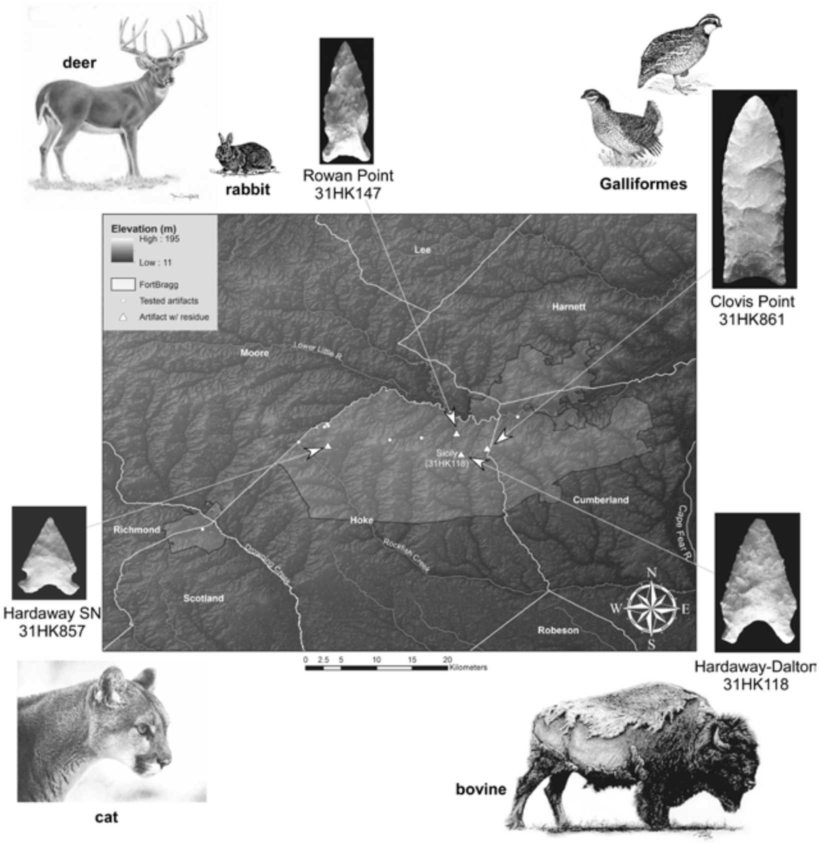
North Carolina Archaeology



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THE SETTLEMENT ECOLOGY OF MIDDLE-RANGE SOCIETIES IN THE WESTERN NORTH CAROLINA PIEDMONT, AD 1000–1600

by

Eric E. Jones

Abstract

From AD 1000–1600, the western North Carolina Piedmont was home to both hierarchically organized Mississippian societies and egalitarian Piedmont Village Tradition (PVT) societies. Given the spatial proximity of these groups and evidence of interaction between them, this is a prime area for studying the comparative geography and ecology of middle-range societies (traditionally labeled tribes and chiefdoms). In this work, I analyze regional settlement patterns of and natural landscapes around Mississippian and PVT sites in the Yadkin-Pee Dee and Catawba River valleys using a combination of geographic information systems (GIS) to measure characteristics and discriminant function analysis to compare sites. The goal is to describe and explain the environmental factors that influenced the geographic distribution of sociopolitical complexity in the western North Carolina Piedmont. The site-specific results show clear differences in settlement location choice between Mississippian and PVT settlements. The landscape results show that Mississippian and PVT communities inhabited areas with different resource concentrations, suggesting that ecology played a role in the distribution of complex societies. This work is the first stage of a larger project aimed at understanding why complexity arose and persisted in particular locations throughout the Piedmont Southeast after AD 1000.

This research examines the factors that influenced the geographic distribution of Mississippian and Piedmont Village Tradition (PVT) communities in the western North Carolina Piedmont from AD 1000–1600. The goal is to provide an explanation for why complex sociopolitical organizations were created and persisted where they did. Investigations of why complex Mississippian polities formed where they did are not new. In their individual research into the geography of Cahokia, Milner and Pauketat both presented conclusions that the ecological relationships between people and their natural and cultural environments played a considerable role in the emergence of sociopolitical hierarchies in particular places in the American Bottom.

> The most desirable places—that is, those areas most intensively occupied during the Emergent Mississippian and subsequent Mississippian periods—

> had roughly equal amounts of dry ground for crops, permanent lakes and swamps, and frequently inundated low-lying ground. [Milner 1998:167]

> That Cahokia, for instance, emerged in the middle of a wide patch of Mississippi River floodplain but close to a wedge of upland prairie soils is no accident. [Pauketat 2004:42]

> The overall "ethnoscape" of the Mississippi Valley at contact was complex, indicating an equally complex history of local developments, migrations, exchanges, and intermittent encounters of peoples along the Mississippi leading up to AD 1050. [Pauketat 2004:44]

They are two of a handful of researchers (also Beck and Moore 2002; Meyers 1995) to examine the settlement ecology—the factors that influenced settlement patterns and processes—of a Mississippian polity as a way of exploring the geography of sociopolitical complexity, or why complexity arose where it did. The distribution of hierarchical communities and societies across the Eastern Woodlands had important reflexive relationships with natural resources and culturally constructed landscapes. They arose in particular places for particular reasons, and their placement had subsequent wide-ranging impacts on the environment, landscape, and history of eastern North America, including the modification of landscape (Demel and Hall 1998; Lewis et al. 1998), trade (Johnson 1994), warfare (Milner 1999; Steinen 1992), and interactions with European colonizers (Jones 2014; Milner et al. 2001).

While researchers have identified potential factors behind settlement patterns for particular Mississippian polities in the Southeast (Beck and Moore 2002; Meyers 1995), the next necessary step is to empirically test them. The research described here is an early step in using settlement ecology theory and spatial and statistical analyses to accomplish this goal. Settlement ecology is the study of human interaction with surrounding natural and cultural landscapes, and how these relationships influence settlement patterns and processes. The basic assumption is that human settlement is a behavioral reaction to our surroundings. That is, we place ourselves on the landscape strategically with respect to particular resources, places, and other communities and societies. As a result, if we can establish significant spatial correlations between past settlements and various features of the surrounding environment and landscape, we can make conclusions about past human behaviors that created the observed patterns.

This is the first stage of a larger research venture. As such, it works with a small sample, does not distinguish different Mississippian traditions, and is synchronic. These are all complexities that will be addressed once a baseline of settlement ecology is established with this work. In this project I comparatively study—using geographic information systems (GIS) to reconstruct past landscapes and settlement patterns and discriminant function analysis (DFA) to establish spatial relationships—the settlement ecology of a sample of communities with and without evidence of complex sociopolitical organization (defined below) in the western North Carolina Piedmont from AD 1000–1600. This includes communities displaying Mississippian traits and Piedmont Village Tradition (PVT) communities in the Yadkin-Pee Dee and Catawba River valleys (Figure 1). I do this to determine the ecological factors that influenced the settlement location choices of each group. I then broadly characterize the landscapes in the Mississippian areas (the upper Catawba and Pee Dee River valleys) and the PVT area (the upper Yadkin River valley). The initial goals of this research are: (1) to compare Mississippian and PVT settlement location choices; and (2) to compare the landscapes around these two groups with respect to the factors influencing these choices. The larger goal is to use these results to theorize about the role environment and landscape played in the distribution of complex societies in the North Carolina Piedmont.

Background

Terminology

I use the term *chiefdom* very sparingly throughout this work because it is defined as a regional entity composed of multiple communities (Earle 1991). Like Boudreaux (2008:5–6), I focus more on the community scale than the polity/society scale, so using the term would be inappropriate in this work. I do use the term *complexity*, and I define it as the existence within a community or society of unequal access to economic resources or social or political status positions. At this point in this research I am not examining differing degrees of complexity, only its presence or absence. In the Piedmont, and the Southeast in general, complexity tends to correlate with the existence of Mississippian cultural traits (described in more detail below). Not all complex societies in the Southeast displayed Mississippian traits; the Powhatan in southeastern Virginia are a good example of this. However, in the western Piedmont, this correlation has held through over a century of archaeological investigation with a few idiosyncrasies in the Yadkin-Pee Dee River valley, as I describe below.

Many archaeologists, based on historically recorded place names, purport that Siouan speakers inhabited most of the North Carolina Piedmont from AD 1500 on, and that Iroquoian speakers inhabited the

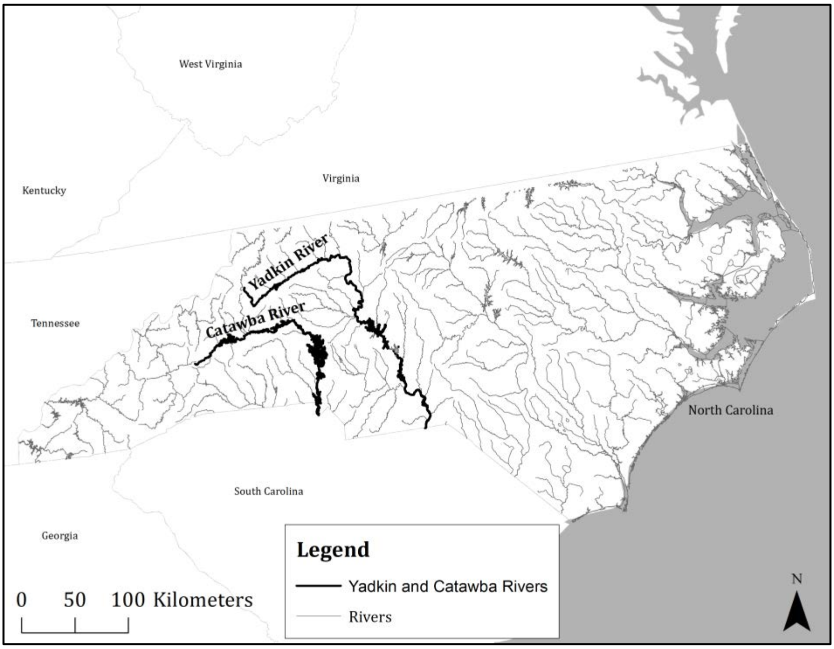

Figure 1. Location of the Yadkin-Pee Dee and Catawba Rivers in North Carolina.

Appalachian Mountains to the west and coastal plain to the east (Mooney 1894; Sturtevant 1958). Material culture distinctions (i.e., pottery styles, house forms, and burial styles) correlate positively with the proposed Siouan and Iroquoian language areas and show continuity through time. I address this debate here for two reasons. First, it shows that several lines of evidence place a linguistic and material culture boundary to the west of the upper Yadkin River valley, suggesting an ethnic boundary. Second, PVT cultures are sometimes referred to as "Siouan" or "Woodland". The former term can be confusing because Pee Dee people who lived a Mississippian lifestyle may have been Siouan speakers (Coe 1995). Woodland is also problematic because it is associated with the Late Woodland time period, which can refer to either pre-Mississippian or non-hierarchical societies contemporaneous with Mississippian. As a result of these potentially confusing terms, I use Piedmont Village Tradition because it is based on spatial and temporal patterning of material culture and associated behaviors.

Brief Cultural History of the Western North Carolina Piedmont

Occupation of the North Carolina Piedmont (NCP) extends back over 10,000 years as evidenced by scattered Paleoindian lithic tools and debitage across the region (Ward and Davis 1999:37). Settlement focused on the major river valleys during the Early Archaic Period, but expanded to interriverine zones during the Middle Archaic. Evidence from South Carolina suggests that river valleys were still occupied more intensively during this period despite this expansion (Blanton and Sassaman 1989:61–62). During the Late Archaic, groups became more sedentary and included local domesticates into their diets (Yarnell and Black 1985). However, they did not leave any strong evidence of burgeoning social distinctions (Ward and Davis 1999:64) as is seen in other areas of the Eastern Woodlands at this time. Around 3000 BP in the Southeast, plant domestication intensified (Smith 1986), and in the Piedmont this resulted in the development of the Piedmont Village Tradition, marked by distinctive ceramic styles, more settled life, and swidden agricultural practices (Coe 1964; Davis and Ward 1991; Dickens et al. 1984; Woodall 1990, 1999, 2009; Simpkins 1987; Ward and Davis 1993). This tradition lasted in many areas of the Piedmont until the early 1700s.

