0	0	0	0	1
1	Scraper End Paleoindian	0	0	0	0	0	1	0	0	0	1
1	Scraper End Plaeoindian	0	0	0	0	0	0	0	1	0	1
1	Scraper Paleoindian Fluted	0	0	0	0	0	1	0	0	0	1
2	Rowan	0	1	1	0	1	1	0	0	0	4
3	Kirk Coner Notched	1	0	0	0	0	0	0	0	0	1
3	Kirk Knife	0	0	0	0	0	1	0	0	0	1
3	Kirk Serrated	0	0	1	0	1	0	0	0	0	2
4	Stanly	0	0	1	0	0	0	0	0	0	1
5	Morrow Mountain	3	0	2	2	3	0	0	0	0	10
5	Morrow Mountain Drill	0	0	0	0	1	0	0	0	0	1
6	Guilford Crude Round	0	1	1	1	0	1	1	0	0	5
6	Guilford Crude Straight	0	2	1	0	1	0	0	0	1	5
6	Guilford Refined Round	0	0	0	0	2	0	0	0	0	2
6	Guilford Refined Straight	0	1	1	0	1	0	0	0	0	3
7	Savannah River	2	1	2	0	1	0	0	0	0	6
7	Savannah River Small	0	1	0	0	0	0	0	0	0	1
8	Eared Yadkin	0	1	0	0	0	0	0	0	0	1
8	New River Cord 1	1	0	0	0	0	0	0	0	0	1
8	New River Fabric 2	1	0	0	0	0	0	0	0	0	1
8	New River Punc	0	1	0	0	0	0	0	0	0	1
8	Thom's Creek Plain	0	0	1	0	0	0	0	0	0	1
8	Yadkin Cord 1	0	1	0	0	0	0	0	0	0	1
8	Yadkin Cord 1 Amphiblolite	0	0	1	0	0	0	0	0	0	1
8	Yadkin Cord 1 Quartz	1	0	0	0	0	0	0	0	0	1
8	Yadkin Cord 4	0	1	0	0	0	0	0	0	0	1
8	Yadkin Fabric 2 Granite	1	1	0	0	0	0	0	0	0	2
8	Yadkin Fabric 4 Granite	1	0	2	0	0	0	0	0	0	3
8	Yadkin Granite	2	0	0	1	0	0	0	0	0	3
9	Cape Fear	0	2	0	1	1	0	0	0	0	4
9	Cape Fear Cord 1	2	0	1	1	0	0	0	0	0	4
9	Cape Fear Cord 2	6	1	1	0	0	0	0	0	0	8
9	Cape Fear Fabric 2	0	0	0	1	0	0	0	0	0	1
9	Cape Fear Fabric 4	4	4	3	0	0	0	0	0	1	12
9	Cape Fear Fabric 5	1	0	0	0	0	0	0	0	0	1
9	Hanover Fabric 2 Grog	0	1	0	1	0	0	0	0	0	2
9	Hanover Fabric 4 Grog	2	0	0	0	0	0	0	0	0	2

Table 3 continued.

Chronology	Type	15	20	25	30	35	40	45	50	55	Total
		Depth cmbs Top									
9	Hanover Fabric 4 Sand	1	0	0	0	0	0	0	0	0	1
9	Hanover Grog	1	1	0	0	0	0	0	0	0	2
9	Hanover Plain Grog	0	0	0	1	0	0	0	0	0	1
9	Pee Dee Triangular	0	1	0	0	0	0	0	0	0	1
	Total	30	24	21	10	14	7	1	2	2	111

- Main Focus
- Outliers

by including the straight and round base distinctions along with crude and refined workmanship. Fifteen Guilfords *senso lato* were recovered (Table 3). Of these, only the Guilford refined straight base was confined to a single depth horizon at a Middle Archaic depth. The other varieties (Guilford refined straight base, Guilford crude straight or round base) occurred from Early Archaic to Early Woodland levels. As is normal with small samples, the findings yield a relatively qualitative result—that is, they are hypotheses for further research.

There is evidence that the Middle Archaic was an active time at Horses Grazing. The largest number of points (n=10) is of the Morrow Mountain type. Kirk, Stanly, and Savannah River comprise lesser proportions of the assemblage. The Guilford evidence was inconclusive from a projectile point perspective as discussed above. However, the only visible evidence of stratigraphy in the entire site was a dark stain in Block 7 between 35–40 cmbs. It was about two meters across and appeared to be at the same horizon as the large accumulation of lithics in the northwest corner of the bock mentioned earlier. The lithics were associated with a Guilford refined straight base. Guilford points of other varieties appeared above and below the stain. Geochemical and archaeobotanical analyses did not reveal anything special about the stain. It may have been a Guilford living floor with human activity increasing the organic content. Though short of diagnostics, the associated high concentration of artifacts, and the similarly positioned highest vertical concentration of artifacts across the site, imply an intense but ill-marked period of activity during the Guilford and/or Morrow Mountain periods. A similar period of intense activity has been identified at other sites such as Lowder's Ferry (Drye 1998).

Organizing Points by Functions

Tool function is perhaps the oldest topic of conversation in archaeology. It was taken for granted in early archaeological writings of the nineteenth century. In the mid-twentieth century, such categories were questioned for a time, only to be reinstated by intensive new forms of analysis pioneered by Semenov (1973) and Keeley (1980). While extremely convincing when carried out in the context of double-blind experiments, these techniques required extensive experimental replication and analysis of artifact surfaces at time-consuming high microscopic resolution.

Under the demands of analyzing large numbers of artifacts in constrained time windows, the possibility of being able to detect artifact function through morphology has been of interest to us for the last few years. While we do not adhere to the belief that tools can be satisfactorily analyzed in broad categories simply as projectile points and scrapers, we do think that careful attention to form and breakage add sufficient detail to subdivide gross artifact forms into narrower and more realistic functional types, though not as narrow as the high-resolution microscopic/replicative analyses. Macroscopic and low-resolution microscopic wear analysis can also be both efficient and helpful. When this neotypology is supplemented with materials and spatial distributions, both within and between sites, it often becomes clear what the makers and users of prehistoric tools intended to do with them. The methodology allows the practical archaeologist to take advantage of many insights gained from intensive replicative wear studies, such as those performed by Keeley, but at the same time process a large array of artifacts in a timely manner.

Points have given the most direct access to this technique. Differences in haft length are evident in Archaic points, and they are frequently either directly or indirectly the subject of analysis. The evidence suggests that points were carefully engineered to serve at least two purposes. It is well understood that so-called “projectile points” served as both projectile points and knives, so much so that the acronym PPK, projectile point-knife, is commonly applied. Hence, there are points as a class, and subclasses of points can be either projectile points or knife points. (Are there other such classes?)

If one examines the tips of unbroken points, it becomes readily evident which is which. Some have carefully prepared, sharp tips. These would be projectile points. Others have round, blunt, unprepared tips that certainly could not penetrate a hide and are likely candidates for knives.

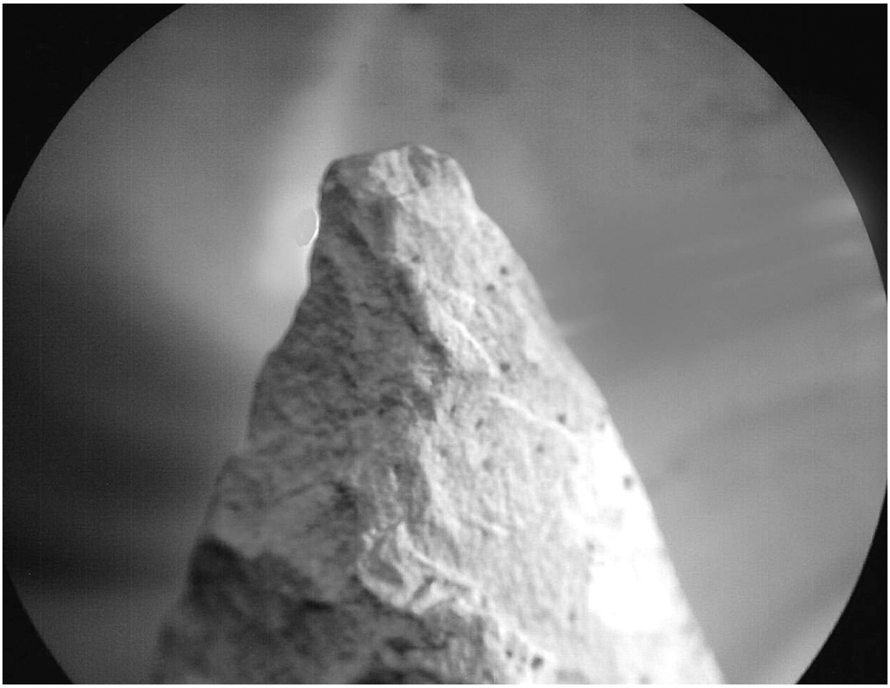

Figure 3. Microphotograph of a Rowan shafted tip (specimen #830).

Examples can be seen in the points that Cooper (1970) used as a type collection for the Rowan type. Of the six points, the upper three have round and blunt tips. If attached to atlatl shaft and propelled toward a thick-skinned animal, they would have bounced off rather than penetrated. The lower three points bear sharp tips. Sharp-tipped specimens dominated the Rowan assemblage at Horses Grazing. A microphotograph of a Rowan tip (Figure 3) shows that the tip was carefully prepared by the removal of nearly-microscopic pressure flakes from either side. The tip was then slightly ground. It is a well-known technique among flint knappers that slight grinding of a sharp edge reduces the likelihood of the edge shattering on impact. At Horses Grazing, these sharp, or shafted we will say, tips appear in subsequent generations of points such as Stanly, Morrow Mountain, and Pee Dee. The continuation of the shafted tip technique through the whole of the Holocene underscores its great utility in the preparation of projectile point tips. One of the benefits of this analysis is that point tips, which are frequently found in sites, can enter the analysis on an equal footing with whole points.

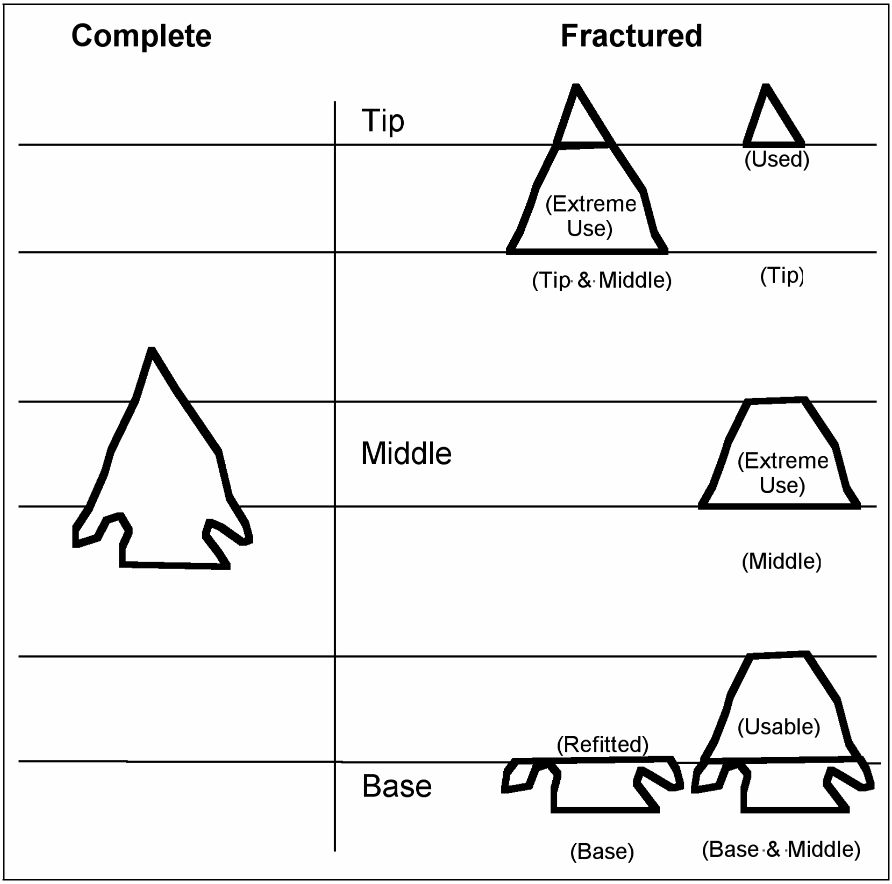

Figure 4. Point breakage classification.