Several archaeological investigations in the upper Yadkin River valley have confirmed the presence of PVT communities in this particular area of the Piedmont (Woodall 1984, 1990, 1999, 2009; Jones et al. 2012; Jones and Ellis n.d.). Settlement during this time largely focused on the floodplains. More sites and more permanent occupations suggest that overall population in the valley increased after AD 800 (Woodall 1990:83, 91). Community size may have been growing during this time because two of the largest sites, Donnaha and Forbush Creek, have returned dates in the AD 800–1100 range. After AD 1200, sites tend to be smaller, suggesting either a decline in population or dispersal of people into smaller communities. Evidence of warfare has been identified in the Dan, Eno, and Haw River valleys of the Piedmont but is interestingly absent at sites in the Yadkin River valley (Coe 1964:92–93; South 1959:272–275; Ward and Davis 1999:96–98; Woodall 1984, 1990, 1999, 2009).

Mississippian traits, specifically those of the South Appalachian Mississippian tradition, appear along the Catawba River and the extreme upper Yadkin River after AD 1400 (Beck and Moore 2002:201). They are often referred to as Lamar Mississippian (Moore 2002). The traits that define Lamar include platform mounds, steatite tempered pottery (referred to as Burke series in North Carolina but are similar to Georgia Lamar series), and sociopolitical and socioeconomic hierarchies observed in burial and domestic contexts (Moore 2002). Many of these

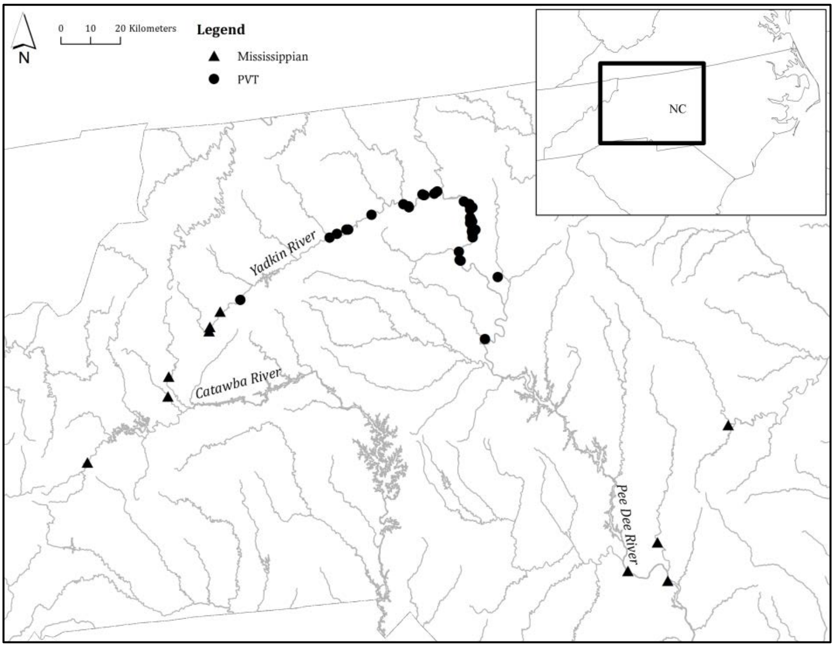

Figure 2. Locations of the sites used in this study.

communities persisted until the arrival of the Spanish in the mid-sixteenth century and were documented during their travels into the region (Moore 2002).

Mississippian traits also appear along the tributaries of the Pee Dee River after AD 1000, and the corresponding sites are thought to have been occupied by Pee Dee migrants from the south (Boudreaux 2007:9; Coe 1995; Oliver 1992). The most well-known site from this migration is Town Creek. There were also a small number of settlements without mounds, such as Leak and Teal, which were also Pee Dee and associated with Town Creek (Oliver 1992). Thus, from AD 1000–1600, both egalitarian PVT and hierarchical Mississippian communities inhabited the western Piedmont of North Carolina (see Figure 2).

History of Archaeological Research in the Western North Carolina Piedmont

The Piedmont has a long history of archaeological investigation of settlement patterns at several scales of analysis covering several time periods (Coe 1964, 1995; Thomas 1887:61–75, 1894:333–350; and see Ward and Davis 1999:6–23 for an overview). The Yadkin River valley has itself been the focus of settlement research for several decades

(Barnette 1978; Beckerman 1986; Jones et al. 2012; Jones and Ellis n.d.; Woodall 1984, 1990). As a result, 30 PVT sites have been identified as settlements. From these sites, we have a basic understanding of subsistence, social and political organization, and economic organization.

Extensive excavations have occurred at five PVT sites in the upper Yadkin River valley, and a large part of the valley has been surveyed (Woodall 1984, 1990). Rogers (1995) explored the sociopolitical organization of the upper Yadkin River valley based on the site size results from the surveys and presented a compelling case for the heterarchical sociopolitical organization of communities. Woodall (1999, 2009) examined the relationship between Mississippian and PVT societies in the extreme upper end of the valley and found evidence of interaction with Mississippians at two sites: T. Jones (31Wk6) and Porter (31Wk33). T. Jones is the closest PVT settlement to the Mississippian communities to the west, followed by Porter, which is approximately 15 miles downstream. Both sites were occupied at similar times; radiocarbon dates at Porter range from AD 1500–1600 (Woodall 1999) and at T. Jones from AD 1400–1600 (Woodall 2009). Woodall identified a small number of burials at both sites with shaft tomb construction and objects with Southeastern Ceremonial Complex motifs. These burials looked distinctly different from typical PVT burials but similar to those at Mississippian sites (Woodall 1999, 2009). At the Porter site, changes in pottery construction techniques to resemble Mississippian styles offer further evidence of interaction (Woodall 1999:66). The T. Jones site also shows evidence of Mississippian leisure activities (Woodall 2009). It is just unclear what those interactions looked like exactly. The AD 1300–1400 Redtail site (31Yd173), approximately 20 miles downstream from Porter, and the AD 800–1300 Donnaha site show no evidence of Mississippian influence. Thus, archaeological evidence supports the conclusion that after AD 1400 there was interaction across the PVT-Mississippian boundary.

Research into Western Piedmont sites with platform and conical mounds dates back to the late 1800s (Spainhour 1873; Thomas 1887, 1891, 1894). Systematic and consistent work by professional archaeologists began in the Catawba River valley in the 1960s and identified dozens of Mississippian sites (Moore 2002: 56). During this work, archaeologists discovered and studied several important sites that helped to establish Burke pottery chronology, the cultural evolution of Mississippian societies, and the development of sociopolitical hierarchies. Those sites include McDowell and Berry, which have both been sites of extensive archaeological research (Moore 2002). Town Creek is perhaps the best-known Mississippian site in Piedmont North Carolina and has been the subject of professional archaeological research since the 1930s (Boudreaux 2008; Coe 1995; Reid 1965; Ward and Davis 1999:122). Oliver (1992) examined two sites, Leak and Teal, having similar cultural traits to Town Creek and used them to refine the chronology for Pee Dee occupation in southern-central Piedmont.

We are not certain why Mississippian traits and complexity occur only in particular locations within and around the Western Piedmont. Mississippian societies existed to the west and south of the upper Yadkin River valley but never there. The Mississippian sites discussed above occur along the fringes, either in the transition to Appalachian uplands or the edges of the coastal plain. Thus, we know those environments and landscapes were different from those firmly in the Piedmont, but how were they different? Beck and Moore (2002) proposed environmental diversity and proximity to trade routes as reasons why complexity occurred in the upper Catawba River valley and not in the upper Yadkin River valley, but these ideas have not been tested. In addition, we are not sure why some PVT communities began showing Mississippian traits and others did not. Answering questions associated with these trends is important for a discussion of the geography of complexity in North Carolina and eventually the wider Southeast.

With this in mind, I present two scenarios. The first is that there were no environmental restrictions to the establishment of complex societies in the Piedmont. The influence of Mississippian societies was spreading down the Yadkin River valley, as evidenced at the T. Jones and Porter sites, and had not yet reached downstream communities by AD 1600 when it was disrupted either by European presence the area or another cause. This scenario asserts that the distribution of complex societies and communities across the region is primarily explained by historical events. To support this scenario, analyses should show that the respective Mississippian and PVT landscapes (i.e., the areas around these sites) look similar with regard to the individual landscape features that influence each group's settlement location choices.

The second scenario is based on Beck and Moore's (2002) aforementioned ideas that there were environmental or sociopolitical factors tied to landscape that explain why complexity was restricted to certain areas near or on the edges of the Piedmont. That is, complexity could not develop in some areas because environmental or cultural characteristics of those areas (i.e., resource productivity, access to trade networks, areas of resource competition, etc.) did not allow for the necessary preconditions. To support this scenario, the analyses should show that the Mississippian and PVT landscapes look different with regard to the landscape features that influence their respective settlement location choices.

Overview of Research on the Geographic Distribution of Complex Societies

As mentioned earlier, exploring the geographic distribution of complexity has only been done in a few studies. In addition to Milner's (1998) and Pauketat's (2002) work, two projects have explored the ecological setting of chiefdoms in the Southeast. The first is the aforementioned study by Beck and Moore (2002) of the Catawba River valley Mississippian communities. The second is by Meyers (1995), who examined the role of soil productivity in the placement of chiefdoms in northeast Georgia, concluding that soil diversity was more important than soil quality. Both of these studies conducted extensive settlement pattern and landscape work to identify possible spatial correlations between Mississippian settlements and various environmental and landscape features.

The next step in the process of establishing spatial patterning is to test these relationships to determine significance. A simple example explains why this is necessary. If we examine a sample of 10 settlements and seven of them are located within loamy soil, which is best for growing corn, we could conclude that loamy soils were impacting decisions of where to live. However, if 70% of the study area is loamy soil, our result of 70% is exactly what we would expect if people chose settlement locations randomly with respect to soil texture. Thus, our initial observation may be assuming intentionality where there was only randomness. Determining significance requires statistical testing of spatial relationships between settlements and a large number of factors, which is the focus of this study.

Because research into the geography of complex societies is related to the broader study of why complexity arises, it is important to discuss this area of research. Studies from eastern North America have presented a variety of factors as causes for the emergence of complexity, including adoption of maize and associated feasting, increases in interregional contacts and exchange, competition and conflict, resettlement/migration, and ritual control (Blitz and Lorenz 2006; Boudreaux 2007; Cobb and Butler 2006; Hammerstedt 2005; Kelly 1990; Milner 1996; Pauketat 2003; Scarry 1996). In the Southeast, difficulties in identifying even a small group of causes are attributed to environmental and cultural diversity (Scarry 1996). Theories often discuss the introduction of a new resource, such as maize (Milner 1996; Scarry 1990, 1996) or exotic raw materials or goods (Milner 1996; Rogers 1996) into a system with already present but incipient signs of status differences. These new items promoted population increases (Kelly 1990) or catalyzed status gains for particular individuals or groups at the expense of others. Some hold that warfare and competition allowed certain members of society to gain status, especially those who gained control of essential resources, restricted access to them, and establishing inherited leadership positions (Milner 1996). Eventually, people are drawn to these "wealthy" individuals. Many of these explanations are offered with the caveat that they require more testing, and the incredible diversity across the region prevents attempts to generalize from them. To clarify these relationships, several researchers (Anderson 1999; Cobb and Garrow 1996; Smith 1990) have suggested taking a multiscalar approach to explore the multitude of exogenous and endogamous factors that may have caused chiefdom formation.

In the North Carolina Piedmont, Beck and Moore (2002:202) proposed that richer and more diverse environments in particular locations led to larger and more permanent populations and the ability for some to pursue Mississippian strategies, like those listed above. Without the need for population fission in these productive locations, emergent leaders could maintain a large group of followers and acquire more resources. Access to trade routes would have allowed them use that wealth to obtain exotic materials and objects that would have become prestige goods (Anderson 1999:225). Woodall's (1999, 2009) results from T. Jones and Porter suggest that prestige goods and even the migration of Mississippians were part of interactions between Mississippian and PVT communities. Researchers in other regions suggest that prestige goods were a way to form alliances (Brown et al. 1990:253). This is one possible explanation for the patterns in the upper Yadkin River valley.

These hypotheses can be used to guide research into the factors behind the spatial distribution of chiefdoms by identifying their geographic components. For example, particular soil types, topographic features, and microclimates promote agricultural production. Examining the spatial relationships between settlements and these features could indicate whether communities were choosing locations that optimize agricultural production. Similarly, the defensibility of settlements can be assessed through viewshed and topographic analysis, indicating how influential warfare was in settlement location choice. These examples display how particular locations on the landscape may have promoted activities like agricultural production, population aggregation, or warfare that led to the development of hierarchical sociopolitical structures.

Methods

The first step in this research was to collect a sample of Mississippian and PVT settlement sites (Figure 2 and Table 1). I chose 10 Mississippian sites from existing publications. For Town Creek, Teal, Leak, and Payne, I used descriptions and maps from Coe (1995). For Berry, McDowell, 31Bk17, Broyhill-Dillard, Jones Mound, and Nelson, I used Moore’s (2002) descriptions and maps. Teal, Leak, and Payne are not mound sites, but they are settlements linked culturally to Town Creek and show many South Appalachian Mississippian traits (Oliver 1992; Ward and Davis 1999). Nelson is a burial mound excavated in the late nineteenth century with an assumed associated settlement, and Broyhill-Dillard does not have a mound but is closely associated with the Lenoir burial pit (Moore 2002). The locations of Jones Mound and Nelson site are not precisely known, but their estimated locations are adequate for this study because of the focus on large areas of landscape around sites.

For the PVT settlements, I focused on the upper Yadkin River valley because it contains the nearest PVT settlements to the Mississippian sites I use here. In addition, previous surveys (Barnette 1978; Jones et al. 2012; Woodall 1990) identified 30 settlement sites in the valley that date AD 1000–1600. Research in other Piedmont river valleys has focused more on settlements occupied after AD 1600 (Dickens et al. 1987; Ward and Davis 1993). The large number and contemporaneous dates made it possible to have a sample large enough to divide into multiple groups of 10 for comparisons of equal-sized samples as the Mississippian sites. This is important because finding similar trends across multiple statistical comparisons is a more significant find than a single comparison with a small sample size. Of the 30 Yadkin River valley sites, 24 were previously the subject of systematic surface collection or excavations, which provided strong evidence for their categorization as post-AD 1000 settlements. During earlier research, I confirmed the settlement status of six other sites in the upper Yadkin River Valley and confirmed broad occupation dates through ceramic analysis (Jones et al. 2012).

I divided these 30 PVT settlements into three groups of 10. Group 1 contains the 10 sites with the strongest evidence—radiocarbon dates and

Table 1. List of Sites Used in the Study.

Site Number	Cultural Affiliation	Group Number
31Yd2	Piedmont Village Tradition	Group 1
31Yd9	Piedmont Village Tradition	Group 1
31Yd173	Piedmont Village Tradition	Group 1
31Yd47	Piedmont Village Tradition	Group 1
31Yd95	Piedmont Village Tradition	Group 1
31WK6	Piedmont Village Tradition	Group 1
31Wk26	Piedmont Village Tradition	Group 1
31Wk33	Piedmont Village Tradition	Group 1
31Wk155	Piedmont Village Tradition	Group 1
31Fy245	Piedmont Village Tradition	Group 1
31Yd24	Piedmont Village Tradition	Group 2
31Yd32	Piedmont Village Tradition	Group 2
31Yd37	Piedmont Village Tradition	Group 2
31Yd41	Piedmont Village Tradition	Group 2
31Yd44	Piedmont Village Tradition	Group 2
31Wk27	Piedmont Village Tradition	Group 2
31De51	Piedmont Village Tradition	Group 2
31Fy153	Piedmont Village Tradition	Group 2
31Sr50	Piedmont Village Tradition	Group 2
31Sr58	Piedmont Village Tradition	Group 2
31Fy155	Piedmont Village Tradition	Group 3
31Fy202	Piedmont Village Tradition	Group 3
31Fy361	Piedmont Village Tradition	Group 3
31Sr57	Piedmont Village Tradition	Group 3
31Sr59	Piedmont Village Tradition	Group 3
31Yd34	Piedmont Village Tradition	Group 3
31Yd38	Piedmont Village Tradition	Group 3
31Yd45	Piedmont Village Tradition	Group 3
31Yd48	Piedmont Village Tradition	Group 3
31Yd132	Piedmont Village Tradition	Group 3
31Mg2	Mississippian	-
31Rh1	Mississippian	-
31An1	Mississippian	-
31Mr15	Mississippian	-
31Mc41	Mississippian	-
31Bk22	Mississippian	-
31Bk17	Mississippian	-
31Cw8	Mississippian	-
31Cw3	Mississippian	-
31Cw1	Mississippian	-

evidence of settlement features from excavations or intensive surveys—for long-term habitation and settlement after AD 1000. The other two groups have strong evidence, but not as conclusive as Group 1. Next, I reconstructed past environmental conditions using digital elevation models (DEM) from the U.S. Geologic Survey (USGS), sediment data from the National Conservation and Resource Service (NRCS), and hydrographic data from the state of North Carolina. Modern sediments and topography are reasonable to use because I address relatively recent time periods and these are relatively stable resources and features. The wetland data is somewhat problematic because of suburban and rural development. I discuss potential sources of error with these data in the results.

I then created catchments around each of the sites. Ethnohistoric, geographic, and historic studies have found that a 2 km radius is a good maximum distance to assume that swidden agriculturalists ranged to work in fields or gather daily materials (Chisholm 1968; Fecteau et al. 1991:5). In addition, Lawson (1967:52) describes Sapona Town on the lower Yadkin as having a clearing one-mile (1.6 km) square around it. From these data, I created 2 km-radius buffers around each settlement in ArcGIS and then modified these buffers to take into account the landscape and any impeding features that would restrict daily movements. For example, every settlement lies near a major river. I assumed that on a daily basis people were staying on their side of the river to collect resources and tend fields, as the resources would have been easier to monitor than those across a major river. Thus, I excluded the portions of the buffers on the opposite sides of major waterways. This created a unique catchment for each settlement (Figure 3).

I recorded 15 characteristics of each settlement, listed in Table 2. I then compared the measurements from the Mississippian settlements to those from the total group of PVT settlements and each individual group of 10 using discriminant function analysis in SPSS. Discriminant function analysis is statistically similar to multivariate regression analysis and compares two datasets, indicates whether they are significantly different with regard to their various characteristics, and which of those characteristics most distinguish them if they are different, represented by a function value (Poulsen and French, 2004; Sokal and Rohlf, 1995:679–680). The larger a function value is, the more that variable distinguishes the two datasets. It also indicates the dataset with the higher average value of a particular variable using positive or negative values. In this work, a positive value indicates that the

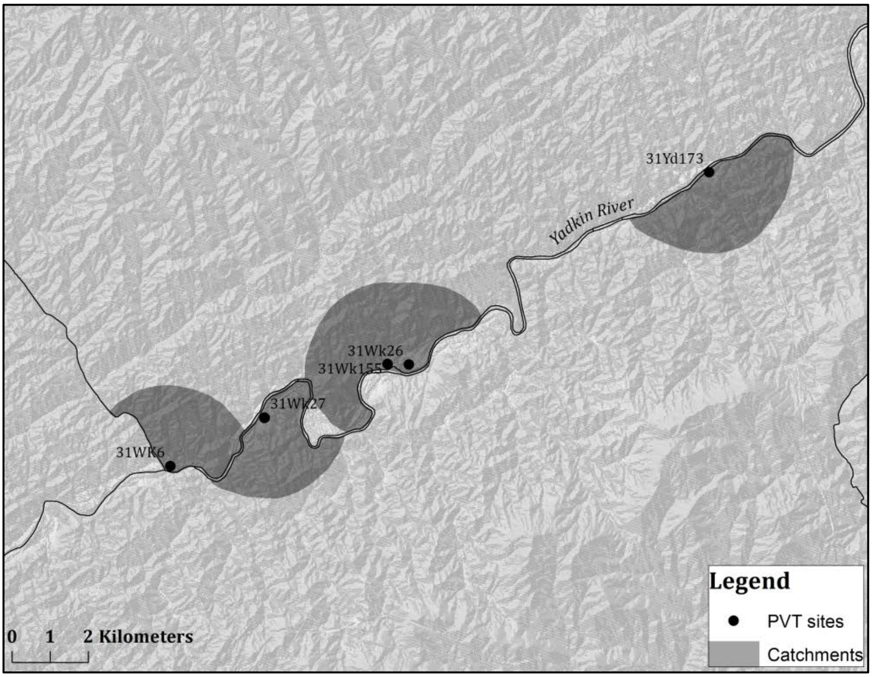

Figure 3. Catchments for a sample of the Piedmont Village Tradition (PVT) settlements.

Mississippian settlements had more of a particular feature within their catchment compared to the PVT settlements. This allowed me to not only determine if the settings of Mississippian and PVT settlements were different but also which landscape features most distinguished them and how.

Finally, I characterized the landscape of the upper Catawba and Yadkin-Pee Dee River valleys and three subareas within that landscape that cover the three different settlement clusters: (1) South Appalachian Mississippian (SAM) covers the Mississippian sites in the upper Catawba River and extreme upper Yadkin River valleys; (2) Pee Dee Mississippian (PDM) covers Town Creek and associated sites; and (3) PVT covers the upper Yadkin River valley PVT settlements (Figure 4). The results from the discriminant function analysis identified the features important to communities but not how the various landscapes look with regard to those features. That is, if one set of sites chose locations near a particular feature, did they do so in a landscape that was uniform with regard to that feature, or did they choose a particular area with more of that feature in a variable landscape? Answering this question will determine which of the aforementioned scenarios is best supported. I

Table 2. Variables Measured, How They Relate to Behavior on the Landscape, and How I Measured Them.

Variable	Activity	Measurement
Percent loam within catchment	Agriculture	Calculate percentage of 2km buffer covered by loam sediment types
Percent well-drained sediment in catchment	Agriculture	Calculate percentage of 2km buffer covered by well-drained sediment
Average solar radiation in catchment	Agriculture/ structure placement	Used slope from USGS 10m DEM and solar radiation tool in ArcGIS; parameters set for annual radiation for year A.D. 1500
Average slope within catchment	Agriculture	Used slope tool (measured in %) in ArcGIS on USGS 10 m DEM and Zonal Statistics
Average aspect within catchment	Structure, settlement, and field placement	Used zonal statistics on USGS 10m DEM
Area of good hardwood growth within catchment	Wood resources	Calculate m^2 of sediments conducive to tree growth (as defined by NRCS) within 2km buffer
Area of good conifer growth within catchment	Wood resources	Calculate m^2 of sediments conducive to tree growth (as defined by NRCS) within 2km buffer
Wetlands within catchment	Foraging	Count of wetlands of which any portion falls within with 2km buffer
Largest wetland within catchment	Foraging	Identification of the largest wetland within 2km buffer
Distance to tributary	Fresh water	Straight-line distance between site and nearest stream (as defined by NWI)
Slope at site	Structure placement	Used slope tool (measured in %) in ArcGIS at site point location on USGS 10m DEM
Aspect at site	Structure placement	Used aspect tool (measured as degree) in ArcGIS at site point location on USGS 10m DEM
Viewshed size	Intergroup relations	Used viewshed tool in ArcGIS using site location and USGS 10m DEM
Visible length of river	Intergroup relations	Measured the length of rivers overlapped by site specific viewsheds
Percent uplands in catchment	Wild resources	Measured percentage of catchment that overlaps with upland environments (i.e., non-floodplain)

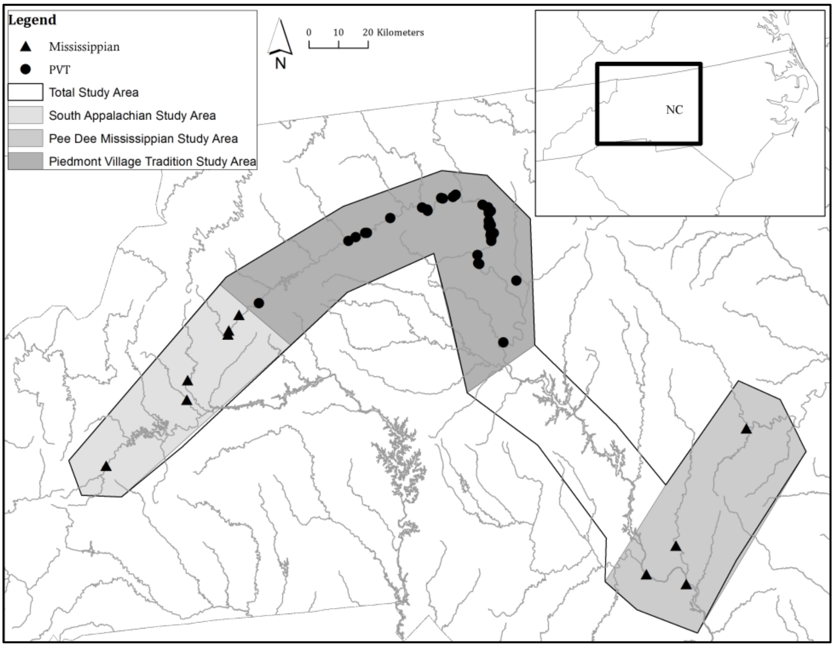

Figure 4. Areas used to characterize landscapes around the settlements.

measured the following characteristics: average wetland size within each area and wetland area, loam sediment area, good conifer-growing sediments, good hardwood-growing sediments, and well-drained sediments as a percentage of the total area. I also created histograms showing the number of 10x10 m cells in each study area with different slope percentage rise values and different aspects.