This sort of analysis of tips can be extended to the middle and base segments of points. Are the edges of the mid section blunted or backed, or are they sharp and serrated? Did frequent resharpening lead to beveling? As with tips, breakage simply adds more information rather than removing a point from analytical consideration. We assume that if the tip of a point is broken, it occurred during impact, usually detectable by characteristic impact fractures or by light knife work (Figure 4). If a mid section is found, it suggests that the point continued in knife-use after the tip was broken in a situation ill-suited for rehafting. This could be during the immediacy of butchery away from base camp. It also implies extremely vigorous use of the remnant point. If a haft is found, it suggests the more

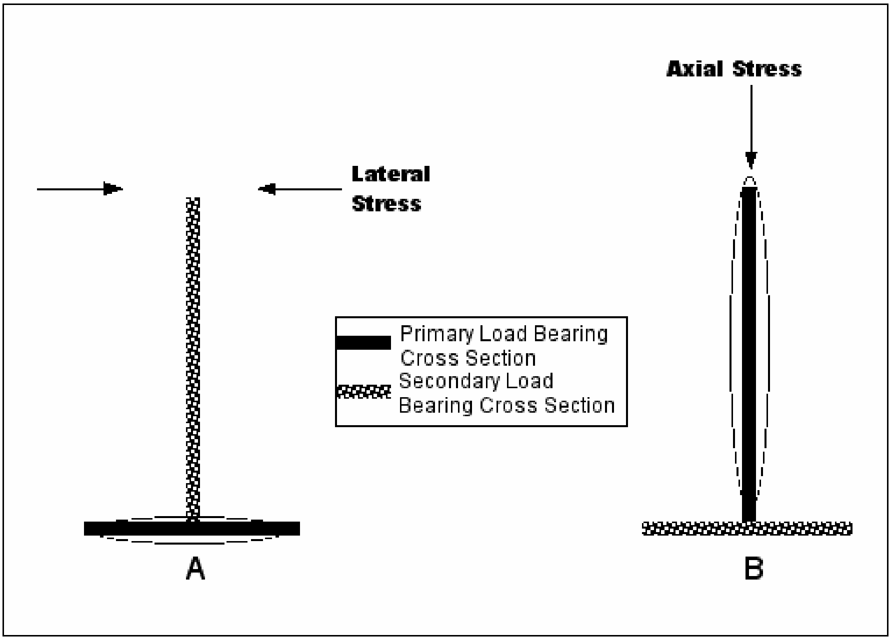

Figure 5. Load model of point function (adapted from Gunn and Kerr 1984:136).

relaxed conditions such as a base camp where time allowed implements to be re-hafted at leisure.

A load model helps to visualize the interaction of form, breakage, and refabrication. The knife and projectile functions impose different kinds of stresses on points. In terms of the stress borne in use, a projectile point receives end-on or axial stress upon impact (Figure 5). It must be designed to absorb that stress and disperse it to its haft—a spear or dart—in a manner that does not weaken or destroy the haft (Gunn and Brown 1982:245; Gunn and Kerr 1984:136). The common solutions to this problem included making the base relatively wide, and blunting the basal edge with grinding. Interestingly, basal grinding occurs in all periods at Horses Grazing, although it is less frequent in the latter periods. Undoubtedly plastic glues were also applied to disperse energy. Steve Watts (personal communication 1995) believes that a similar effect was achieved with Morrow Mountain points by melting or “shrink wrapping” them into cane hafts.

A knife point bears a different kind of stress. Most of the pressure it receives arises from sideways or lateral pressure during cutting. This lateral stress tends to twist the point in the haft. Managing this stress was approached through lengthening the haft. This could be accomplished by adding a stem to the base of a point, or by extending the notches up the sides of the point. The stem or side notches would be bound inside or supported by more flexible material such as wood or bone, which also served as a handle.

The study of notches and stems is always a fulcrum of controversy in point classification. This is evident in Daniel's (1998:60) discussion of the Palmer and Kirk points. He reports that Palmers and Kirks are distinguished at the Research Laboratories of Archaeology at UNC by plotting the tang length, the distance from the base to the top of the notches, against the tang width, the distance across the notches. In this distribution, the Palmer and Kirk types overlap in a subtle gradation (Figure 6). The whole corner-notch and side-notch problem can be thought of as a gradation in which the notches rotate around the corners of the base from corner to side (Gunn and Prewitt 1974). For that matter, stems can be thought of as large corner notches. The tang length also defines the length of the base or, in terms of physical mechanics, the load arm of the knife. In the case of the Palmer, the load arm is very short, leading one to suspect that it is a projectile point. In the case of Kirk, the load arm is longer, suggesting that it is a knife. For Big Sandy and its variants, this model can be extended by thinking of the load arm as reaching further up the blade. This is accomplished by chipping longer notches up the side of the blade. As can be seen in Figure 6, the effect of the broad Big Sandy-Rowan notches is to move their distribution to the right of Kirk on the plot. The next question is, why would a point that has obvious qualities of a projectile such as shafted tips, have such a long load arm?

For people on the move, as the Early Holocene Paleoindian and Early Archaic point manufacturers, a priority would have been to reduce the number of implements they were required to carry, the so–called "curated" technology (Goodyear 1989). This could have been accomplished by broadening the function of points to both knife and projectile capabilities. The Big Sandy and Stanly points at Horses Grazing have a combination of sharp tips and long hafts, one by long side notches and the other by adding a stem. There is an interesting morphological difference between the Big Sandy-Taylor points of southern South Carolina and the Rowan points. As can be seen in Figure 6, the Taylors plot in stem length among the shorter notched Kirks. The Big Sandy points from Horses Grazing, and especially the Swamp site (31CD876) specimen, plot well beyond Kirks. Can this be taken to imply that the Rowans were made for a more mobile situation? Perhaps the Fayetteville area of the Sandhills was traveled into as a

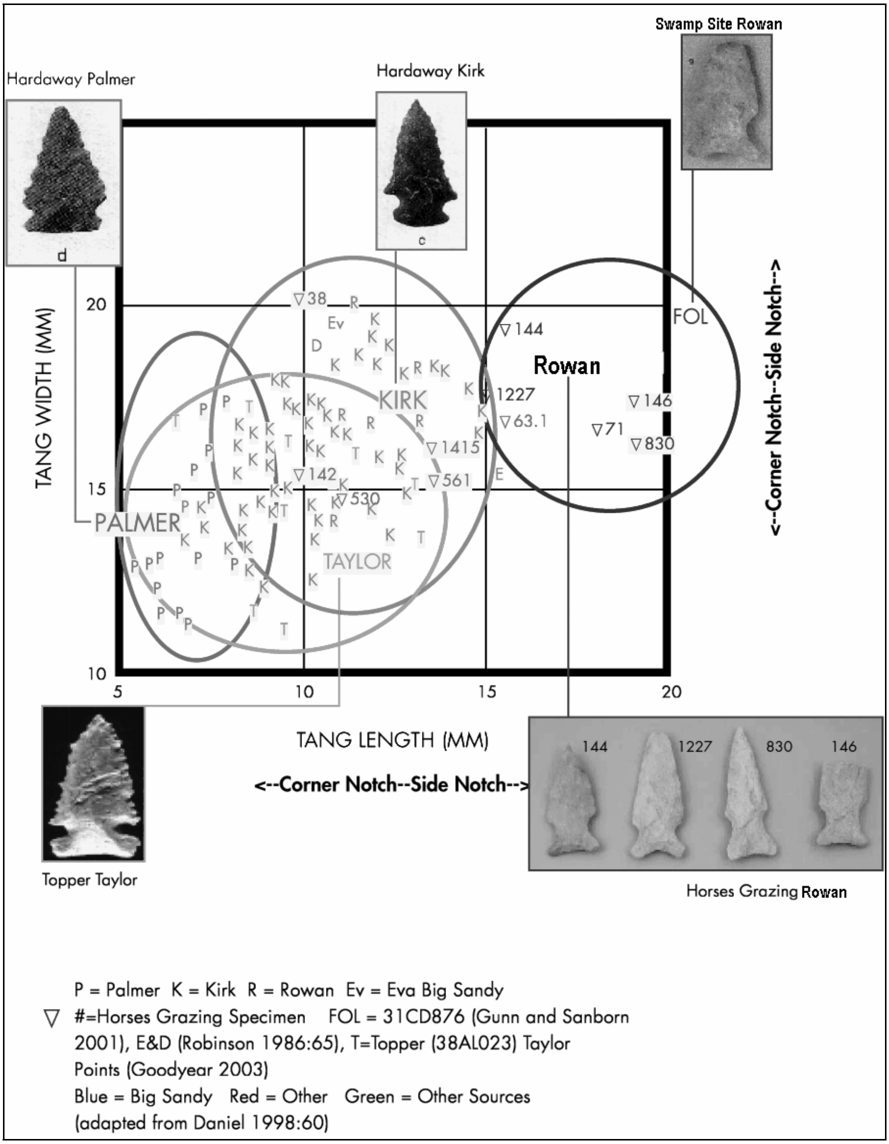

Figure 6. Tang length-width for notched points (adapted from Daniel 1998:60).

hunting ground rather than inhabited on a permanent basis. If such were the case, the makers of Taylor and Rowan points could have been the same people. They were just equipped for long-distance travel when they came to the Fayetteville-area Sandhills with their combination projectile-knife points. An alternative model would have been that they traveled from the Piedmont. This seems more likely as the animal migrations patterns would have shifted from north–south in the Pleistocene (glacier to southern coasts) to east–west (mountains to coast) in the Holocene.

The implications of functional morphology, breakage, and refabrication can largely be read from Table 1. There are relatively few point fragments (5 bases, 2 blades, and 15 tips) compared to the points (n=47). The relatively large number of tips suggests that they were brought to the camp in game and discarded when found during consumption. The few blades suggest that little extraordinarily vigorous uses were made of points (i.e., no butchery of big game on site, no surprise). These uses seem to have declined over time even though site activity increased, perhaps as attention turned to smaller game such as turtles and fish. The long persistence of point technological traditions such as shafting the tip and grinding the bases leads one to suspect persistence of populations, at least until Early Woodland times. This need not be the case, however, as useful means of making implements can readily be reinvented or even copied from field losses of earlier traditions.

Table 4 is sorted to show the shortest lived traditions on the left and longer lived traditions on the right. Shafting the tip is the longest tradition, extending from Early Archaic to Late Woodland. Grinding of the haft and base are nearly equally as enduring. On the other hand, making points with robust blades and thinned bases fades by Middle Archaic times, and beveling is equally short lived. The fading of these traditions probably signals the end of large game hunting by inhabitants of the site.

Of course, another question is why were most of the carefully engineered Rowan points left unbroken at Horses Grazing? Or is travel the answer here as well? Suppose Crane Creek was such a good wetland that they knew they would return, so they cached the points at the site. Four of the points near the west end of Block 1 were scattered up through the profile. This and other indications suggest a disturbance in the western area of Block 1 and eastern Block 5 in preceramic times. It could have been a tree tilt or the result of human activity. That the points are all in near horizontal proximity may indicate that they were left together in a single package.

Table 4. Persistence of Technological Traditions at Horses Grazing by Frequencies.

Description	Size	ThickBa-ThinBl	Beveling	Binding Notches	Serration	Backing	Shafted Tip	Grind base	Grind haft	Grind blade
Big Sandy		1					1	2	1	
Big Sandy			1				1	3	3	1
Big Sandy		1						2	1	
Big Sandy		1					1	2	2	
Big Sandy		1	1					1	1	
Kirk Serrated	l			1	1		1	1	1	
Kirk Coner Notched	s						1	1	1	
Kirk Knife	v							1	1	
Kirk Serrated	s		1			1	2	1	1	
Stanly	l	1	1	1			1	2	2	
Stanly	s	1			1		1		1	
Morrow Mountain Drill	l		1	1				1		
Morrow Mountain	s	1								
Morrow Mountain	s			1			1	1	1	
Morrow Mountain	s	1		1			2	1	1	
Morrow Mountain	s				1		2		1	1
Morrow Mountain	s			1			1	3	3	
Morrow Mountain	s			1				1	1	
Morrow Mountain	s			1			1		1	
Morrow Mountain				1			2	1	1	
Morrow Mountain	s			1				1	1	
Guilford Crude Round	s					1				2
Guilford Crude Round	s						1			
Guilford Crude Round	s							1	1	3
Guilford Crude Straight	v									
Guilford Crude Straight									1	
Guilford Refined Round	s							2		
Guilford Refined Round	s							1	1	1
Guilford Refined Straight	s							1	1	
Guilford Refined Straight	s								1	
Guilford Refined Straight	s				1			2	2	1

Table 4 continued.

Description	Size	ThickBa-ThinBl	Beveling	Binding Notches	Serration	Backing	Shafted Tip	Grind base	Grind haft	Grind blade
Savannah River										
Savannah River								1		
Savannah River	1								2	
Savannah River										
Savannah River Small								1	1	
Savannah River Small								1	1	
Eared Yadkin								1		
Pee Dee Triangular							1			

Point Morphology: Organizing Points by Stylistic Forms

In the previous section, the points from Horses Grazing were discussed in terms of established point terminology. This terminology was developed by Coe and other early archaeologists in the Southeast, and elaborated in the years since by still others (Cooper 1970; McAvoy and McAvoy 1997; Michie 1966; Oliver 1985). The fact that the Rowan variant of Big Sandy has largely escaped attention during the last 30 years can be attributed to several causes. As Cooper points out in his original type definition, they are widely but sparsely distributed. Even so, they appear in most collections "lumped with various side-notched and corner-notched types despite their distinctive morphology and technological differences" (Cooper 1970:114). What other types and their peculiar implications lay under the veil of existing terminology?

A means of opening investigations into new subsets of existing data is to attempt to gain new perspectives such as can be revealed by unbiased analysis. Avenues to new perspectives and unbiased analysis often arise from new technologies that free researchers of existing preconceptions. One such technology that has been broadly applied in many areas ranging from the study of satellite images of earth surfaces to the study of microscopic phytoliths is automatic measurement followed by pattern recognition analysis. Rovner has used a program (Prism: Image Analysis & Measurement Program, from Analytical Vision, Inc., Raleigh, NC) to automatically characterize phytoliths and, following the 1999 Uwharrie Lithic conference, expanded the technique to the study of lithic debitage. With this measurement technique, a program evaluates a digitized image taken from a scanner, video, or still camera, and performs a wide range of measurements on each object in the field of vision. The measurements range from relatively straight forward, such as measuring the area of each object, to quite elaborate, such as convexity, which is the ratio of the true distance around the object to the length of a rubber band stretched around the object (see Appendix A).