Results

All four discriminant function analyses—the comparison to all 30 PVT settlements and to each of the three groups of 10—returned significant *p*-values (<0.05). Many statisticians have begun rejecting *p*-values as a valid test of statistical significance (Cohen 1994; Gelman and Stern 2006; Goodman 1999; Lang et al. 1998; Rothman 1998; Ziliak and McClosky 2008). Thus, to further determine significance, I systematically removed variables from each of the four discriminant function analyses and observed the results. In each, the direction and ordering of the function values did not change drastically with different sets of variables, indicating that the results were significant.

Table 3 displays the results from the comparison of the set of 10 Mississippian settlements to the entire group of 30 PVT settlements. I determined qualitative degrees of influence on settlement location choice based on observations of natural breaks in the data, as shown in the table by the shading. The variables with the highest value indicate that Mississippian settlements had better visibility of adjacent rivers and better conifer growth within their catchments. The set of variables with the second highest values show that Mississippian settlements had larger wetlands within catchment and more slope at site locations, and that PVT settlements had more well-drained soil. Mississippian settlements also had larger viewsheds and better hardwood growth within their catchments.

Tables 4–6 show the results from my comparison of the Mississippian settlements to the three sets of 10 PVT settlements. I divided those results that I determined to be important based on three criteria: (1) those variables that are in the top three categories based on natural breaks and the same positive or negative value across all three comparisons; (2) those variables that are in the top three categories in two of the three comparisons and are the same value across all three; and (3) those variables that are highly ranked in only the first comparison (the group with the best evidence of long-term, Late Prehistoric settlement) and are the same value. The results that were highly ranked and had the same value across all three analyses indicate that Mississippian settlements have better conifer growth within catchment and more visibility of adjacent rivers. The results with the same value and highly ranked in two analyses show that Mississippian settlements have larger wetlands within catchment, better hardwood growth within catchment, and are located on terrain with more slope. These results also show that PVT settlements have more loam within catchment. The results with the same value and highly ranked in the first comparison show that Mississippian settlements have more slope in catchment and that PVT settlements have more wetlands within their catchment. These results were consistent with the results seen in Table 3.

The measurements of landscape characteristics (Table 7) show variability across the different culture areas. The SAM area has larger wetlands but less surface area covered by them. The PDM area has an average wetland size close to the overall average but more surface area covered by them. The PVT area has a higher percentage of loam sediments, much lower percentages of good conifer and hardwood-growing sediments, and higher proportions of well-drained sediments. The slope histogram (Figure 5) shows that the PDM and PVT areas are relatively similar with regard to slope. The PDM area has a higher

Table 3. Discriminant Function Results from Comparing the Mississippian Settlements to All 30 Piedmont Village Tradition Settlements.[1]

Variable	Function
River length visible	0.198
Percentage good conifer growth within catchment	0.183
Largest wetland within catchment	0.156
Percentage of well-drained soil within catchment	-0.155
Slope at site	0.149
Viewshed size	0.123
Percentage good hardwood growth within catchment	0.122
Average slope within catchment	0.098
Percent loam within catchment	-0.093
Wetlands within catchment	-0.087
Distance to tributary	0.082
Percentage of uplands in catchment	-0.064
Average aspect within catchment	-0.012
Aspect at site	-0.010
Average solar radiation within catchment	-0.003

[1] The shading highlights natural breaks in the results, showing the most influential factors.

Table 4. Discriminant Function Results from Comparing the Mississippian Settlements to Group 1 of the Piedmont Village Tradition Settlements.[1]

Variable	Function
Slope at site	0.088
Largest wetland within catchment	0.087
River length visible	0.083
Wetlands within catchment	-0.063
Percentage good conifer growth within catchment	0.053
Average slope within catchment	0.042
Percent loam within catchment	-0.037
Average solar radiation within catchment	0.028
Percentage good hardwood growth within catchment	0.018
Percentage of uplands in catchment	0.012
Average aspect within catchment	0.011
Distance to tributary	0.009
Viewshed size	0.008
Percentage of well-drained soil within catchment	-0.007
Aspect at site	0.006

[1] The shading highlights natural breaks in the results, showing the most influential factors.

Table 5. Discriminant Function Results from Comparing the Mississippian Settlements to Group 2 of the Piedmont Village Tradition Settlements.[1]

Variable	Function
Percentage of well-drained soil within catchment	-0.158
Percentage good conifer growth within catchment	0.156
Viewshed size	0.153
Percentage good hardwood growth within catchment	0.111
Slope at site	0.093
River length visible	0.090
Wetlands within catchment	-0.066
Distance to tributary	0.052
Largest wetland within catchment	0.051
Average slope within catchment	0.048
Percentage of uplands within catchment	-0.045
Percent loam within catchment	-0.033
Average aspect within catchment	-0.027
Average solar radiation within catchment	-0.024
Aspect at site	0.002

[1] The shading highlights natural breaks in the results, showing the most influential factors.

Table 6. Discriminant Function Results from Comparing the Mississippian Settlements to Group 3 of the Piedmont Village Tradition Settlements.[1]

Variable	Function
Percentage of well-drained soil within catchment	-0.111
Viewshed size	0.084
Percentage good conifer growth within catchment	0.058
Percent loam within catchment	-0.057
River length visible	0.045
Largest wetland within catchment	0.042
Percentage good hardwood growth within catchment	0.039
Percentage of uplands within catchment	-0.032
Distance to tributary	0.031
Average slope within catchment	0.025
Average solar radiation within catchment	-0.023
Slope at site	0.020
Wetlands within catchment	-0.019
Aspect at site	-0.012
Average aspect within catchment	-0.002

[1] The shading highlights natural breaks in the results, showing the most influential factors.

Table 7. Results from the Measurement of Landscape Characteristics for the Study Area and Specific Cultural Areas Within It.

Landscape Characteristic	Total Study Area	PVT Area	SAM Area	PDM Area
Average Wetland size	27,077m^2	27,849m^2	44,009m^2	27,816m^2
Wetland area as percentage of total area	3.50%	3.10%	2.40%	5.60%
Loam area as percentage of total area	47.60%	61.30%	45.70%	18.90%
Good conifer land area as percentage of total area	42.60%	24.50%	45.20%	57.60%
Good hardwood land area as percentage of total area	41.90%	24.50%	45.20%	54.70%
Well drained sediment area as percentage of total area	80.80%	89.50%	76.30%	62.00%

proportion of flat land because it contains coastal plain as well as piedmont. The SAM area has much more higher slope land than the other two areas. The aspect histogram (Figure 6) shows similarity between the SAM and PVT areas. The PDM area has a higher proportion of area covered by eastern and western facing slopes.

Discussion

Settlement Location Choice

Several trends in the results stand out, including the preference of Mississippian communities for better conifer and hardwood-growing sediments, locations with more visibility of the river, and locations near larger wetlands. Conifers include species like cedars, which are rot resistant (Blew and Kulp 1964, Krzyzewski et al. 1980, Purslow 1976, Warrick 1988), and were thus important building materials in some areas of eastern North America (Warrick 1988). Eastern red cedars are common across the Southeast and stands may have attracted settlement. Hardwoods would have also provided building material in addition to fuel for fires and food in the form of nuts (Kreisa et al. 2002; Rolingson and Mainfort 2002; Wetmore 2002). Thus, there are several reasons why communities would want to settle near denser stands of these trees. The role of tree resources in the formation of socioeconomic hierarchies is

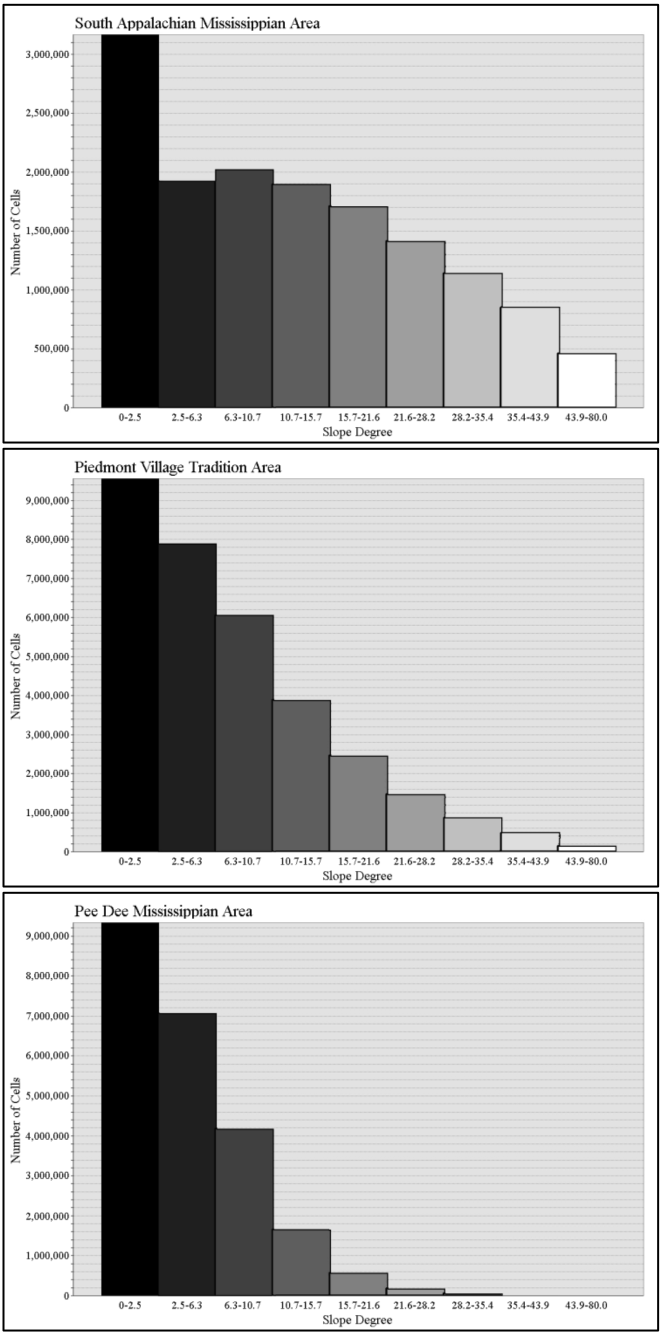

Figure 5. Histograms showing the number of 10x10m cells in each study area of a particular slope.