In this study, we wanted to bring about a clearer understanding of Rowan points relative to their morphological co-types. To do this, all of the points from Horses Grazing were measured. This is referred to as the "classification" collection (Figure 7). The classification collection also includes points from Daniel's (1998:54) "Other corner-notched points," "Kirks" from Claggett and Cable's (1982:461, Plate 12) Haw River sites, points from Copperhead Hollow (Gunn and Wilson 1993:130), and Rowans found by Robinson (site 31CD396 on the east Fayetteville Outer Loop, excavations sponsored by the North Carolina Department of Transportation and Wake Forest University).

To provide reference collections, examples were measured from several related sources: Daniel's (1998:51–57) discussions of points at Hardaway (Hardaway-Dalton, Hardaway Side-Notched, Kirk, Palmer), Cooper's (1970:112) Rowan type collection from Granville and Rowan counties, Big Sandys from Eva in Tennessee (Lewis and Lewis 1961:38, Plate 7), Taylor points from the Topper site (Goodyear 2001:18), and Fort Nottaway points (McAvoy and McAvoy 1997:151).

We understand that any assemblage is a part of its immediate landscape. Hence, the Horses Grazing point morphology is unique to the wetland margin circumstances of eastern Moore County (Gunn et al. 2003). The mix of point morphologies at any other site would be inappropriate to this ecology. In ecological terms, it makes no sense to compare the morphologies from Horses Grazing with those from Hardaway, whose mix of points was clearly bent by its proximity to a major quarry and by the necessities incumbent on those living on an elevated, igneous ridge (Daniel 1998). However, in the interest of a common regional terminology for points, which is an entirely different problem, there is value in comparing implements from distant and ecologically unrelated places.

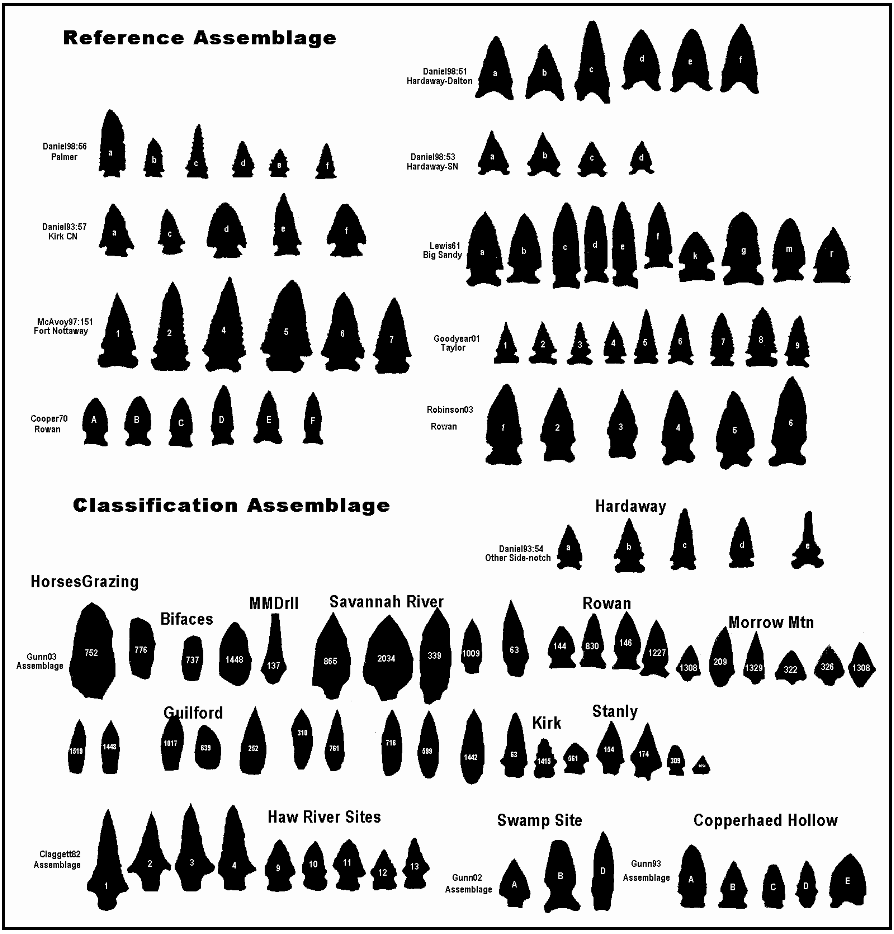

Figure 7. Point outline morphologies used in this study.

To this end, 115 points (i.e., 47 from Horses Grazing, and 68 from the other sources cited above) were treated by automatic measurement (see Figure 7). The reference collections represent those authors' views of what the types should look like as selected from large collections. The points included from Horses Grazing as well as from Gunn and Wilson, Claggett and Cable, and Robinson are target collections to be classified relative to the reference collections. However, none of the collections were singled out to be entered into the analysis as unclassified points. In this way, the entire array of point shapes is interactively involved in a process of defining shape variations of points in the North Carolina

Piedmont/Coastal Plain region. The question is, how do the points as a shape population fit together in terms of our ideas of the total range of potential shapes, and how does the existing terminology correspond to parts of that range? There are important questions about the relationship between the total shape space and the parts defined as types. Are there parts of that space that have points but are empty of ideas? These would be potential new types. Do the existing ideas about point types define discrete areas of that space? An important perspective to keep in mind is that this analysis only deals with outline morphology, not other dimensions of point manufacture that are commonly referenced in type descriptions such as edge preparation, beveling, and material selection. In this study, adding the weight or mass of the points, a future undertaking, would have added considerably to the completeness of the descriptions.

To perform the measurements, each point was converted to a binary image; the points were made all black surrounded by white (see Figure 7), and measured by 28 methods such as those described above. To provide an indication of how well the various measures performed relative to the existing point typology, a variable was included with the names of the standard types. A discriminant function routine (SPSS version 8.0) classified the points into the standard point types. Six measurements proved the most powerful descriptors (Tables 5, 6, and 7). "Curl" was the most important determinant of point type shape in combination with "Area," "Breadth," etc. The six measurements are discussed in Appendix A. Since the complex data collected by the program were unsupervised by human intervention, the data are unbiased apart from the preconceptions inherent in the programming.

Perhaps the more important part of this result from the perspective of as-yet-undiscovered types is what was not classified. If a pattern of points is found outside the territories marked by existing point types, does it represent an unrecognized type lying beyond the scope of the existing terminology? If an existing type is scattered across other type territories, does it represent an inconsistency within the terminology, or are non-measured dimensions involved? Maps of how the types lie on the most important dimensions are helpful in evaluating these questions. The first four dimensions account for most (92.61%) of the variation in the point measurements. We will map and discuss them to give a preview of what occurs in the six total dimensions.

Examination of the first map of type territories shows that several types—Fort Nottaway, Savannah River, Taylor, Guilford, and perhaps Hardaway—are strongly separated (Figure 8). The cross in the center of the territories we will call the "zeros." Specimens clustered around the

Table 5. Discriminant Function Statistics: Variables Selected as Most Powerful Discriminators Between Types.

	Statistic	df1	df2	df3	Statistic	df1	df2	Sig.
Step					Exact F			<
1 Curl	0.348	1	11	99.0	16.843	11	99	0.000
2 Area	0.130	2	11	99.0	15.818	22	196	0.000
					Approximate F			
3 Breadth	0.068	3	11	99.0	12.919	33	286.5	0.000
4 Y-Cent. Grav.	0.037	4	11	99.0	11.491	44	369.2	0.000
5 Equiv. Diam.	0.024	5	11	99.0	9.9585	55	443.3	0.000
6 Convexity	0.017	6	11	99.0	8.8852	66	508.4	0.000

At each step, the variable that minimizes the overall Wilks' Lambda is entered.
Maximum number of steps is 52.
Minimum partial F to enter is 3.84.
Maximum partial F to remove is 2.71.
F level, tolerance, or VIN insufficient for further computation.

Table 6. Discriminant Function Statistics: Variance Accounted for by the Functions.

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.97	41.88	41.88	0.87
2	1.99	28.07	69.95	0.82
3	0.98	13.80	83.75	0.70
4	0.66	9.36	93.11	0.63
5	0.28	4.00	97.11	0.47
6	0.21	2.89	100.00	0.41

zeros are not related to the dimensions being mapped. The area around the zeros is a classification black hole. They may be classified on other dimensions, but the points around the zeros are not meaningful on the dimensions being plotted. The tighter and further away from the zeros the clusters are, the more coherent the type. Guilford, for example, has a close knit and largely discrete cluster some distance from the zeros. It clusters, as might be expected, near bifaces and small Savannah Rivers; a Morrow Mountain has also crept in among the Guilfords. However, as in the tang length-width plot discussed above (see Figure 6), Palmers and Kirks are

Table 7. Discriminant Function Statistics: Cross Classifications.

Type	1	2	3	4	5	6	7	8	9	10	11	12	Total
1 Hardaway Dalton (HD)	5		1										6
2 Hardaway Sidenotched (SN)	1	3				1							5
3 Big Sandy (Bi)	1	1	8										10
4 Taylor (Ta)				7		2							9
5 Rowan (Ro)	1		2		14		1		2	1			21
6 Palmer (Pa)		1	1	2	2	5							11
7 Kirk (Ki)		2	1	1	1	1	5		2	1		3	17
8 Nottaway (No)	1							5					6
9 Stanly (St)									2				2
10 Morrow Mountain (MM)		1			1				2	3	1		8
11 Guilford (Gu)					1						10		11
12 Savannah River (Sa)											2	3	5
Total	9	8	13	10	19	9	6	5	8	5	13	6	111

mixed and scattered among other types near the zeros. Rowans are also scattered around the zeros. Since we are dealing with six dimensions in all, they could be separated by other dimensions. How about dimensions 3 and 4?

Additional types—Hardaway, Morrow Mountain, Big Sandy, and Rowan to some extent—are separated by dimensions 3 and 4 (Figure 9). Palmer and Kirk also produce clusters off the zeros. Kirk, however, is widely scattered across Morrow Mountain and Hardaway territories and mixes with Palmer. Neither map achieves satisfactory separation of the Kirk type. This may be the ambiguous character of Kirk, a character that led Cable (1996:112) to argue for the abandonment of the Kirk Corner-Notched variety in favor of Palmer. However, there is an indication that a plot of dimensions 2 and 3 would clarify the Kirk picture some, a topic to be explored in another project.

Careful examination of plots of all six primary dimensions in various combinations might help discover which dimensions are discriminating Palmers and Kirks. However, how the types overlap in territories is clear in Table 7. Although not supplying the visual and spatial information of the plots, Table 7 will serve to help us understand the relationships between types for now. Table 7 shows the number of points of each type that was classified correctly on the diagonal and not correctly classified off the diagonal. The rectangle inside the table outlines the Early Archaic Big Sandy variants along with Kirk and Palmer. As can be seen, there are few

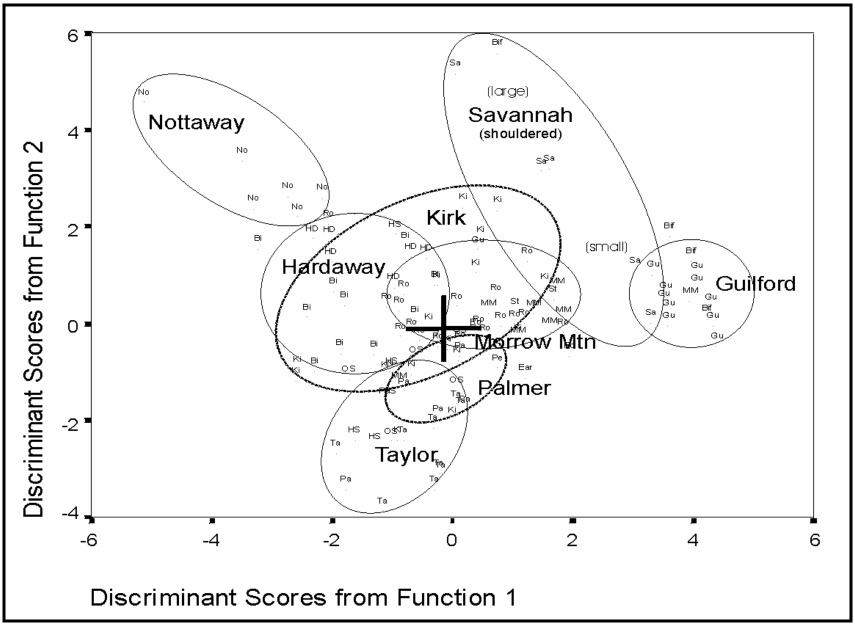

Figure 8. Type territory map of the first and second dimensions (69.95% of the variance).

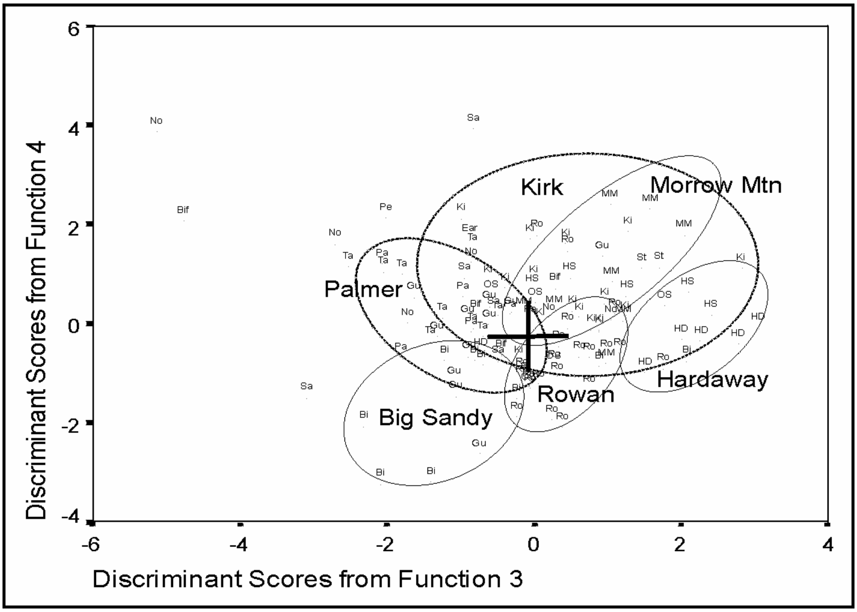

Figure 9. Territorial map of point types for the first four functions.