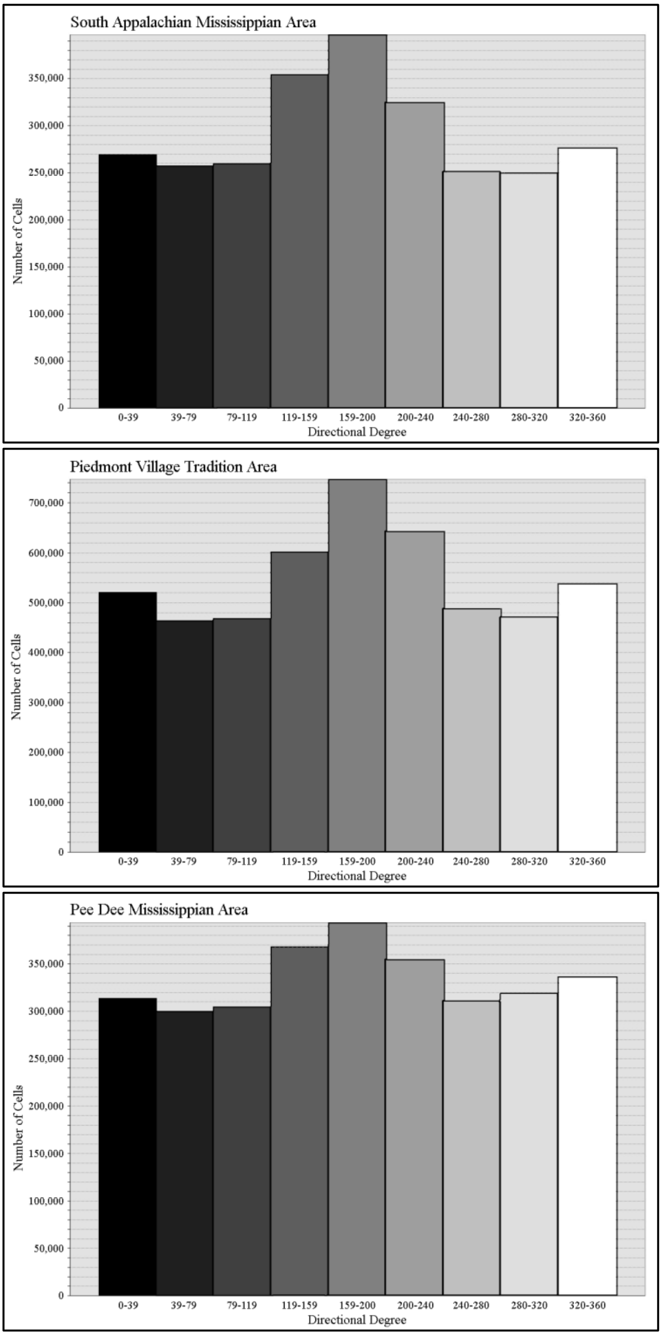

Figure 6. Histograms showing the number of 30x30m cells in each study area of a particular aspect.

not a commonly studied topic but is not entirely unheard of (see Gould 1975). Regardless, this result tells us that the general productivity of forests influenced Mississippian settlement location decisions. The most likely explanation for this finding is that these more productive forest areas allowed for larger populations and more permanent settlement, as Beck and Moore (2002) suggested with the area's diverse sediment profiles. As communities cleared forests for building materials and fuel, they would not have needed to move as frequently if forests were more densely populated within their catchments. This increased sedentism either set the stage for the appearance of complexity or was preferred by already complex communities.

The tendency for Mississippian settlements to be located near fewer but larger wetlands within their catchment compared to PVT settlements suggests more diversity in the environments surrounding Mississippian communities. This supports Beck and Moore's (2002) finding that ecotones were influential in the rise of complex Mississippian societies in the Appalachian foothills. In an earlier study, I found that PVT settlements on their own do not tend to spatially correlate with wetlands (Jones et al. 2012), even though they tend to have more wetlands in their catchments than Mississippian settlements. As mentioned, Milner (1998) credits wetlands and their associated resources as important factors in some individuals gaining an advantage over others during the formation of social status differentiation in the American Bottom. A similar process could have had an impact in the Piedmont Southeast. We must view these results with a skeptical eye, however. Even though most of the sites examined here are in rural areas with less development, farming and building activities over the last 300 years may have destroyed some wetlands.

Mississippian settlements also tend to have more sediment diversity within their catchments. Looking at the raw data, 40% of Mississippian settlements had catchments with all loamy soils; the percentage of PVT settlements with the same pattern was 70%. Mississippian settlements also tend to be in areas with more sediment drainage diversity, which has been cited as a possible risk management strategy (Jones 2010). In wet years, well-drained sediments will produce well. In dry years, more poorly drained sediments will produce well. Meyers (1995) and Beck and Moore (2002) both recognized this spatial relationship between Mississippian settlements and diverse environments, which are influenced significantly by sediment types, and it stands up to empirical testing here. Beck and Moore (2002) proposed that these areas would have supported a richer set of food resources and allowed for larger and more permanent populations. Furthermore, Pauketat (2002) suggested that access to diverse soil types likely played a role in intrasocietal resource variation, which ultimately played a role in the development of hierarchical social statuses at Cahokia. The forest, wetlands, and soil texture results show that Mississippian communities in the Piedmont were favoring areas that likely allowed for larger and more permanent populations. In fact, following Smith's (1978) original work on this subject, these results may be showing us not just an after-the-fact preference, but that complex Mississippian communities and polities in the Piedmont were more likely to arise in such locations that allowed for more permanent and larger human settlements.

Mississippian settlements having greater visual access to nearby rivers may be related to communication, economic control, or warfare. However, we must be careful to not read too much into these results. In a recent study, Jones and Ellis (n.d.) found that PVT settlements were disproportionately located in places that are not visible from the river. Closer inspection of settlement locations showed that this was most likely the result of a preference for larger floodplains located along river bends, which provide less visibility up and down the river. That said, I cannot rule out the possibility that Mississippian communities valued the visibility of the surrounding area, including rivers, which were significant transportation routes through the region. Overall, compared to PVT communities, Mississippian communities appear to have favored environments with diverse resources and possibly chose specific locations with visibility of major waterways.

The Geography of Complexity

The results show clear differences in the settlement strategies of Mississippian and PVT communities. However, the settlement location choice results do not provide enough information to answer why complex sociopolitical organizations and Mississippian strategies formed and persisted on either end of the upper Yadkin River valley but not within. Was this location ecologically capable of supporting complex Mississippian communities? The landscape characterization results suggest it was not. Both of the Mississippian areas look different than the PVT area. The better sediments for tree growth and more diverse sediments in the Mississippian areas mirror the location choice results. The PVT area appears to not have the combination of landscape features sought out by Mississippian communities. It is dominated by one sediment texture and drainage type and has a much smaller area of good tree growth sediments. These results suggest that the Yadkin River valley either was not attractive to complex communities or was not capable of supporting sociopolitically complex societies or Mississippian strategies.

Returning to the earlier discussion, the lack of forest productivity and low diversity in sediment types may have discouraged larger and more permanent aggregations of people. In fact, several previous research projects (Jones et al. 2012; Jones and Ellis n.d.; Woodall 1990, 1999, 2009) suggest the Yadkin River valley was populated by small, scattered settlements after AD 1200. This is a considerably different picture than the two Mississippian areas and even different from other, more populated PVT areas in the Dan, Eno, and Haw River valleys (Simpkins 1985; Dickens et al. 1987; Davis and Ward 1991; Ward and Davis 1993). The Yadkin River valley may have acted as an ecological barrier to the formation or expansion of complex societies, either because it was too uniform or not productive enough.

This discussion has proceeded with an environmental tone to this point because I analyzed only environmental variables. Nevertheless, the environmental variables did produce significant and corroborating results, leading to the conclusion that the diversity and distribution of resources played some role in the resulting distribution of communities and societies with hierarchical sociopolitical structures in the western North Carolina Piedmont. It would be naïve, however, to think sociopolitical and historical factors did not play some role. After all, Woodall (1999, 2009) produced clear evidence that interaction between Mississippian and PVT communities in the upper Yadkin River Valley occurred, and that people of Mississippian origin maintained at least their identity and possibly their status while living in PVT communities. While Mississippian communities may not have been able to or chose not to spread into the Yadkin River valley, interaction across this cultural and sociopolitical boundary was certainly occurring, and some Mississippian practices and ideas could survive there. This shows that there is more to this story than simply certain areas were not ecologically capable of supporting complexity.

Throughout the history of the field, archaeologists have debated whether complexity arises in times of plenty or need. A consensus has never been reached because each example is unique and must account for particular environmental and cultural idiosyncrasies. In the North Carolina Piedmont, perhaps sociopolitical complexity did occur in times and places with plenty. These circumstances allowed for larger and more sedentary populations and for some to acquire more resources than others, through both direct acquisition and trade, leading to hierarchical social, political, and economic structures. People in those societies may have seen little value in areas like the upper Yadkin River valley for either furthering or maintaining their status, explaining why the extent of Mississippian settlement stopped there.

Conclusions

Overall, these results show that Mississippian and PVT communities in the Late Precontact North Carolina Piedmont preferred different settlement locations with respect to various resources. The landscape results suggest this was not due to different cultural preferences in a relatively uniform landscape. The variability in productivity and corresponding potential of particular areas to support large and permanent populations may have had a significant influence on the geographic distribution of Mississippian polities in the western North Carolina Piedmont. These results support Beck and Moore’s (2002) hypothesis that the Yadkin River valley may not have been capable of supporting sociopolitically complex communities or polities. They purported that ecological diversity played a roll, and my results identify productivity of forests, sediment diversity, and wetland resources as specific factors. As Beck and Moore (2002) also suggested, trade routes alone may have a significant influence on the location of Mississippian polities. In addition to larger sample sizes, a key direction for future research is to incorporate cultural features of the landscape, such as trails, as variables in spatial analyses of this region.

On a theoretical level, I suggest that we revisit some of the cultural ecological models for discussions of why complexity occurred where it did. There is no doubt that a modern approach that incorporates historical ecology, agency, and more ideational definitions of landscape is needed. However, these ideas are compatible with the concept of human adaptation to environments. Perhaps there is legitimacy to the idea that the environment places some limitations on human behaviors and cultural expressions. A truly blended approach would then be able to account for human modification of the landscape, for any reason, that then modifies or eliminates those limitations. In this theoretical model, adaptation takes on a broader definition that is not just reaction to external stimuli. It accounts for human-landscape interactions and re-adaptations to new situations. Such a model would investigate ultimate and proximate causes for a more inclusive explanation of past behaviors. To accomplish such an explanation, we must explore the interplay of environment and the resources within, conceptualizations of landscape, and human interactions with each other and their natural and cultural surroundings.

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GIS CEMETERY DIGITIZATION EFFORTS AT THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

by

Paul J. Mohler

Abstract

North Carolina’s rampant development has not only brought about much-welcomed and needed transformations but also created a greater awareness regarding thousands of abandoned or otherwise obscured gravesites that may hold clues to the past lives of our state’s earlier populations. This article highlights the GIS digitization efforts the Archaeology and Historic Architecture groups of the North Carolina Department of Transportation (NCDOT) are undertaking to identify and document the many cemeteries, graveyards, and burial sites that constitute an integral part of the North Carolina landscape.

Since the early 1920s and the advent of the “Good Roads Movement” (Brown 1931; Hilles 1958; McKown 1972; Turner 2003), the North Carolina landscape has changed significantly. The ever-increasing development rampant across this State has brought about not only a much-welcomed and needed transformation, but also an increasing awareness of the plight of many abandoned or otherwise obscured gravesites that certainly hold clues to the lives of our state’s earlier populations. Throughout the course of a year, many of these cemeteries are encountered during planning and environmental review at the North Carolina Department of Transportation (NCDOT). This article profiles the GIS digitization efforts of the Archaeology and Historic Architecture groups to identify and document the many cemeteries, graveyards, and burial sites that constitute an integral piece of our state’s cultural landscape (see also Mohler 2013).

As part of the Human Environment Section for the NCDOT, the Archaeology and Historic Architecture groups are responsible for helping the Department and the Federal Highway Administration (FHWA) comply with Federal and State legislation and regulations pertaining to archaeology and historic preservation and, in this instance, North Carolina’s civil statutes pertaining to burial sites, namely General Statute (GS) 65 [Cemeteries] and GS 70, Article 3 [Unmarked Human Burial and Human Skeletal Remains Protection Act].