Table 8. Successful versus Unsuccessful Classifications of Early Archaic Side-notched Types.

Type	Successful	Unsuccessful	Percent Successful
Big Sandy	8	0	100
Nottaway	5	0	100
Taylor	7	2	78
Rowan	14	5	74
Palmer	5	5	50
Kirk	5	6	46
Total	45	18	

misclassifications outside the box, but many inside. Tabulating the classifications inside the box will focus our attention on the Early Archaic points (Table 8). Large proportions of the Big Sandy (100%), Nottaway (100%), Rowan (74%), and Taylor (78%) points were classified as expected. Palmers (50%) and Kirks (46%), however, proved more difficult. Particularly impressive is the confusion between Palmers and Kirks and most of the other types in both cases. Some of this confusion is explainable in terms of neglect of the Rowan type. In the Gunn and Wilson, and Claggett and Cable assemblages, and the Daniel (1998) "other side-notched points" category, Rowans are present. This accounts for three of the Rowans that were classified as Kirks. Are there other such missing types?

Returning to the original data (see Appendix A and Figure 7), it can be seen that all of Cooper's Rowans were correctly classified. Two of Goodyear's Taylors were classified as Palmers. One point from the Palmer reference collection (Daniel) was classified as a Taylor and the other a Big Sandy. All of this underscores the close outline-relationships between the types. Three of the five points in Daniel's Kirk reference collection were misclassified as Palmer, Big Sandy, and Hardaway Side-Notched. Similar problems are apparent among the points from Claggett and Cable, which were classified by the authors as Kirks. It was anticipated that one of the points would be classified as a Rowan. However, three of the Kirks were grouped with the Small Savannah Rivers and one as a Hardaway Side-Notched. These are classification problems similar to the issue raised by Drye (1998) of resharpening Savannah Rivers and Morrow Mountains till they look like Guilfords. Other such clues—

clues that could inform subsequent analyses with large samples and more time to focus on the analysis of classifications—may exist in this table.

Conclusions

The strata of Horses Grazing contained a full-Holocene sequence of cultures, perhaps including some occupation during the Late Pleistocene. Technological traditions for making points were sustained in some features, such as shafting the tip and grinding the base, through the whole record. Other features, such as beveling the blade and making the blade thicker than the haft, were confined to the Early Archaic. Medium-sized bifaces commonly identified as Guilfords were found to be scattered through the Archaic levels. Only the Guilford refined round based form was confined to the Middle Archaic. That, however, is based on only two points. Using an automatic measuring technology and analyzing the data with discriminant function analysis, we found that as is generally recognized, it is difficult to separate Kirks and Palmers. The Big Sandy variants (Taylor, Rowan, Fort Nottaway), however, are often morphologically distinct from their notched contemporaries. The study was based strictly on outline shape, which ignores technological attributes except in so far as they are captured by the outline morphology.

The presence of a Big Sandy-Rowan component at the site raises questions about this little-studied point type and the people who made them. That there are two related varieties of Big Sandy to the south and north at differing time periods (Taylor points in South Carolina and Fort Nottaway in Virginia), but similar tool kits, suggests that perhaps the same culture moved up the Atlantic Slope in the tenth millennium B.P. There are plausible explanations for such a movement. The period was the transitional millennium between Pleistocene globally cold conditions and Holocene warm conditions. This suggests that isotherms would have been moving northward across the region.

Early and Middle Holocene climates would have required adapting to an extremely mobile game population in the case of the larger game such as elk and bison. Under strong seasonal pressure, large species tend to use their long legs to migrate to favorable seasonal reserves, to the mountain high pastures in summer and to the coastal lowlands in the winter. A number of worldwide examples of this pattern can be cited, such as wild cattle in the Palestine who were ambushed at Tabun, or the site of Ambrona-Torralba in the uplands of western Spain. In North Carolina, semiannual migrations between the Coastal Plain and highland areas such as Avery County, a high plateau north of Asheville, would have been likely patterns. The Fall Line-Sand Hills would have offered a location for ambushes as the migrating herds moved through the narrow valleys of the first dissected landscape inland from the coastal winter grazing areas.

In his book on the survey of the North Carolina-Virginia border in the eighteenth century, William Byrd (1967:236) reported that bison occurred south of 37 degrees latitude while elk were to the north. This is the Latitude of Newport News, Virginia. It suggests that the Big Sandy variants could represent a group (or groups) focused on bison hunting. The focus of their activity was in the South Carolina Savannah River area early on after Dalton during the Younger Dryas subpluvial. Dalton probably represents the terminal phase of the very large game hunting of elephants (Anderson 1995), while Big Sandy *vars*. was concerned with the medium-sized game that survived the collapse of the megafauna. This accounts for the peculiar similarity of the tool kits between Dalton and Big Sandy (Driskell 1996; McAvoy and McAvoy 1997). The interesting question is what was the change in stress factors that dictated a shift from the Dalton to Big Sandy morphology? The northward drift of the Big Sandy variants could be justified in terms of warming climate at the end of the Pleistocene. As the isotherm that defined the northern limit of the elk-bison range moved north, so did the Big Sandy variants. The final extension of their range was in southern Virginia with the Fort Nottaway variant near the northern range of the bison in the eighteenth century as reported by Byrd.

The location of the Horses Grazing site could be associated with the reported game migration trail between the mountains and the coast (Oates 1981). Brooks (personal communication 1995) has found that the routes of modern interstate highways were frequented by Paleoindians and probably represent megafaunal migration routes. Megafauna appear to have spent summers near the glaciers in the north and winters on the Gulf Coast (Guthrie 1978). As migration in the Holocene shifted 90 degrees to a coastal-mountain axis, the patterns of human movement and settlement would have followed suite. Rowan points appear to cluster near the Fall Line and near the Mountains, both at increases in topographic relief and increased opportunity for ambushes. This adaptation would have yielded a pattern of the sort suggested by Daniel (1998) in his analysis of lithics during the late Paleoindian-Early Archaic periods and would have coincided with major streams along the Atlantic Slope rather than crossing them.

The evidence of Big Sandy variant bands focused on bison hunting and movement with isotherms is circumstantial. As has been pointed out in the past, direct evidence of bison hunting remains elusive in the

Southeast east of the mountains because of lack of osteological evidence. There are a number of reason why osteological evidence might be the absent. The bones were unlikely to be carried to camps because of their weight. Even the Plain Indians who had horses stripped the bison meat and carried only the dried meat to camp. The Shoshone Indians of the Great Basin made trips on foot to the Plains to hunt bison, and certainly striped the meat and dried it before carrying it back to the Basin for the winter (Stewart 1938). The bones would have been at the time of consumption 500 miles distant. Also, bison bones are often mistaken for cattle bones. Bison bones and any other bones are unlikely to have survived the acidic soil environment of the Sandhills, even in the unlikely event they were taken to camp. Other means of approaching this problem need to be sought such as residue analysis and hair traces in flotation samples.

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J.J. Barnes, on whose property the Horses Grazing site was located, was generous with his time and knowledge of the area around the site, including a tour of a massive, once commercially exploited, quartz quarry a few hundred meters downstream from the site. He also provided extremely useful on-site accommodations for the crew and equipment. The project was sponsored by the North Carolina Department of Transportation (TIP R-210, Federal Aid No. NHS 0001(3), State Project 8.T560302, Improvements to US Highway 1, Moore County, Division 8).

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APPENDIX A
Variables Used in Discriminant Analysis

Morphometric analysis and expert vision systems are a promising approach to unbiased analysis of artifact forms (Rovner 1995; Russ 1990; Russ and Rovner 1989). The six most powerful classifiers of point shapes by automatic measurements, from a list of 28, are discussed below. This is followed by the data for those measurements accompanied by the discriminant scores for the points. The discriminant scores are plotted in the last two figures.

Curl is a measure of departure from a straight line or a measure of asymmetry. It is the length divided by the "skeleton's" center line. If an object is "long" and symmetrical, then the length and the center line are the same. If an object is asymmetrical, the center line will deviate from a straight line and becomes longer in ratio to length. Curl is obtained by dividing length by center line distance, which arbitrarily gives values of 1.0 or less. Length is not the vertical axis of a point, but the longest distance, from the corner of a tang to the tip on a side-notched point, but through the vertical axis on a Morrow Mountain. This variation in measurement from normal archaeological measurement procedures probably explains why curl is such a powerful descriptor. It is an example of the serendipitous findings than can emerge from unbiased investigations. It deserves further consideration.

Area is straightforward size.

Breadth is the width of a box needed to contain the object into. It is equivalent to "maximum" width.

Y-Center of Gravity is the center of gravity along the vertical axis of the object.

Equivalent Diameter is the diameter of a circle having the same area as an irregular object.

Convexity is a shape measure of irregularity. It is the ratio of true perimeter divided by the length of a "taut string" or rubber band placed around the outside of the object. An irregular object has a longer true perimeter than the size of the polygon it fits into. It would, for example, discriminate between straight and serrated edges.

Table A1. Measurements on Points and Discriminate Scores.

Sequence	Ref-Class	Plate	Type Map Symbol	TypeN	Label
1	classification	01Gunn	Bif	0	biface
2	classification	01Gunn	Bif	0	biface
3	classification	01Gunn	Bif	0	biface
4	classification	01Gunn	Bif	0	biface
5	classification	01Gunn	MM	10	MMdrill
6	classification	01Gunn	MM	10	MMG03
7	classification	01Gunn	MM	10	MMG03
8	classification	01Gunn	MM	10	MMG03
9	classification	01Gunn	MM	10	MMG03
10	classification	01Gunn	MM	10	MMG03
11	classification	01Gunn	MM	10	MMG03
12	classification	01Gunn	Ro	5	RowanG03
13	classification	01Gunn	Ro	5	RowanG03
14	classification	01Gunn	Ro	5	RowanG03
15	classification	01Gunn	Ro	5	RowanG03
16	classification	01Gunn	Sa	12	SavRivG03
17	classification	01Gunn	Sa	12	SavRivG03
18	classification	01Gunn	Sa	12	SavRivG03
19	classification	01Gunn	Sa	12	SavRivG03
20	classification	01Gunn	Sa	12	SavRivG03
21	classification	02Gunn	Ear	13	EaredYadG03
22	classification	02Gunn	Gu	11	GuilfordG02
23	classification	02Gunn	Gu	11	GuilfordG02
24	classification	02Gunn	Gu	11	GuilfordG02
25	classification	02Gunn	Gu	11	GuilfordG02
26	classification	02Gunn	Gu	11	GuilfordG02
27	classification	02Gunn	Gu	11	GuilfordG02
28	classification	02Gunn	Gu	11	GuilfordG02
29	classification	02Gunn	Gu	11	GuilfordG02
30	classification	02Gunn	Gu	11	GuilfordG02
31	classification	02Gunn	Gu	11	GuilfordG02
32	classification	02Gunn	Ki	7	KirkG03
33	classification	02Gunn	Ki	7	KirkG03
34	classification	02Gunn	Pe	13	PeeDeeG03
35	classification	02Gunn	Ro	5	RowanG03
36	classification	02Gunn	St	9	StanlyG03
37	classification	02Gunn	St	9	StanlyG03
38	classification	03Claggett	Ki	7	KirkC82
39	classification	03Claggett	Ki	7	KirkC82
40	classification	03Claggett	Ki	7	KirkC82
41	classification	03Claggett	Ki	7	KirkC82
42	classification	03Claggett	Ki	7	KirkC82
43	classification	03Claggett	Ki	7	KirkC82
44	classification	03Claggett	Ki	7	KirkC82
45	classification	03Claggett	Ki	7	KirkC82

Table A1 continued.

Sequence	Ref-Class	Plate	Type Map Symbol	TypeN	Label
46	classification	03Claggett	Ki	7	KirkC82
47	reference	04Cooper	Ro	5	Rowan
48	reference	04Cooper	Ro	5	Rowan
49	reference	04Cooper	Ro	5	Rowan
50	reference	04Cooper	Ro	5	Rowan
51	reference	04Cooper	Ro	5	Rowan
52	reference	04Cooper	Ro	5	Rowan
53	reference	05Daniel	HD	1	Hard-Dalt
54	reference	05Daniel	HD	1	Hard-Dalt
55	reference	05Daniel	HD	1	Hard-Dalt
56	reference	05Daniel	HD	1	Hard-Dalt
57	reference	05Daniel	HD	1	Hard-Dalt
58	reference	05Daniel	HD	1	Hard-Dalt
59	reference	06Daniel	HS	2	Hard-SN
60	reference	06Daniel	HS	2	Hard-SN
61	reference	06Daniel	HS	2	Hard-SN
62	reference	06Daniel	HS	2	Hard-SN
63	classification	07Daniel	OS	6	OtherSN
64	classification	07Daniel	OS	6	OtherSN
65	classification	07Daniel	OS	6	OtherSN
66	classification	07Daniel	OS	6	OtherSN
67	classification	07Daniel	OS	6	OtherSN
68	reference	08Daniel	Pa	6	Palmer
69	reference	08Daniel	Pa	6	Palmer
70	reference	08Daniel	Pa	6	Palmer
71	reference	08Daniel	Pa	6	Palmer
72	reference	08Daniel	Pa	6	Palmer
73	reference	08Daniel	Pa	6	Palmer
74	reference	09Daniel	Ki	7	Kirk CN
75	reference	09Daniel	Ki	7	Kirk CN
76	reference	09Daniel	Ki	7	Kirk CN
77	reference	09Daniel	Ki	7	Kirk CN
78	reference	09Daniel	Ki	7	Kirk CN
79	reference	10Goodyear	Ta	4	Taylor
80	reference	10Goodyear	Ta	4	Taylor
81	reference	10Goodyear	Ta	4	Taylor
82	reference	10Goodyear	Ta	4	Taylor
83	reference	10Goodyear	Ta	4	Taylor
84	reference	10Goodyear	Ta	4	Taylor
85	reference	10Goodyear	Ta	4	Taylor
86	reference	10Goodyear	Ta	4	Taylor
87	reference	10Goodyear	Ta	4	Taylor
88	classification	11Gunn	HS	2	HardawaySNG93
89	classification	11Gunn	MM	10	MMG93
90	classification	11Gunn	Ro	5	RowanG93

Table A1 continued.

Sequence	Ref-Class	Plate	Type Map Symbol	TypeN	Label
91	classification	11Gunn	Ro	5	RowanG93
92	classification	11Gunn	Ro	5	RowanG93
93	classification	12Gunn	Gu	11	GuilfordG93
94	classification	12Gunn	Ki	7	KirkSTG93
95	classification	12Gunn	Ro	5	RowanG93
96	reference	13Lewis	Bi	3	Big Sandy
97	reference	13Lewis	Bi	3	Big Sandy
98	reference	13Lewis	Bi	3	Big Sandy
99	reference	13Lewis	Bi	3	Big Sandy
100	reference	13Lewis	Bi	3	Big Sandy
101	reference	13Lewis	Bi	3	Big Sandy
102	reference	13Lewis	Bi	3	Big Sandy
103	reference	13Lewis	Bi	3	Big Sandy
104	reference	13Lewis	Bi	3	Big Sandy
105	reference	13Lewis	Bi	3	Big Sandy
106	reference	14McAvoy	No	8	Nottaway
107	reference	14McAvoy	No	8	Nottaway
108	reference	14McAvoy	No	8	Nottaway
109	reference	14McAvoy	No	8	Nottaway
110	reference	14McAvoy	No	8	Nottaway
111	reference	14McAvoy	No	8	Nottaway
112	reference	15Robinson	Ro	5	Rowan
113	reference	15Robinson	Ro	5	Rowan
114	reference	15Robinson	Ro	5	Rowan
115	reference	15Robinson	Ro	5	Rowan
116	reference	15Robinson	Ro	5	Rowan
117	reference	15Robinson	Ro	5	Rowan

Appendix 1 continued.

Sequence	Predicted Type(if different)	Predicted TypeN	p P(D>d | G=g)	df	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid
1		12	0.000	6	0.98	34.27
2		11	0.865	6	0.97	2.53
3		11	0.420	6	0.72	6.02
4		11	0.961	6	0.99	1.48
5	Gu	11	0.930	6	0.99	1.88
6		10	0.910	6	0.53	2.10
7	St	9	0.874	6	0.73	2.45
8	Ro	5	0.971	6	0.63	1.31
9	St	9	0.970	6	0.81	1.33
10		10	0.393	6	0.64	6.28
11	HS	2	0.619	6	0.90	4.43
12		5	0.927	6	0.58	1.92
13		5	0.654	6	0.49	4.16
14		5	0.875	6	0.77	2.44
15	St	9	0.741	6	0.50	3.52
16	Gu	11	0.976	6	0.90	1.21
17		12	0.145	6	0.99	9.55
18		12	0.001	6	0.72	22.01
19		12	0.981	6	1.00	1.12
20	Gu	11	0.967	6	0.90	1.38
21		10	0.119	6	0.65	10.13
22		11	0.875	6	0.97	2.44
23		11	0.955	6	0.99	1.57
24		11	0.743	6	1.00	3.50
25		11	0.900	6	1.00	2.21
26		11	0.404	6	0.82	6.17
27		11	0.963	6	0.96	1.45
28		11	0.948	6	0.99	1.66
29		11	1.000	6	0.98	0.19
30		11	1.000	6	0.97	0.26
31		11	0.994	6	0.98	0.72
32	St	9	0.872	6	0.35	2.47
33	MM	10	0.879	6	0.62	2.40
34		6	0.000	6	0.66	44.85
35	MM	10	0.218	6	0.43	8.29
36		9	1.000	6	0.74	0.27
37		9	1.000	6	0.65	0.27
38	Sa	12	0.331	6	0.65	6.89
39	Sa	12	0.370	6	0.65	6.50
40	Sa	12	0.290	6	0.88	7.35
41		7	0.292	6	0.78	7.32
42	Ro	5	0.976	6	0.40	1.22
43		7	0.913	6	0.52	2.07

Appendix 1 continued.

Sequence	Predicted Type(if different)	Predicted TypeN	p P(D>d | G=g)	df	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid
44		7	0.972	6	0.53	1.29
45		7	0.846	6	0.32	2.69
46	HS	2	0.931	6	0.34	1.88
47		5	0.778	6	0.60	3.24
48		5	0.944	6	0.74	1.72
49		5	0.964	6	0.62	1.44
50		5	0.871	6	0.71	2.48
51		5	0.810	6	0.42	2.99
52		5	0.899	6	0.70	2.22
53	Bi	3	0.607	6	0.45	4.52
54		1	0.989	6	0.96	0.92
55		1	0.813	6	0.93	2.97
56		1	0.981	6	0.96	1.12
57		1	0.914	6	0.99	2.06
58		1	0.992	6	0.94	0.80
59		2	0.553	6	0.55	4.93
60		2	0.980	6	0.86	1.13
61		2	0.986	6	0.90	1.00
62	Pa	6	0.467	6	0.46	5.62
63		5	0.976	6	0.60	1.22
64		4	0.498	6	0.74	5.37
65		6	0.980	6	0.45	1.12
66		2	0.976	6	0.80	1.22
67		5	0.957	6	0.42	1.54
68	Bi	3	0.195	6	0.30	8.65
69		6	0.995	6	0.57	0.68
70		6	0.903	6	0.70	2.18
71		6	0.758	6	0.77	3.40
72		6	0.299	6	0.84	7.24
73	Ta	4	0.143	6	0.82	9.58
74		4	0.067	6	0.45	11.79
75	Pa	6	0.929	6	0.41	1.89
76	Bi	3	0.801	6	0.29	3.06
77		7	0.147	6	0.60	9.52
78	HS	2	0.406	6	0.58	6.15
79		4	0.820	6	0.92	2.91
80		4	0.699	6	0.97	3.84
81	Pa	6	0.286	6	0.50	7.39
82		4	0.368	6	0.97	6.52
83	Pa	6	0.994	6	0.61	0.72
84		4	0.986	6	0.49	0.98
85		4	0.942	6	0.92	1.74
86		4	0.243	6	0.87	7.94

Appendix 1 continued.

Sequence	Predicted Type(if different)	Predicted TypeN	p P(D>d | G=g)	df	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid
87		4	0.763	6	0.61	3.35
88	HB	1	0.627	6	0.77	4.37
89		10	0.977	6	0.54	1.19
90		5	0.688	6	0.49	3.91
91	St	9	0.574	6	0.53	4.77
92		5	0.724	6	0.41	3.65
93	Ro	5	0.151	6	0.70	9.44
94	St	9	0.370	6	0.92	6.50
95	HD	1	0.375	6	0.57	6.45
96		3	0.906	6	0.94	2.14
97		3	0.998	6	0.82	0.51
98		3	0.425	6	0.93	5.99
99		3	0.174	6	0.97	9.00
100		3	0.337	6	0.85	6.83
101		3	0.973	6	0.68	1.27
102	HS	2	0.548	6	0.52	4.97
103		3	0.379	6	0.64	6.41
104		3	0.840	6	0.77	2.75
105	HD	1	0.918	6	0.82	2.02
106		8	0.000	6	1.00	29.53
107		8	0.928	6	1.00	1.91
108		8	0.942	6	0.99	1.74
109		8	0.972	6	1.00	1.30
110	HD	1	0.678	6	0.86	3.99
111		8	0.425	6	0.66	5.99
112	Bi	3	0.945	6	0.64	1.70
113		5	0.881	6	0.55	2.39
114		5	0.691	6	0.56	3.90
115		5	0.926	6	0.57	1.93
116	Ki	7	0.684	6	0.50	3.94
117	Bi	3	0.851	6	0.46	2.65

Appendix 1 continued.

Sequence	Curl	Area	Breadth	Y-Cent.Grav.	Equiv. Diam.	Convexity
1	1.00	25.05	4.05	30.09	5.65	0.95
2	1.00	10.07	2.40	30.65	3.58	0.96
3	1.00	11.86	2.90	30.36	3.89	0.95
4	1.00	6.22	1.90	30.11	2.81	0.96
5	0.98	7.86	2.30	30.65	3.16	0.95
6	0.94	5.75	2.59	15.65	2.70	0.94
7	0.98	5.63	2.40	15.41	2.68	0.94
8	0.89	8.27	2.60	13.21	3.25	0.92
9	1.00	8.09	2.40	12.87	3.21	0.94
10	0.96	4.19	2.18	11.74	2.31	0.94
11	0.77	5.03	2.67	11.55	2.53	0.89
12	0.91	7.10	2.35	15.27	3.01	0.93
13	0.86	6.52	2.50	14.85	2.88	0.92
14	0.90	8.73	2.55	13.90	3.33	0.93
15	0.99	5.48	2.05	13.45	2.64	0.94
16	1.00	10.10	2.32	23.26	3.59	0.95
17	1.00	17.71	2.85	21.91	4.75	0.95
18	1.00	22.24	4.45	21.66	5.32	0.94
19	1.00	16.94	3.35	21.35	4.64	0.94
20	1.00	6.37	1.90	22.74	2.85	0.95
21	0.94	3.49	1.75	13.12	2.11	0.93
22	1.00	9.70	2.45	31.05	3.51	0.95
23	1.00	7.71	2.14	30.96	3.13	0.95
24	1.00	5.48	1.68	30.43	2.64	0.95
25	1.00	6.12	1.75	30.44	2.79	0.96
26	1.00	7.16	2.45	30.57	3.02	0.96
27	1.00	10.22	2.20	25.02	3.61	0.95
28	1.00	8.12	1.90	25.07	3.22	0.96
29	1.00	8.13	2.00	24.90	3.22	0.95
30	1.00	7.26	2.00	25.29	3.04	0.95
31	1.00	6.48	1.85	24.87	2.87	0.95
32	0.97	8.64	2.45	14.02	3.32	0.94
33	0.93	5.05	2.09	13.07	2.54	0.94
34	0.92	1.76	1.53	15.92	1.50	0.96
35	0.88	4.54	2.30	13.23	2.40	0.94
36	0.98	7.24	2.46	13.95	3.04	0.94
37	0.93	7.84	2.73	13.62	3.16	0.92
38	0.92	15.83	3.74	21.12	4.49	0.91
39	0.88	15.95	3.61	21.20	4.51	0.89
40	0.91	17.97	3.85	19.84	4.78	0.89
41	0.85	13.54	3.79	20.74	4.15	0.88
42	0.88	7.28	2.47	7.66	3.05	0.90
43	0.79	9.46	3.01	7.69	3.47	0.85
44	0.87	9.27	2.87	7.54	3.44	0.89
45	0.89	7.77	2.38	7.53	3.14	0.89

Appendix 1 continued.

Sequence	Curl	Area	Breadth	Y-Cent.Grav.	Equiv. Diam.	Convexity
46	0.83	6.23	2.51	7.12	2.82	0.89
47	0.86	9.37	2.60	14.16	3.45	0.90
48	0.91	8.30	2.31	13.94	3.25	0.92
49	0.89	8.70	2.52	14.10	3.33	0.91
50	0.93	9.49	2.25	5.47	3.48	0.92
51	0.86	8.55	2.80	5.16	3.30	0.91
52	0.92	6.66	1.99	5.20	2.91	0.92
53	0.87	14.90	3.27	13.06	4.36	0.89
54	0.84	11.84	3.52	12.57	3.88	0.91
55	0.80	10.11	3.57	12.25	3.59	0.90
56	0.83	13.87	3.58	4.97	4.20	0.90
57	0.81	13.22	3.84	4.88	4.10	0.90
58	0.82	12.91	3.62	4.93	4.05	0.89
59	0.71	6.87	2.98	10.97	2.96	0.82
60	0.77	7.25	3.14	10.85	3.04	0.87
61	0.76	5.50	2.79	10.53	2.65	0.87
62	0.75	4.14	2.40	6.29	2.30	0.86
63	0.87	8.58	2.43	10.19	3.30	0.90
64	0.74	8.82	2.89	10.14	3.35	0.81
65	0.85	6.40	2.37	10.20	2.85	0.88
66	0.77	7.51	3.04	4.84	3.09	0.86
67	0.86	7.63	2.39	4.88	3.12	0.89
68	0.87	11.56	2.54	10.45	3.84	0.86
69	0.82	5.69	2.15	9.43	2.69	0.87
70	0.87	4.72	1.93	9.19	2.45	0.89
71	0.85	4.52	2.07	4.45	2.40	0.90
72	0.83	3.75	2.01	4.25	2.19	0.90
73	0.75	3.16	1.93	4.22	2.01	0.84
74	0.74	9.22	3.15	11.52	3.43	0.80
75	0.82	6.15	2.38	11.18	2.80	0.86
76	0.82	9.42	2.66	5.16	3.46	0.86
77	0.72	12.89	3.61	4.89	4.05	0.80
78	0.72	11.67	3.59	4.85	3.85	0.82
79	0.74	5.04	2.51	15.83	2.53	0.83
80	0.73	4.38	2.24	15.79	2.36	0.83
81	0.80	4.36	2.22	15.68	2.36	0.89
82	0.77	4.77	1.93	4.09	2.46	0.81
83	0.84	6.00	2.16	10.42	2.76	0.88
84	0.80	5.95	2.26	10.35	2.75	0.86
85	0.80	4.68	1.97	10.15	2.44	0.84
86	0.72	9.75	2.86	4.64	3.52	0.79
87	0.81	7.05	2.17	4.52	3.00	0.84
88	0.90	12.33	3.43	6.28	3.96	0.92
89	0.95	6.61	2.18	14.82	2.90	0.93
90	0.95	11.76	2.68	15.64	3.87	0.93

Appendix 1 continued.