The term *cemetery*, derived from the Greek *koimeterium*, meaning a place to sleep, was rarely employed during the eighteenth century (Lounsbury 1994) and reflects a transformation of burial practices that first became common in the nineteenth century. It is currently used to describe nearly any burial place, although it most commonly denotes burials of the nineteenth, twentieth, and twenty-first centuries, and is the term most often used here. Historically, g*raveyard* or *churchyard* were typically used to differentiate historic burial grounds of the seventeenth, eighteenth, and nineteenth centuries from modern-day cemeteries. *Burial ground* and *burying ground* were most commonly used to indicate a seventeenth- or eighteenth-century burial site. Today, and within this article, the phrases *cemetery*, *graveyard*, *churchyard, burial ground,* and *burying ground* are used interchangeably since popular usage has given considerable latitude to the many terms used to refer to the final resting places of our forefathers (Baugher and Veit 2014; Little 1998; Sloane 1991; Strangstad 2013; Yalom 2008).

Throughout history, public cemeteries would seem to have been a necessity for newly established towns; however, the incorporation of a public burying ground usually did not occur until many years after a town's establishment. As Little and Kullen (1998) note, the oldest cemetery in some towns originated as a public burying ground, but most often it was a church burying ground that was later adapted for public use. For example, the "Old Burying Ground" in Beaufort (Figure 1), founded in 1713, was established on a lot deeded by the trustees for the town to St. John's Parish in 1724; the area would later be enlarged in 1731 when Nathanael Taylor, a private citizen, gave an additional lot to the inhabitants of the town for the purpose of a burying ground (SPUS 1972a). Although the City of New Bern was founded in 1710, its public cemetery, Cedar Grove, dates to 1854, when Christ Episcopal Church, which established the cemetery in 1800, donated it to the city (SPUS 1972b). The burying ground of the Hillsborough Presbyterian Church, established in 1757, would later evolve into the Old Town Cemetery (Slane 2013). In response to the overcrowded conditions at the churchyard at St. James Episcopal Church, which had served as Wilmington's public graveyard, the city, in 1852, chartered its first public burying ground, Oakdale Cemetery, at the time located five blocks beyond the municipal boundaries (Seapker 2007).

Some towns, like Raleigh, Salisbury, and Fayetteville, opened public burying grounds once they were established. Folks in Wake County living on farms and plantations typically had their own family

Figure 1. The Old Burying Ground, Beaufort, Carteret County, North Carolina. Photo property of Megan Privett, NCDOT Architectural Historian.

graveyards; however, those living in the "city" of Raleigh, renting or owning only a small portion of a block, had no such space to inter their loved ones. Therefore, in 1798, six years after the city was set aside as the State Capital, the assembly made a provision for the city commissioners to parcel out four acres of state-owned land on the east side of town as a public burying ground (Little 2008; Murray 1983) (Figure 2). Salisbury, founded around 1760, has had a public burying ground, known as the "Old English Cemetery," since 1770 when it was granted to the city by the British government (Little and Kullen 1998; Topkins and Hinson 1975). The city of Fayetteville has also had a public cemetery since the earliest days of its existence. Known today as Cross Creek Cemetery #1, the old public cemetery was established in 1785 when James Hogg of Hillsborough deeded a narrow spit of land too small to build upon to the town of Fayetteville for five shillings (CCROD 1821 [1785]). In 1833, John Eccles conveyed in his will the remaining land that would make up the entirety of Cross Creek Cemetery #1 to the town, specifically for cemetery expansion (LePine and Sherman 1984; NCSA 1833).

Regardless of location and terminology, there are thousands of cemeteries across North Carolina, ranging from single, isolated, and often unmarked graves to expansive memorial parks and gardens

Figure 2. City Cemetery, Raleigh, Wake County, North Carolina. Photo property of Shelby Spillers, NCDOT Architectural Historian.

spanning hundreds of acres. Efforts to identify and locate these cemeteries have begun at the NCDOT and should become a goal of our many partners around the State, for cemeteries are among our most valuable repositories of cultural information. They are reminders of various settlement patterns, such as plantations, rural and crossroad communities, and urban centers. Cemeteries can reveal information about historic events, religions, lifestyles, and genealogy. They embody changing ideas regarding commemoration and remembrance. Names on gravemarkers serve as a directory of early residents and reflect the ethnic diversity and unique population of an area; they are part material culture and part document. Cultural influence in gravemarker design, cemetery decoration, and landscaping contribute to the complete narrative of North Carolina history. Established in large part for the benefit of the living, cemeteries perpetuate the memories of the deceased, giving a place character and definition.

Unfortunately, cemeteries do not necessarily remain permanent reminders of our heritage. They are subject to long-term deterioration from natural forces such as weathering and uncontrolled vegetation. Neglect accelerates and compounds the process. Development activities and construction projects are also a threat to these precious resources. Vandalism and theft continue to plague both rural and urban burial

Figure 3. Cross Creek Cemetery #1, Fayetteville, Cumberland County, North Carolina. Photo property of Vanessa Patrick, NCDOT Architectural Historian.

grounds across the State as well as the nation. If not properly recorded and cared for, these reminders of our early settlements could be lost forever. Hopefully, the following examples will shed light on the various reasons behind our digitization efforts.

Old Mallett Graveyard (31CD1998**)

Cross Creek Cemetery #1 is the oldest public cemetery in the City of Fayetteville, North Carolina (Figure 3). Bounded by North Cool Spring Street, Grove Street, and Cross Creek, the cemetery is the final resting place of many early settlers and locally significant people in Fayetteville's history (Little and Kullen 1998). The cemetery encompasses 4.98 acres and contains approximately 1,170 gravemarkers. A wide variety of stone monuments dating from 1786 to 1964 is present. Almost every major type of gravemarker found in North Carolina is exhibited at Cross Creek Cemetery #1: brick vaults, ledgers, tomb-tables, headstones, obelisks, pedestal-tombs, and granite monuments. Only wooden markers are not represented. The first Confederate monument erected in North Carolina (1868) stands in its military section, which contains approximately 43 stones of small government-issue design, the majority of which mark the graves of Confederate and Spanish-American War soldiers. In addition to containing examples of ornate headstones, box tombs, and obelisks, the cemetery holds the premier collection of gravestones cut between the 1840s and 1880s by Scotsman George Lauder, arguably the most prolific stonecutter in North Carolina during the nineteenth century. Born in Edinburgh, Scotland, in 1810, Lauder was one of the many stonecutters to work on the State Capitol in Raleigh and assisted in the construction of the U.S. Arsenal in Fayetteville where he later established his own marble yard in 1845 (Little 1998; *North Carolinian* 1888).

Such detail about Cross Creek Cemetery #1 provides context and a comparison for the Old Mallett Graveyard (Site 31CD1998**), which is also located in Fayetteville, a mere mile down the road from Cross Creek Cemetery #1. Upon first glance, similarities between the two cemeteries are readily apparent. Both were established roughly around the same time. Cross Creek Cemetery #1 was established in 1785 with its earliest interment being that of Thomas Duene in 1786 (LePine and Sherman 1988; Little and Kullen 1998). Based on headstone information, the Old Mallett Graveyard presumably began in 1789 with the burial of Charles Robinson Mallett, a son of Peter Mallett (1744–1805) and his second wife Sarah (nee Mumford) (1765–1836). In 1777, Peter Mallett had acquired from James Council of Bladen County a 55-acre tract, upon which Mallett built his home and a prosperous mill industry (CCROD 1777). The property would remain in the Mallett Family until the early 1850s when it was sold to the Union Manufacturing Company (CCROD 1851, 1853). From 1789 to 1874, fifteen members of the immediate and extended Mallett Family were interred within the brick wall surrounding the graveyard (Figure 4). Oates (1972:414) notes the presence of 18 burials, though a list is not offered. Of particular note are the three burials that occurred after 1851, suggesting that the graveyard was still accessible to family members and had not been abandoned.

Both Cross Creek Cemetery #1 and the Old Mallett Graveyard also contain the remains of prominent Fayetteville citizens. Those within Cross Creek Cemetery #1 include the Scottish Reverend Colin McIver, the prominent grocer Charles T. Haigh, Captains Robert Adam and John Winslow of the Fayetteville Independent Light Infantry, early settler Lewis Barge, Governor Warren Winslow, and the Reverend James Douglass of St. John’s Presbyterian Church (LePine and Sherman 1988; Little and Kullen 1998). Within the Old Mallett Graveyard lies Colonel Peter Mallett, who passed away in February 1805. At 31 years of age, in

Figure 4. The Old Mallett Graveyard, Fayetteville, Cumberland County, North Carolina. Photo property of the author.

April 1776 Mallett served as the Commissary for the 5th Regiment of the North Carolina Militia and later in the same position for the 6th Regiment of the Continental Line during the American Revolution. In 1778, Col. Mallett was appointed to the local commissions to “lay out and regulate the town, to make such streets, ways, and alleys,” and “to design, contract, and cause to be built the courthouse, gaol (*sic*), pillory, and stocks” (Oates 1972:81–2). Along with Robert Rowan, Peter Mallett was also chosen as one of the first two representatives of Cumberland County in the North Carolina State House of Commons (Oates 1972:176).

Gravestones dating from the late eighteenth century to the 1840s in Cross Creek Cemetery #1 are similar to those of other early graveyards in North Carolina’s oldest towns. In fact, they’re similar to the ones in the Old Mallett Graveyard, not only in style but also in maker for George Lauder’s signature mark can be recognized in the lower right-hand corners of an 1880 commemorative tabletop marker for Peter and Sarah Mallett as well as the 1874 headstone for Sally Smith Mallett, one of Colonel Peter Mallett’s daughters. Lauder signed gravestones until about

Figure 5. George Lauder's signature mark on the 1880 commemorative marker for Peter and Sarah Mallett. Photo property of the author.

1880, but he was blind in his last years and his later stones were probably carved by his apprentices (Little 1998). The commemorative tabletop marker may then be one of Lauder's final pieces (Figure 5).

Given all the similarities in location, timeframe, prominent citizenry, and consumer choice in marker style, variety, and maker, Cross Creek Cemetery #1 started out as a large-scale public cemetery whereas the Old Mallett Graveyard was set aside solely as a small-scale family plot. Perhaps, maintaining an emotional, familial tie to the land may have played a hand in Colonel Mallett's choice of final resting place or it simply could have been based on cost. Ten months before he passed away, Col. Mallett wrote in his will,

> I desire to be buried among my children near my mill in Fayetteville in a frugal manner without any unnecessary expense.... [NCSA 1805]

There is another, more distinct difference between these two cemeteries, one that is integral to the focus of this article. Cross Creek Cemetery #1 and its overall historic significance is well-known and well-published. The Old Mallett Graveyard, however, is not. At first, nowhere could it be found on any maps. Prior to it being documented as

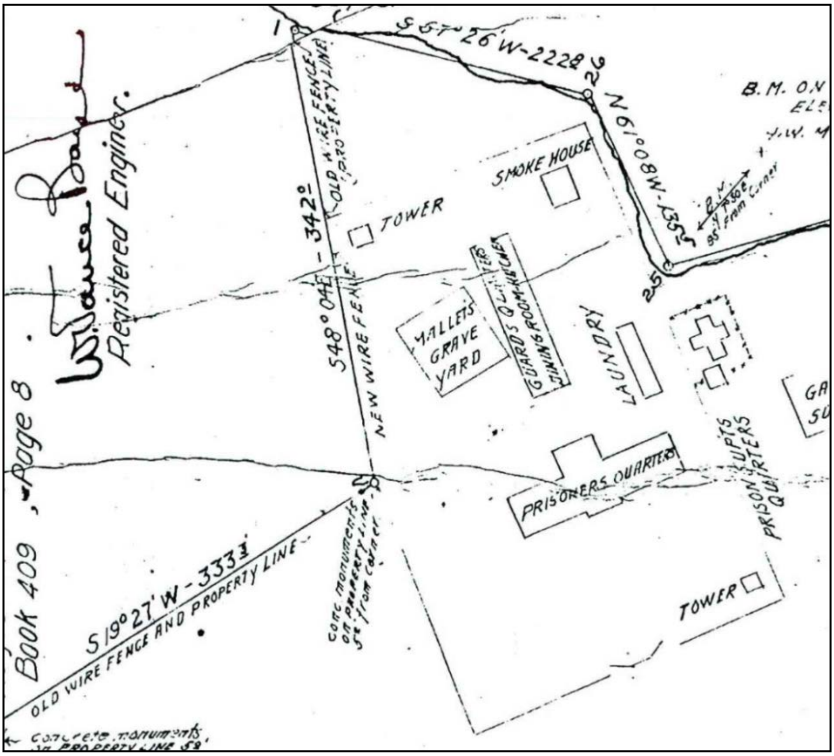


Figure 6. Property of North Carolina State Highway and Public Works Commission (Plat Book 11, Page 2 [CCROD 1944]).