Sequence	Curl	Area	Breadth	Y-Cent.Grav.	Equiv. Diam.	Convexity
91	0.97	5.69	2.09	14.98	2.69	0.92
92	0.85	7.60	2.70	14.73	3.11	0.91
93	1.00	11.29	2.12	4.19	3.79	0.95
94	0.95	7.93	2.81	3.16	3.18	0.93
95	0.85	14.90	3.35	3.89	4.36	0.91
96	0.79	14.81	3.30	2.98	4.34	0.84
97	0.83	12.90	3.09	3.03	4.05	0.87
98	0.90	12.65	2.34	3.74	4.01	0.88
99	0.93	14.34	2.45	3.66	4.27	0.92
100	0.93	11.61	2.19	3.94	3.85	0.92
101	0.83	9.87	2.60	2.79	3.55	0.87
102	0.73	10.27	3.24	4.69	3.62	0.84
103	0.78	17.21	3.79	3.16	4.68	0.86
104	0.80	12.37	2.99	2.91	3.97	0.84
105	0.82	11.04	3.31	2.61	3.75	0.89
106	0.83	28.06	4.90	4.68	5.98	0.85
107	0.86	22.55	4.20	3.93	5.36	0.87
108	0.86	19.44	3.77	3.78	4.98	0.88
109	0.82	19.44	4.16	3.50	4.97	0.86
110	0.84	16.14	3.87	3.39	4.53	0.89
111	0.89	17.03	3.69	3.07	4.66	0.90
112	0.87	10.56	2.64	2.79	3.67	0.90
113	0.89	8.39	2.49	2.75	3.27	0.90
114	0.92	6.91	2.15	2.50	2.97	0.91
115	0.89	8.22	2.35	3.09	3.24	0.90
116	0.88	9.81	2.70	2.70	3.53	0.88
117	0.90	11.41	2.70	3.39	3.81	0.90

SITE FORMATION PROCESSES OF BURIED CULTURAL HORIZONS IN THE SANDHILLS OF NORTH CAROLINA: AN EXAMPLE FROM THE HORSES GRAZING SITE (31MR205)

by

Keith C. Seramur and Ellen A. Cowan

Abstract

Site 31MR205 is located on the crest and northeast slope of a ridge in the Sandhills of the western Coastal Plain. These ridges are eroded from ancient fluvial and marine sediment and capped by Pleistocene and Holocene alluvium and aeolian deposits. The cultural horizon at 31MR205 is buried in a massive sand that is characteristic of surficial deposits throughout the Sandhills. Particle-size analyses of this sand indicate that it is an aeolian deposit with evidence of stratification within the archaeology excavation blocks. A perched water table within the porous surficial deposits supplies water to springs around the perimeter of this ridge. These springs provided a source of potable water for Native Americans, and one area of 31MR205 is located adjacent to a spring on the northeast slope. This stratigraphy is common in the Sandhills, and the hydrogeology interpretation provided here is probably applicable throughout this area. The results of this geoarchaeology study are summarized in a model for site burial by Holocene aeolian sedimentation.

Introduction

Petersen (2001) and Petersen and Mohler (2002) recognized the difficulty in identifying former surfaces or soils in the massive sands that cover ridges in the Sandhills and other areas of the Coastal Plain. They correlated the depth of increased artifact density with increased phosphate concentrations at 31MR205 and considered it as evidence of a former land surface and an indication of site integrity. This study and the data recovery by Gunn et al. (in press) continues the geoarchaeology investigation at 31MR205 to interpret sedimentary processes that deposited the massive sand with a buried cultural horizon (Figure 1).

Holocene sedimentary processes in upland settings such as the ridge slope at 31MR205 are limited to aeolian deposition and possible reworking by colluvial processes. Bioturbation can contribute to the migration of artifacts through the soil profile (Bocek 1986; Gunn and Foss 1994;

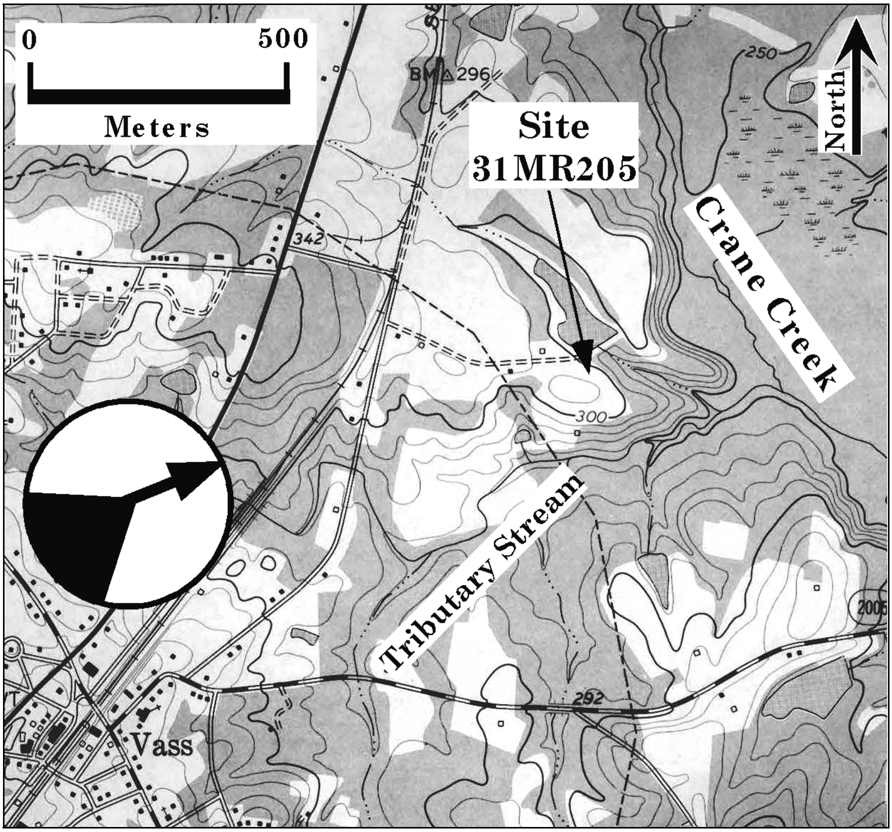

Figure 1. USGS topographic map of the study area. Arc within circle shows predominant annual direction of winds greater than 11 knots, and arrow indicates the direction of potential sand transport in this area (Markewich and Markewich 1994).

Johnson 1989; Leigh 1998). A comprehensive review of bioturbation is presented by Petersen and Mohler (2002).

Holocene aeolian sedimentation has been documented throughout the Atlantic Coastal Plain. Daniels et al. (1969) dated aeolian deposits at Toisnot Swamp younger than 10,700 yr. B.P., but they questioned the reliability of their dating method as little evidence of Holocene aeolian activity in the Southeast had previously been published. However, numerous studies have since documented additional evidence of Holocene aeolian activity. Soller (1988) indicated that the most recent aeolian activity along the Cape Fear River was between 6,000 and 8,000 B.P. Ivester et al. (2001) reported aeolian activity along the Flint River at 8,600

± 940 yr. B.P. and along the Altamaha River at 4830–4570 cal yr. B.P. Ivester et al. (2001) suggest this aeolian activity is related to reworking of dune crests and is limited to deposits not more than ~2m thick. Markewhich and Markewhich (1994) suggest that the "most recent dune forming episode began some time after 12 ka [~12,000 B.P.] and ended some time before 3 ka [~3,000 B.P.]." Daniel (2002) dated stratified Holocene cultural horizons in what he suspected was an aeolian dune on Barber Creek. Seramur et al. (2003) used the geomorphology and sedimentology of this landform to confirm that it is indeed an aeolian dune deposited on the edge of a fluvial terrace.

Late Pleistocene and Holocene aeolian sedimentation in the Southeast occurred during periods of drought (Markewhich and Markewhich, 1994). Drought conditions caused the water table to drop and vegetation along the floodplains is particularly susceptible to lower water tables because of their shallow root systems. As floodplain vegetation decreases, loose alluvial sediment is available for wind transport. Aeolian processes erode alluvium from the floodplains, depositing well-sorted sand along the stream valleys and adjacent uplands on the Atlantic Coastal Plain. Holocene aeolian deposits form a thin, discontinuous sheet of sand on terraces and adjacent uplands, thus burying archaeological sites. Although significant dune sedimentation did not occur during the Holocene (Ivester et al. 2001), limited aeolian activity has deposited sufficient sediment thickness (up to 2 m) to form stratified archaeological sites (Daniel 2002; Seramur et al. 2003).

Site burial by aeolian processes can preserve the integrity of cultural horizons even though there is little evidence of a buried land surface. Aeolian sedimentation tends to form a well-sorted sand, and repeated aeolian events transport and deposit similar sediment. This consistent depositional process forms a massive bed of sand without visual evidence of any internal structure or stratigraphy. The integrity of a buried archaeological site can be determined from other evidence (e.g., phosphate concentrations, the presence of features, and artifact distributions) when the geoarchaeology indicates burial by aeolian processes.

Methods

The geology and geomorphology of the ridge containing 31MR205 is described from aerial photographs and field observations. Geomorphic features are shown on the interpreted aerial photograph (Figure 2). Soil profiles are described for two test units and one geomorphology test pit using standard methods and pedogenic terminology (Birkland 1999;

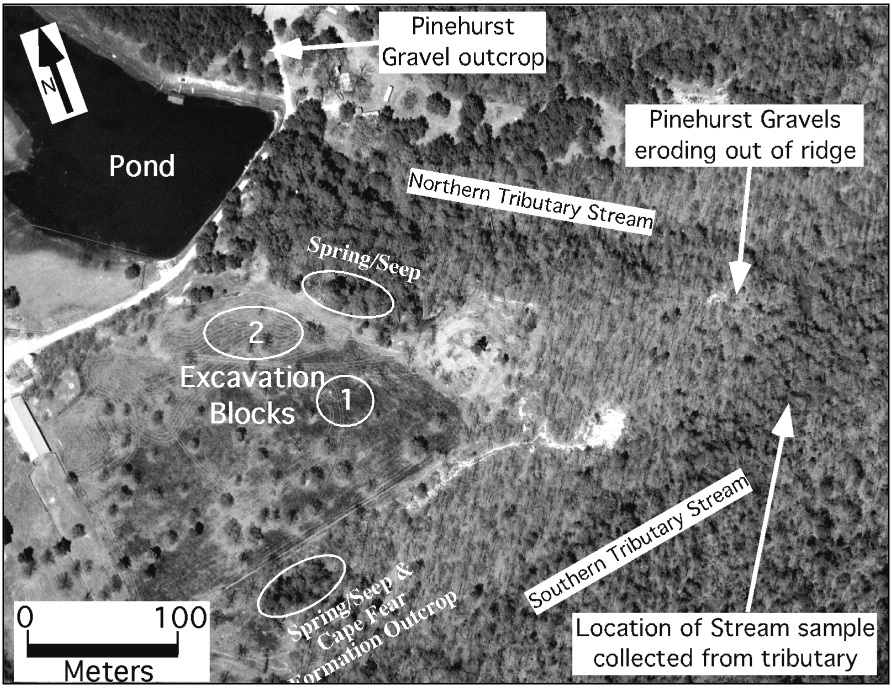

Figure 2. Aerial photograph of study area showing areas referenced in the text. 1980 aerial photograph provided by NC DOT Photogrammetry Unit.

Schoeneberger et al. 1998). Particle-size analyses were completed for 15 sediment samples collected from select stratigraphic horizons in Blocks 1 and 2. This analysis included determining percent sand and fines (silt and clay), and the distribution of the sand fraction.

Particle-size analyses included drying, splitting, and weighing each sample using a digital torsion balance. Samples were then placed in distilled water and dispersed using a sonic dismembrator. Each sample was wet sieved through a 63 micron sieve and the sand fraction retained on the sieve was then dried and weighed. Weight of the sand fraction is divided by total dry weight of each sample to determine percent sand. Sand was dry sieved and each one-half *phi* size fraction was weighed and recorded. The *phi* grade scale (ϕ = log2d, where d is grain diameter in mm) is used for grain size measurements. A larger *phi* number represents smaller grain sizes as 4 *phi* is the boundary between sand and silt and –1 *phi* is the boundary between sand and gravel. This scale facilitates the application of conventional statistical practices to the sedimentology data

(Folk 1980). Histograms were prepared showing particle-size distribution of the sand size fraction in weight percentage for each 1/2 *phi* size.

Particle-size distribution is used to interpret processes that form and bury strata containing cultural horizons. These sedimentary processes or site formation processes can be used to evaluate the potential for site preservation.

Geologic Setting

Site 31MR205 is near Vass in Moore County, North Carolina, and is located along the western edge of the Coastal Plain physiographic province in the Sandhills region. The Sandhills consist of sandy aeolian, fluvial, and marine sediment dissected by streams. The site is ~11 km southeast of the fall line, which is the contact between the crystalline Piedmont rocks and the Coastal Plain. Coastal Plain sediment forms a wedge that thins toward the west and the metasedimentary and volcanic rocks of the Piedmont (Burt 1981).

Vass is located on a long northwest-southeast trending ridge that separates the drainage basins of Crane Creek to the north from the Little River to the south. This ridge crest reaches an elevation of 350 to 400 ft amsl, and the floodplains of these rivers consist of low-lying swamps or wetlands at an elevation of ~250 ft amsl. Tributary streams flow northeast from Vass through small valleys to Crane Creek. Site 31MR205 is located on a relatively narrow east–west trending ridge between two of these tributary streams (Figure 1). The tributary stream on the southern side of the ridge has a relatively linear floodplain that extends about ~500 m southwest of the site (Figure 1). During the field visit a frontal system moved through the area and a strong wind blew to the northeast from the stream valley up and across the ridge crest. This wind followed the predominant wind direction for this area as shown by Markewhich and Markewhich (1994) (Figure 1). Excavation Blocks 1 and 5 were located on the ridge crest and Blocks 2, 3, and 4 were located on the lee side or northern slope of the ridge. The excavation blocks on the northeast slope of the ridge are sheltered from this wind by the ridge. A pond was constructed on the tributary north of the site (Figure 1). This tributary extends about 1.5 km upstream from the site. Local residents stated that the spring at the western end of the pond consistently discharges groundwater. This spring reportedly dried up last summer after several years of drought conditions. The valley of the tributary south of the site is oriented southwest–northeast parallel to the predominant wind direction (Figure 1).

A geologic map of the Vass area was originally published by Conley (1962). This map was revised by Burt (1981) to reflect updated formation names such as the Middendorf Formation and overlying Cape Fear Formation. Sediment on the ridge at site 31MR205 is mapped as the lower Cape Fear Formation that consists of gray, slightly to well indurated, muddy sands and sandy mud (Burt, 1981). The Pinehurst Formation is a white to light brownish red massive sand. The lower sections of this formation are fluvial gravels, and the upper part of the formation is aeolian sand (Conley 1962; Owens 1989; Soller and Mills 1991). The Pinehurst has been interpreted to range in age from Pliocene (5.3 to 1.6 million years ago) to Holocene (Soller and Mills 1991).

Conley (1962) had originally mapped the Pinehurst Formation along the ridge crests in eastern Moore County. Burt (1981) does not show the Pinehurst Formation north of the Little River. He has included the smaller areas of Pinehurst sand and gravels into areas mapped as Middendorf Formation. Conley (1962) had mapped separate units of the Pinehurst Formation north of the Little River, including along the ridge that forms the drainage divide through Vass. This is the ridge that extends to site 31MR205. The Pinehurst Formation probably occurs throughout the Sandhills Region in areas that are too small to be shown on recent regional geologic maps.

Two outcrops were identified during a reconnaissance of this ridge and a ridge northeast of the pond. One outcrop was observed at a spring discharging along the slope southwest of the site (Figure 2). Sediment around this spring is a dark gray to black, sandy mud interpreted as a member of the Cape Fear Formation. An outcrop of fluvial gravels was identified in a cut bank on the ridge northeast of site 31MR205 (Figure 2). Fluvial gravels were also observed eroding out of the nose of the ridge southeast of the site (Figure 2). These ridges are capped with sheets of the Pinehurst Formation that overlie the Cape Fear Formation. The surficial sands and underlying fluvial gravels at site 31MR205 are interpreted as the upper and lower strata of the Pinehurst Formation.

Aerial photographs dated 3-12-66 and 4-11-80 were provided by the North Carolina Department of Transportation (NCDOT), Division of Highways Photogrammetry Unit, and were examined for geomorphic interpretations. Site 31MR205 is forested on the 1966 aerial photograph. Geomorphic features around the site are shown on the 1980 aerial photograph (Figure 2). The darker areas around the perimeter of the ridge are areas of vegetation that indicate the location of springs and seeps.

Stratigraphy and Sedimentology Descriptions

The profiles of excavation Blocks 1 and 2 at site 31MR205 were described, as was the profile of a geomorphology test pit on the southwest slope of the ridge. All three profiles consisted of a massive medium sand with very low percentage of fines (silt and clay) (Figure 3). Pedogenesis along this ridge included an A-horizon above E- and B-horizons with transitional zones between the master horizons. The B-horizon was weakly developed and delineated based on color, some initial development of soil structure, and some clay bridges between ped surfaces. The depth to the B-horizon increases from the stoss to lee sides of the ridge (from southwest to northeast). This horizon occurred at depths of 80 cm in the geomorphology test pit, 90 cm in Block 1, and 141 cm in Block 2 (Figure 3).

The fourth profile was recorded on the ridge north of site 31MR205 at an outcrop of a gravel bed representing the lower member of the Pinehurst Formation (Figure 2). This profile consisted of 20 cm of a silty, medium to coarse sand overlying more than a meter of sandy gravel (Figure 3). Pedogenesis at this cut bank showed a thin Ap-horizon or plow zone over a fairly well developed B-horizon.

Fifteen sediment samples were collected from profiles in Blocks 1 and 2 and analyzed for particle-size distribution. These samples consisted of 85–89% sand except in the B-horizon of Block 2 which is 81% sand. These samples have a mode in the range of medium to coarse sand and consist primarily of medium sand (Figure 4). A sediment sample was also collected from the bed of a tributary stream channel southeast of site 31MR205 (Figure 2) to compare alluvial sediment of the tributary streams to the deposits on the ridge. This alluvial sample is 93% sand and primarily medium to very coarse sand. Histograms of sand distribution are shown for two samples from Block 2 and the stream sample (Figure 4). These histograms show that sediment on the ridge has lower percentages of coarse sand (0ϕ to -1ϕ) and higher percentages of fine and very fine sand (2ϕ to 4ϕ) than the stream sample.

Statistical measures were calculated for the sand fraction of each sample to evaluate sedimentation processes that deposited sand on the ridge (Table 1). Silt and clay content was not included in these calculations because fines can be translocated through the profile by pedogenesis. Mean grain size ranged from 1.40ϕ to 1.68ϕ (medium sand) for sediment on the ridge and is 0.95ϕ (coarse sand) for the stream sample (alluvium). Standard deviation calculations measured the spread in *phi*

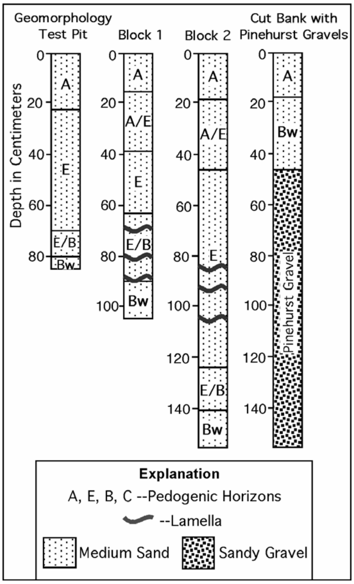

Figure 3. Field logs of profiles for excavation Blocks 1 and 2 and the geomorphology test pit on the ridge at site 31MR205. The profile for the cut bank with the outcrop of Pinehurst gravels was described on the ridge north of site 31MR205.

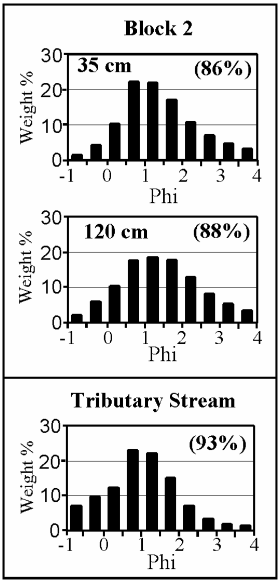

Figure 4. Histograms showing particle-size distribution of sand fraction for two sediment samples collected from the profile of Block 2 and the stream sample. Sand percentage of total sample is shown in parentheses.

Table 1. Statistics Calculated for the Sand-Size Fraction of Sediment Samples Collected at Site 31MR205.

Sample	Coarsest 1% of Sample	Mean	Standard Deviation	Skewness
B1-20 cm	-0.25ϕ	1.67ϕ	0.91ϕ	0.11
B1-45 cm	-0.50ϕ	1.68ϕ	0.98ϕ	0.06
B1-65 cm	-0.60ϕ	1.57ϕ	1.05ϕ	0.03
B1-80 cm	-0.65ϕ	1.60ϕ	1.08ϕ	0.01
B1-100 cm	-0.8ϕ	1.45ϕ	1.09ϕ	0.02
B2-10 cm	-0.39ϕ	1.47ϕ	0.94ϕ	0.20
B2-25 cm	-0.45ϕ	1.52ϕ	0.95ϕ	0.19
B2-35 cm	-0.50ϕ	1.47ϕ	0.96ϕ	0.19
B2-45 cm	-0.35ϕ	1.55ϕ	0.95ϕ	0.17
B2-55 cm	-0.3ϕ	1.48ϕ	0.94ϕ	0.15
B2-80 cm	-0.5ϕ	1.50ϕ	0.97ϕ	0.16
B2-100 cm	-0.60ϕ	1.47ϕ	1.01ϕ	0.10
B2-120 cm	-0.80ϕ	1.48ϕ	1.04ϕ	0.00
B2-135 cm	-0.80ϕ	1.40ϕ	1.07ϕ	0.08
B2-145 cm	-0.75ϕ	1.48ϕ	1.02ϕ	0.05
Stream	-1.30ϕ	0.95ϕ	0.95ϕ	-0.04

units of each sample, and this ranged from 0.94ϕ to 1.09ϕ in the ridge sediment. The alluvium was also well sorted with a standard deviation of 0.95ϕ (Table 1).

A skewness value of 0 indicates a symmetrical distribution curve. The distribution curves of the ridge samples are symmetrical or positively skewed, ranging from 0.0 to 0.2 (Table 1 and Figure 5). A positively skewed sample indicates excess fine-grained sediment in the curve. The alluvium was negatively skewed with a value of –0.04, indicating higher percentages in the coarse end of the distribution curve.

Standard deviation, skewness, and the coarsest 1% phi size were plotted with mean grain size to evaluate trends in sample populations (Figure 5). These graphs clearly distinguish the alluvium from the ridge samples. Separate populations were also identified within the ridge samples. Samples collected at and above 80 cm in Block 2 and 45 cm in Block 1 could be distinguished from sediment samples collected lower in the profiles (Figure 5). The shallower samples are more positively skewed, have a standard deviation less than 1.0, and also have a slightly finer grain size in the coarsest 1% of the sample.

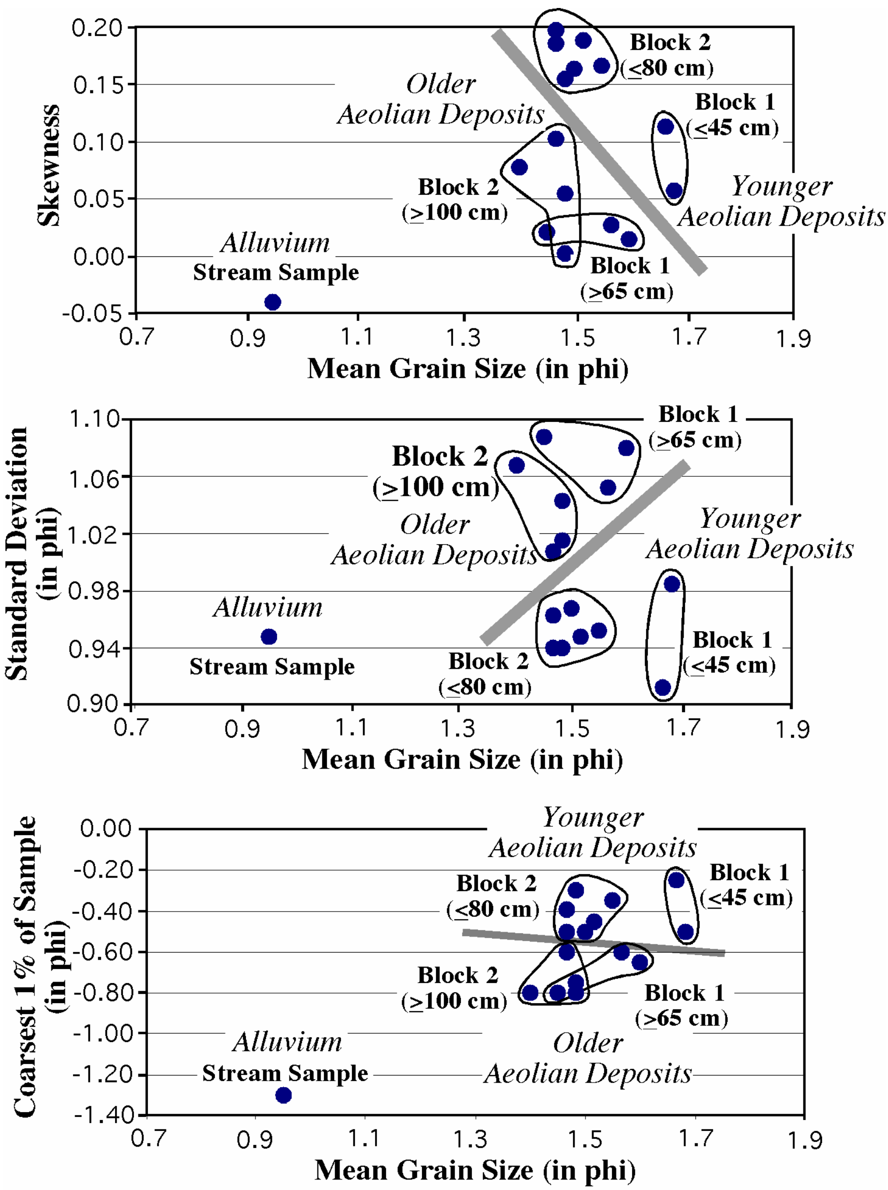

Figure 5. Mean grain size plotted with skewness, standard deviation, and the coarsest 1% of each sample. These graphs clearly distinguish between alluvium and aeolian sediment at 31MR205. There are also distinguishable populations of younger and older aeolian deposits.