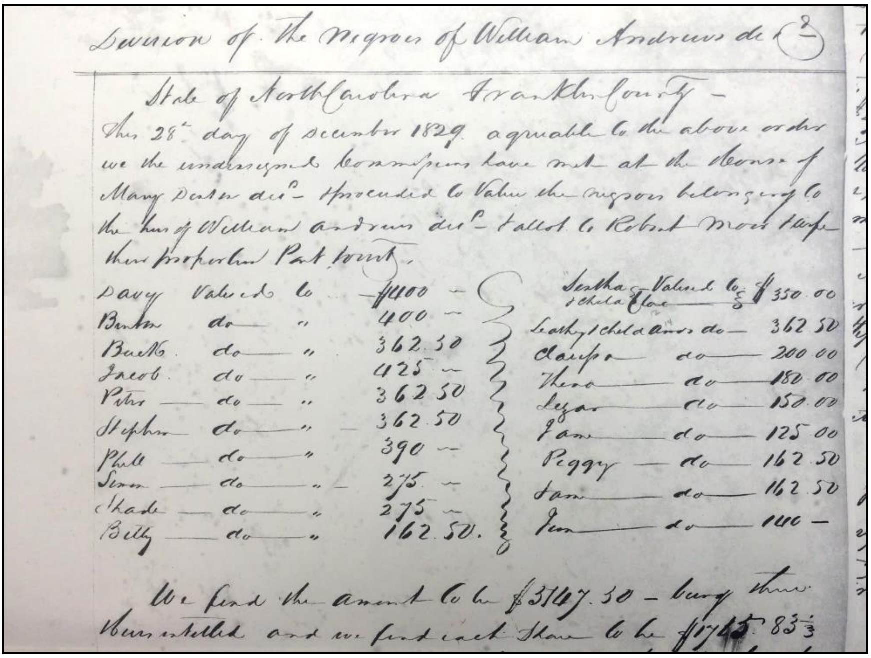
part of a NCDOT project, the Old Mallett Graveyard was not recorded on the maps maintained by the State Historic Preservation Office (NC-HPO) or the Office of State Archaeology (OSA). It also was not depicted on the Fayetteville USGS quad maps (1957 [PR1987], 1997), nor was it shown on the 1922 Soil Map for Cumberland County (Perkins and Davidson 1922) or McDuffie's (1884) Map of Cumberland County, which would have only been 10 years after the final burial in the cemetery. Although written documentation for the cemetery was eventually tracked down in deed references and the county cemetery survey files at the State Archives, the only visual representation found of the cemetery was on a 1944 Plat Map of property owned by the North Carolina State Highway and Public Works Commission (which, at the time, was being used for a prison camp) (CCROD 1944) (Figure 6). Today, the Old Mallett Graveyard is located inside the NCDOT's Cumberland County Maintenance Yard, near Gillespie Street and Southern Avenue (i.e., the Old Lumberton Road).

Andrews-Moore Slave Cemetery (31FK136**)

When approached by the NCDOT, landowners have, on occasion, made mention of nearby slave cemeteries, especially if a road-widening project threatens to take a little sliver of their property. Unfortunately, slave cemeteries are rarely indicated on modern maps, let alone any map for that matter. According to Rainville (2014:13), "there are three primary types of interment for enslaved populations: (1) burial within the cemetery of the plantation owner, sometimes segregated in a corner of the grounds, sometimes not; (2) burial just outside of a white cemetery, whether a churchyard or a family burial ground; (3) burial in a separate cemetery set aside for African Americans." In order to locate any of these three burial site types, the historic plantation associated with the enslaved community must first be determined. In Franklin County is situated the Andrews-Moore House and the last vestiges of the late eighteenth-early nineteenth century plantation owned by the planter and slaveholder William Andrews, who acquired thousands of acres on either side of Cypress Creek as early as 1792 (FCROD 1792; Satterfield 1998). At the time of its nomination to the National Register of Historic Places, the location of the slave cemetery was known, yet for some reason it was not incorporated within the National Register boundary for the property.

William Andrews passed away in 1820, leaving undivided interests in all of his personal property including 2,470 acres, his house, and 20 slaves to his wife Mary Andrews, his daughter Ailsey Andrews Adams, and his three minor grandchildren Martha Andrews Adams, Sarah Andrews Adams, and Mary Andrews Adams. In fact, the "Division of the Negroes of William Andrews, dec'd," dated June 8, 1820, lists 28 slaves by name (21 adults and 7 children) (FCCSC 1820). Afterwards when the widow Mary Andrews passed away in 1828, another "Division of the Negroes of William Andrews, dec'd," dated December 28, 1829, was recorded, listing 21 slaves by name (19 adults and 2 children) (FCCSC 1829). Given the nine-year interval between these records, there is a slight overlap in the names listed. However, some names that appear in 1820 are not present in 1829, whereas some names that appear in 1829 are not present in 1820 (Figure 7). With that in mind, at least 33 slaves (if not more) were present during the 1820s.

Robert R. (aka Robin) Moore married Martha Andrews Adams, one of William Andrews' grandchildren, in December 1828 (FCROD 1976). Robin and Martha Moore had inherited the tract that included the main house upon the death of her mother Mary Andrews Denton, who had remarried. According to the 1830 Federal Census, Robert Moore's



Division of the Negroes of William Andrews dec (2)

State of North Carolina Franklin County –
This 28th day of December 1829 agreeable to the above order
we the undersigned Commissioners have met at the House of
Mary Dean dec'd – proceeded to Value the negroes belonging to
the heirs of William Andrews dec'd – & allot to Robert Moore & wife
their proportion Part to wit –

Davy	Valued to	$400 –	Sentha & child Eloe	Valued to	$350.00
Benton	do	400 –	[illegible] & child Amos	do	362.50
Buck	do	362.50	Clarissa	do	200.00
Jacob	do	425 –	Thena	do	180.00
Peter	do	362.50	[illegible]	do	150.00
Stephen	do	362.50	[illegible]	do	125.00
Phil	do	390 –	Peggy	do	162.50
Simon	do	275 –	Sam	do	162.50
Shade	do	275 –	[illegible]	do	140 –
Betty	do	162.50.			

We find the amount to be $3147.50 – being three
heirs entitled and we find each Share to be $1745.83⅓

Figure 7. "The Division of the Negroes of William Andrews, dec'd" - 1829 (Franklin County Clerk of Superior Courts, Will Book I–J, Page 97).

household included himself, his wife Martha, and nine slaves. By 1840, the Federal Census indicates that Robert Moore's household included himself, his wife Martha, and five children as well as 14 slaves. Ten years later, the household had increased again, including eight children, as well as 21 slaves ranging in age from 1 to 70 years old (1850 Federal Census and Slave Schedules). Robert R. Moore died in 1858, leaving his real property to his widow Martha. Upon her death in 1874, the land was divided among their five sons: William A., James C., Robert A., Moses R., and John W. Moore. Robert A. Moore inherited the tract, which included Martha's "mansion-house," in which she was living at the time (FCCSC 1874). In 1860, Robert's brother William is recorded as owning 26 slaves, ranging in age from 2 to 80 years old (1860 Slave Schedules). On average per year, at least 20 to 30 slaves were recorded as being part of the Andrews-Moore estate, starting with William Andrews in the 1820s up to Robert A. and William A. Moore in the 1850s and 1860s.

Following the Civil War, the immediate area around the Andrews-Moore House showed an influx of African American families (see 1870

Federal Census). After emancipation, some African Americans took surnames for the first time. Others, celebrating their newfound freedom, chose new names, which sometimes separates them in the historical record from siblings who did not (Inscoe 1980; Rainville 2014). Presumably, those taking up residence in the countryside were former slaves, giving rise to the surrounding descendant community. During the course of the project, a story was shared of someone's grandfather telling them of a burial taking place at the cemetery with a horse-drawn carriage and procession; this would have occurred within the first few decades of the twentieth century (~1920s) and shows that the cemetery was still very much valued by the descendant community. Since then, however, the location of the cemetery has become overgrown and abandoned with no visible signs of routine maintenance.

In May 2012, as part of the archaeological survey for the proposed improvements to and widening of SR 1628 (Simon Collie Road), the limits of the cemetery were determined and 60 depressions were recorded (Mohler 2012a, 2012b). At least nine rows of burials were noted, with apparent clustering along each of the rows, which may correspond to family units. Dimensions of some burials suggested the presence of not only adults but also children or adolescents. As in many Christian cemeteries, the grave shafts were aligned roughly east to west. As Rainville (2014:121) points out, "[w]hile there is disagreement among scholars as to the extent and nature of Christian beliefs among enslaved African Americans, ethnographic accounts from nineteenth-century communities reveal that enslaved African Americans believed that the head should be buried in the west so that 'the dead won't have to turn around when Gabriel blows his trumpet in the east'" (Puckett 1926:94). None of the burials was marked with any type of formal headstone. Small fieldstones marking the head and/or foot of the graves were present, but were very few in number. Over time, fieldstone markers may have been removed or become buried underneath the thick root mat and vegetative overburden. Archival research and personal recollections suggest the cemetery had been in use for at least 100 years, from the 1820s up to the 1920s, first established as a place of burial for those who toiled in the fields of the Andrews and Moore Families and later evolving into a communal place of burial for those who would eventually claim their freedom.

Although on opposite ends of the societal spectrum, with the prominent Mallett Family of Fayetteville on the one end and the enslaved and descendant African American community on the other, both familial groups or communities are essentially on equal footing, in that their associated cemeteries were not depicted on any maps and may have been lost forever simply by being absent from the historical record. Incidentally, the Moore Family Cemetery is also not depicted on any maps, despite it receiving a bit more care over the years.

Parker Family Cemetery (31HF268**)

A final example, the Parker Family Cemetery, is located in the hamlet of Mapleton just outside Murfreesboro in Hertford County. The Parker Farm Site was first identified as a surface scatter of historic artifacts in the Fall of 2003 as part of environmental studies for the widening of US 158 (NCDOT TIP# R-2583). One archaeological feature was identified, consisting of "a minimum of three courses of brick in situ," and subsequently interpreted as an intact brick foundation, which led to the site being recommended as eligible for the National Register (Tippett 2004).

Nine years after its initial identification, during the second week of data recovery efforts, unmarked human interments were identified along with the discovery of two brick-lined graves (Figure 8). The brick feature identified during the initial survey was actually part of a grave instead of a structural foundation. In all, 19 historic burials were identified (Jorgenson et al. 2013). Few historic cemeteries in North Carolina have been excavated under the auspices of NC General Statute 70, Article 3. Most archaeological work in the State pertaining to cemeteries has not gone beyond the identification and recording stage; when this does occur, it most frequently takes the form of delineation of boundaries, but not actual exhumation of the burials themselves. However, since the site was to be impacted and an archaeological data recovery project was already underway, consultation with the Office of State Archaeology (OSA) resulted in the decision to remove the burials pursuant to the unmarked burial law. Afterwards, documentary evidence, combined with the archaeological data, indicated that all 19 individuals were members of the Parker Family who had owned and resided on the site for three consecutive generations: (1) David Parker (unknown initial occupation to 1878), (2) his son Jesse Parker (1878 to 1903), and (3) David's grandson (Jesse's nephew) David L. Parker (1905 until he sold the property in 1924). Genealogical evidence (Parker 1971) listed several individuals who may have been buried in the cemetery, and even provided dates from 1872 to 1919 for its use, with one burial perhaps dating as early as 1829.

Figure 8. Two brick-lined graves, Burials 7 and 8, Parker Family Cemetery, Hertford County, North Carolina. Photo property of the author.

The Parkers were a long-established and prominent family in the region since 1756 when Thomas Parker (David's great-grandfather) received a land grant of 519 acres along Beaverdam Swamp in what was to become Hertford County. David Parker (1796–1878), though, is the first known owner of the tract on which the Parker Family Cemetery was located. When David Parker began to occupy the property, how he acquired it, and what if any connection it had to the lands of his father or other Parker ancestors could not be determined (Jorgenson et al. 2013). The early deeds and other official records of Hertford County were almost entirely lost when an arsonist burned the courthouse in 1832 and Federal troops torched it again 30 years later (Sharpe 1958:871–2). However, it is known that David Parker was a man of substance and position within the community. He was an overseer of the road near his property and during the antebellum period was appointed executor of a number of estates (Almasy 1989; Jorgenson et al. 2013). At his death, he owned multiple tracts of land and additional personal property.