Interpretations and Discussion

The soil profile at the cut bank on the ridge north of site 31MR205 has a plow zone resting directly on an older B-horizon. This is a truncated soil profile and indicates that this northern ridge is an erosional landform. The gravel outcrop below this thin soil profile is the lower alluvial member of the Pinehurst Formation. This Pinehurst alluvium underlies the aeolian sand on the ridge at 31MR205, as these gravels were observed eroding out of the eastern end of this ridge (Figure 2).

The pedogenic profiles change across the ridge as the depth to the B-horizon increases from southwest to northeast. Soil development is dependent on many factors, but these factors do not vary across this ridge except for slope. The geomorphology test pit and Block 2 are both on the ridge slopes, but show the greatest contrast between profiles. The A- and A/E horizons in profiles of Blocks 1 and 2 were ~40 cm thick, in contrast to the profile of the geomorphology test pit which has an A-horizon only ~20 cm thick. The difference in the soil profiles across the ridge is not attributed to pedogenesis, but is interpreted as resulting from erosion and sedimentation.

Two depressions or concave areas were observed along the southern slope of this ridge. These depressions are interpreted to have formed by wind erosion on the upwind side of the ridge, a process similar to the formation of "blow outs" on the stoss side of parabolic dunes. Erosion along the southwest slope would be consistent with the absence of an A/E-horizon and the shallower B-horizon in the geomorphology test pit.

Sediment in Blocks 1 and 2 is interpreted to have been deposited by aeolian processes. These deposits have an average mean grain size of 1.46ϕ, which is in the range of medium sand, and contain a low percentage of fines (11% to 19%). Histograms show a rapid decrease in the percentage of particle sizes larger than 0.5 *phi* (0.7 mm), and the coarsest 1% is not greater than –0.8ϕ (1.7 mm). Wind blowing across this ridge primarily transported sand grains up to coarse sand (0.5ϕ) in size. Wind is a very effective sorting agent. Most of the silt and clay size particles transported along with the sand would have been carried beyond the ridge. This aeolian sediment has a positively skewed particle-size distribution. The distribution curve of aeolian deposits tends to be truncated on the coarse end of the curve because there is an upper limit to the sand size that the wind can transport. In contrast, the stream sample is negatively skewed because the fine end of its distribution curve is truncated as fine and very fine sand is transported downstream. Stream currents are able to transport much coarser sediment than wind, and this is reflected in the greater mean grain size (0.95ϕ) and size of the coarsest 1% of the stream sample (-1.3ϕ).

Sedimentology of shallow samples in Block 1 (≤45 cm) and Block 2 (≤80 cm) is different from the underlying strata, as shown by the separate populations distinguished on the statistical graphs (Figure 5). These sedimentological differences can also be observed on the histograms of the two samples from Block 2 (Figure 4). This change in sedimentology with depth is evidence of stratification within the aeolian deposits. The upper aeolian stratum is thicker at Block 2 (~80 cm) on the lee side of the ridge than it is at Block 1 (~45 cm) on the crest of the ridge. Thicker aeolian deposits accumulate on the lee side of these landforms. The buried cultural horizon occurs within the younger, upper strata. The highest concentration of artifacts is found at depths of 25–30 cm in Block 1 on the crest of the ridge and 35–40 cm in Block 2 on the lee side of the ridge (Gunn et al. 2003). This difference in depth of burial is not attributed to bioturbation, as that would result in a similar depth of burial across the site. The difference in depth of artifact concentrations indicates that the latest Holocene aeolian deposits on the northeast slope are 10 cm thicker than on the ridge crest.

A spring and several seeps or areas of wet soil were observed along the ridge slopes (Figure 2). The spring along the southern slope discharged across an exposure of gray to black sandy mud of the Cape Fear Formation. The fine-grained silt and clay in the Cape Fear Formation forms an aquiclude or relatively impermeable layer under the permeable Pinehurst Formation. Thus, surface water infiltrating down through the sand and gravel of the Pinehurst Formation forms a perched water table above the fine-grained Cape Fear Formation (Figure 6). The perched water table discharges at springs and seeps along this contact around the perimeter of the ridge. Springs discharging from the Pinehurst aquifer can be a fairly reliable source of clean water.

The Pinehurst Formation overlies the Cape Fear and Middendorf Formations on many of the ridges in the Sandhills (Conley 1962). The perched water table that forms in porous sediment of the Pinehurst Formation is probably the source of water for springs and seeps throughout much of the Sandhills. Thus, the stratigraphy and hydrogeology interpreted for 31MR205 (Figure 6) could be applicable to other archaeology sites in this setting.

Site formation processes interpreted at 31MR205 are used to construct a model of site burial by Holocene aeolian sedimentation (Figure 7). The prevailing wind direction is southwest to northeast. Site

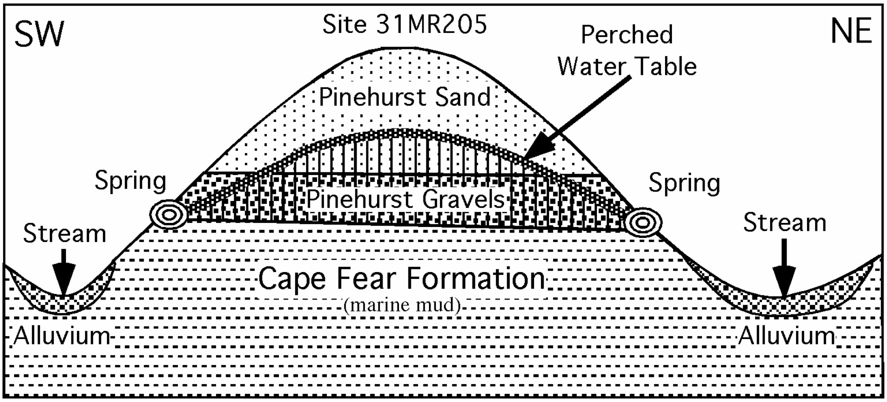

Figure 6. Schematic of stratigraphy and hydrogeology of the perched water table in the porous sand and gravel of the Pinehurst Formation. Springs occur on the ridge slopes along the contact with the low permeability sandy mud of the Cape Fear Formation. Drawing is not to scale.

31MR205 is downwind of a relatively linear floodplain with a fetch of ~500 meters (Figure 1). Wind from the southwest sweeps through this tributary valley and across the ridge. During periods of drought, alluvium in the stream valley is eroded from the floodplains and transported to the northeast by wind. Sand on the southwest or upwind slope of the ridge is also eroded and transported over the ridge (Figure 7). This erosion formed the two concave depressions or blowouts observed along this slope. Both the geomorphology and relatively thin soil profile on the southwestern slope can be attributed to an erosional or deflating surface.

Wind transports sediment up to and across the ridge crest, which then becomes a zone of sediment transport and deposition during periods of drought (Figure 7). As the wind blows over the crest of the ridge, the northeast slope is sheltered, forming an area of lower wind velocity and sediment deposition. Thicker deposits are expected on the northeast slope of the ridge, and aeolian sediment is at least 156 cm thick in Block 2.

These aeolian deposits are stratified, representing at least two different episodes of aeolian sedimentation. The slight differences in sedimentology between these strata could be due to different climatic conditions when they were deposited. For example, the lower unit could have been deposited during one of the long Pleistocene droughts during which active dune formation occurred throughout the Southeast (Ivester et al. 2001; Markewhich and Markewhich 1994). The upper stratum might have been deposited during a series of shorter Holocene periods of

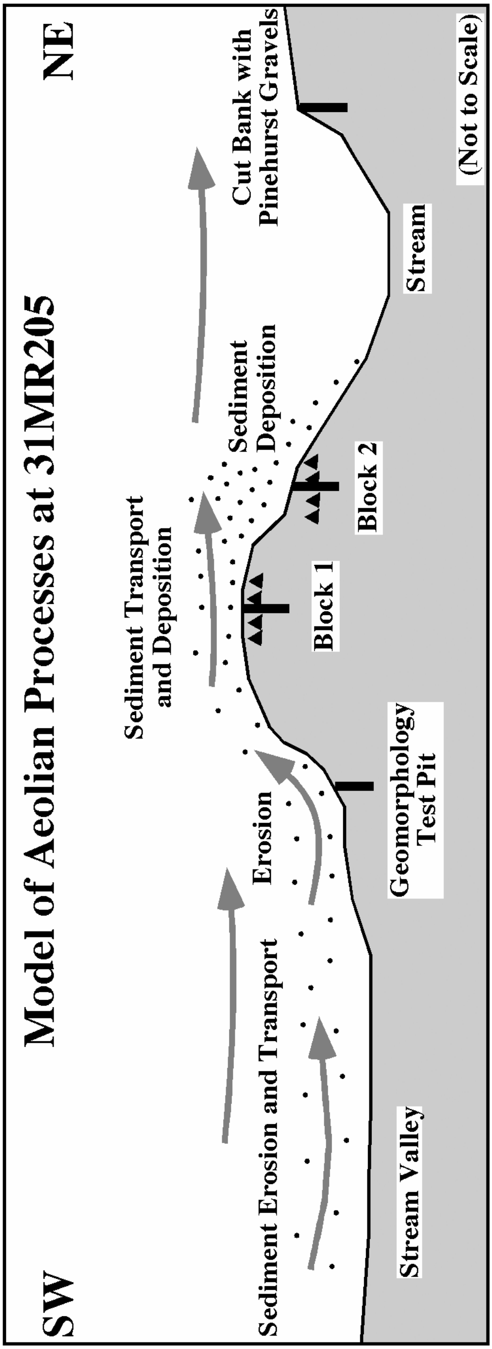

Figure 7. Model of site burial by Holocene aeolian sedimentation using interpreted sediment erosion and deposition across the ridge at 31MR205. Depositional environment changes across the ridge with erosion on the southwest slope and deposition on the northeast slope. Arrows indicate predominant wind direction, and buried artifacts are shown as triangles. Vertical exaggeration is used to show the subtle changes in slope observed across this ridge.

drought. Burial of the cultural horizon in the upper stratum indicates that the most recent aeolian sedimentation in the Sandhills area occurred during a Late Holocene drought. Site occupation could have occurred between periods of drought when food and water resources would be more abundant.

The work of Petersen (2001) and Petersen and Mohler (2002), along with the subsequent data recovery (Petersen 2002; Gunn et al. in press) and this geoarchaeological investigation, provide additional evidence of site burial and preservation in the sandy soils of the Coastal Plain. However, further geoarchaeological studies are needed to determine the timing and extent of Holocene aeolian sedimentation events. These studies should use sedimentology to interpret site formation processes and identify cultural horizons buried in aeolian deposits. These data can be analyzed for evidence of stratigraphy where sites occur in the massive surficial sands common on the Coastal Plain. Archaeological data such as diagnostic artifacts and cultural associations can be used in conjunction with Quaternary dating methods to determine the age of these aeolian deposits. A clear understanding of past Holocene climatic conditions and the timing of aeolian sedimentation events then can be used to construct and refine predictive models for site burial and preservation on the Coastal Plain.

Conclusions

The significant results of this study can be summarized as follows:

1. The cultural horizon at 31MR205 is buried in an aeolian deposit. The aeolian sediment is 81% to 89% sand. The sand fraction of these deposits has an average mean grain size of 1.48ϕ, an average standard deviation of 0.95ϕ, and is positively skewed. This is the upper member of the Pinehurst Formation which is prevalent on ridge crests in the Sandhills.
2. Analyses of statistical measures show distinct shallow and deeper deposits in the two excavation blocks sampled for this study. This is evidence of stratification in what initially appeared to be a massive sand.
3. Geomorphology and pedologic descriptions indicate sediment erosion on the southwest ridge slope and deposition on the northeast ridge slope.
4. Post-occupation aeolian deposits are at least 10 cm thicker on the northeast slope than on the ridge crest.

5. The porous sand and gravel of the Pinehurst Formation forms a perched water table that discharges to seeps and springs around this ridge. The location of site 31MR205 near these springs suggests that they were utilized by Native Americans.
6. The model of site burial by Holocene aeolian sedimentation can be used to evaluate site formation processes at other archaeological sites in sandy Coastal Plain soils.

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