As the second known owner of the property, Jesse Hasty Parker (c.1848–1903) likely spent his entire life there. According to the Federal Census, he was present in 1870, inherited the property in 1878, and died and was buried on his land in 1903. Jesse Parker identified himself as a farmer and a storekeeper in a number of late-nineteenth century sources

(Branson 1889, 1896). The mid-1890s were difficult for Jesse Parker in both his personal and business life (Jorgenson et al. 2013). During the Panic of 1893, perhaps caught up in the turmoil of a major economic depression, he had to mortgage his farm to pay his debts (see Winborne Papers n.d.). Two years later, while he still struggled with debt, Jesse's wife Ellie passed away after a lingering sickness (Murfreesboro Index 1895; Patron and Gleaner 1895). After Jesse's death in 1903, Judge Winborne did not immediately foreclose on the Parker property. However, by 1905 he followed the terms of the 1893 deed of trust and had the property auctioned off on the premises. The aftermath of the sale, as preserved in the Winborne Papers (n.d.), provides insight into the status of the Jesse and Ellie Parker family. "They had taken a few steps down the economic ladder compared to Jesse's grandfather, Silas Parker, and his father David, but had managed to hang onto the rungs. Their children were no longer landed gentry, but had taken positions in the broad middle class" (Jorgenson et al. 2013:18). The property did not immediately leave Parker Family hands. Although the 96-acre Jesse Parker homeplace was purchased at a sheriff's sale in 1905 by E. B. and Mary W. Vaughn (HCROD 1905a), they immediately sold the western 48 acres of it (HCROD 1905b) to David Lawrence Parker (1873–1953), a grandson of David Parker (1796–1878).

Nineteen historic burials, including six infants/children and thirteen adults, were removed from the Parker Family Cemetery. Eight of the burials were female and two were male; the gender of three adults and all six infants/children could not be determined. The cemetery was generally laid out in three rows. Grave shafts consisted of brick-lined, simple, and upper-and-lower types. Burial receptacles included seven hexagonal coffins and twelve rectangular caskets. As a result of the dearth of archaeological cemetery excavations in the State, it is difficult to revisit research themes and questions from previous work; as such, excavation of the Parker Family Cemetery has provided a solid base for future mortuary studies within the region. Funerary material culture was extensive (Figures 9 and 10), as were the personal effects buried with some of the individuals (Figure 11). Both documentary and archaeological evidence indicate the cemetery was utilized roughly from the 1870s to about 1919, a period of history that saw numerous and significant changes in mortuary behavior across the nation, and the remains of the Parker Family Cemetery reflect such trends. Funerary studies (e.g., Lillie and Mack 2015; Pye 2007; Springate 2015) have shown a general shift in mortuary practices during the last half of the nineteenth century. Such changes, particularly in terms of material

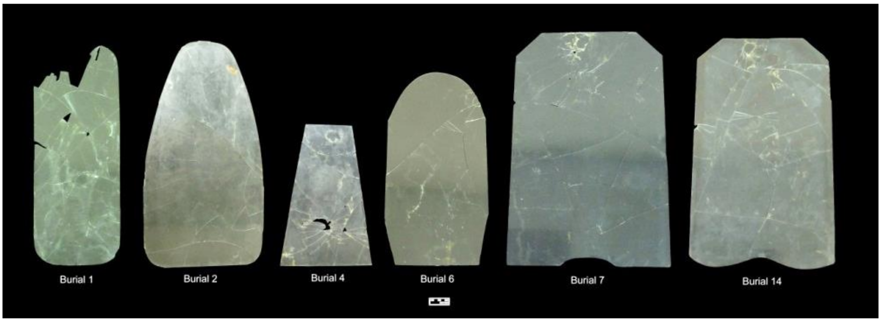


Figure 9. Glass viewing plates from the Parker Family Cemetery. Photo courtesy of Matt Jorgenson and Dan Cassedy.

Figure 10. Select coffin handles from the Parker Family Cemetery. Photo courtesy of Matt Jorgenson and Dan Cassedy.

culture, include the replacement of hexagonal coffins with rectangular caskets, the waning use of glass viewing windows in the lids, the rise in popularity of long-bar handles that eventually replace the older individual swing bail and lug handles, and the modernization of fasteners (e.g., wire nails replacing square/cut nails, hinges, latches). All of these types of material culture are present in the Parker Family Cemetery. Although each individual burial cannot be specifically dated, it is safe to say that the Parker Family's funerary customs changed in line with the rest of the nation. Although some of the Parker Family burials may reflect more conservative funerary ideals, the evidence seems to indicate

Figure 11. Decorative hair pin, hair comb, dentures, and rings from the Parker Family Cemetery. Photos courtesy of Matt Jorgenson and Dan Cassedy.

that much like the rest of the nation, the Parker Family incorporated newer fashions and technologies into their funerary practices (Jorgenson et al. 2013). The dead do not bury themselves, however; funerals reflect both "the deceased and more importantly the…surviving family" (Tharp 1996:75–6).

From a socioeconomic standpoint, the Parker Family represents the burgeoning middle class at the turn of the twentieth century, falling between the Mallett Family of Fayetteville and the enslaved/descendant community in Franklin County. As such, the Parker Family Cemetery also represents the most prevalent type of cemetery encountered (i.e., the small, turn-of-the-century family plot with widely varying degrees of visibility). Even though occupation at this particular site continued into the 1950s, the Parker Family Cemetery was still lost to time, nowhere to be seen on the Murfreesboro USGS (1973) quadrangle. Oral history was not heeded, and farmers renting the land slowly plowed away any semblance of the cemetery.

Existing GIS Cemetery Layers (NCDOT and County-level)

Buried deep within various data layers maintained by the NCDOT's GIS group, hidden inside a Socio_Economic Folder, was a rather non-descript layer very aptly entitled "Cemeteries." With a data layer already in existence, updating it with information compiled from research and survey work, as needed of course, should be simple. Unfortunately, this pre-existing "Cemeteries" layer was not overly informative. Its attribute table consisted of only four columns: (1) Feature ID; (2) Shape; (3) Name, which may or may not have contained a name; and (4) a column consisting of a 5-digit FIPS number (i.e., a numeric code derived by the Census Department for counties, cities, townships, etc.). Data in three of the four columns are automatically generated by the ArcGIS 10.1 software, with the Name column being the only one that contained any input from the user. Other than being able to portray a point on a map, the analytical capabilities of the layer were extremely lacking.

The layer itself depicted the location of 2,680 cemeteries, which is actually a fairly substantial number of cemeteries, depending on one's perspective. With 100 counties in the State, that's an average of 268 cemeteries per county, which may seem like a reasonable number of cemeteries per county, again depending on one's perspective. However, only when the data presented by this GIS layer was visualized did it become apparent that such numbers and overall coverage within the State was not very accurate or all-encompassing (Figure 12). Some counties, like Yadkin, Madison, and Mitchell, appear completely filled in, while other counties barely contain any points at all. Very few cemeteries, if any, are depicted throughout the Coastal Plain, the Piedmont, the Sandhills, or the Foothills. In an effort to correct these perceived discrepancies, an attempt was made to augment the existing data layer with county-level GIS data. However, not all county GIS websites, and their data layers, are equal. Many either do not have their own cemetery layer or, if they do, they are lacking in number (quantity) and detail (quality). For example, Wake County GIS (http://maps.raleighnc.gov/iMAPS/) depicts only 10 cemeteries: four within Raleigh, four within the Knightdale area, and two in Wake Forest. All 10 are listed under "Places of Interest."

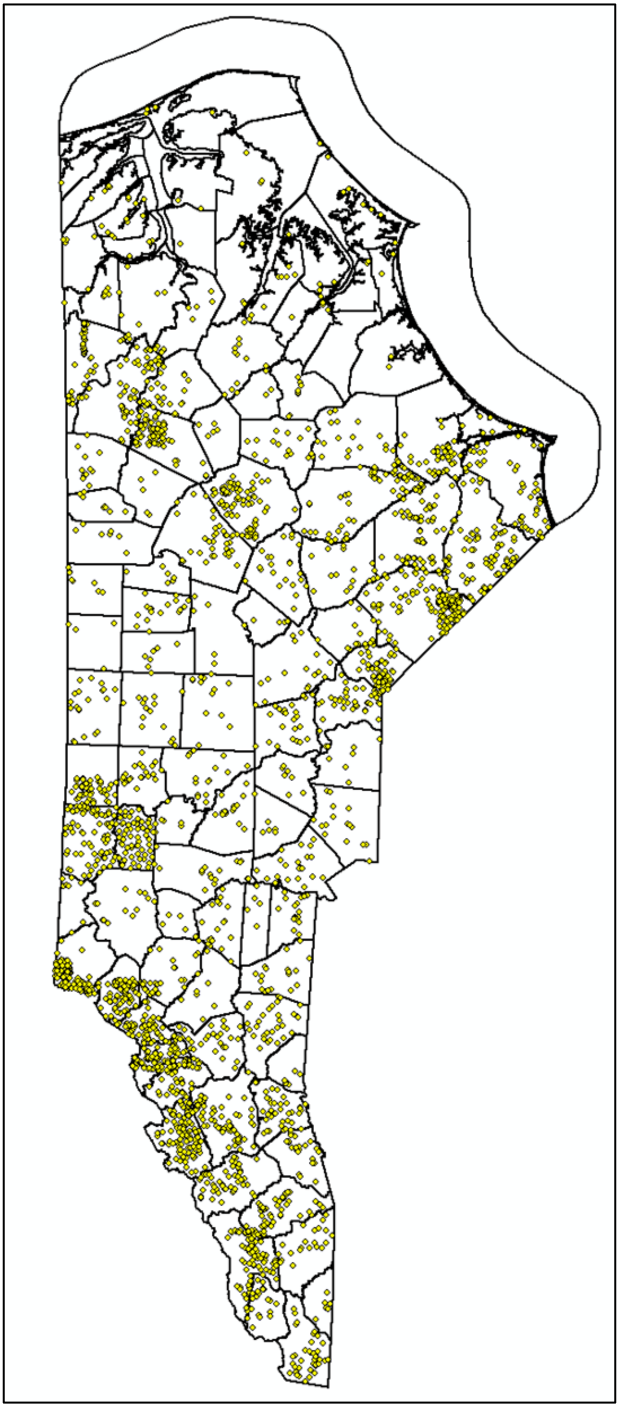


Figure 12. Pre-existing NCDOT GIS cemetery data layer.

On the other hand, Chatham County's GIS Mapping Website (http://new.chathamgis.com/mapguide/ChathamGISWeb/) depicts hundreds of cemeteries within the county; yet, their level of detail currently consists of alphanumeric values, like J44.1 or C88.2, for each cemetery location. Any interested party would have to contact Chatham County in order to decipher the codes and reach the metadata behind each of their points. The Chatham County Cemetery Survey has been an ongoing effort by the Chatham County Historical Association, and its members have worked very hard to visit all of the cemeteries and provide their locations to Chatham County for their planning maps. They have a great deal of information about the cemeteries and would likely be very eager to share it (Dolores Hall, personal communication), but the fact remains that the county GIS does not reflect or offer entry to all the carefully gathered information at this time.

Another rather robust GIS cemetery layer is that of Brunswick County (http://gis.brunsco.net/gisweb/gis.aspx/), whose data layer not only depicts hundreds of locations across the county, but also (by clicking on each cemetery point) offers additional detail for each cemetery like the number of interments, the types of markers, a status and timeline for the cemetery's use, and even images. For planning purposes, a point on a map can be very beneficial, but it's just a point within a larger inventory. The more constructive information lies within the attributes each of these points (i.e., cemeteries) contains. Spatially, knowing where a cemetery is located has utility and, in and of itself, is very important. Yet, linking that cemetery and its attributes or characteristics with other similar resources across the landscape can lead to a greater cultural understanding if the data collected is done so through a meaningful framework. "The greater the detail of the record, the more useful the completed document will be" (Strangstad 2013:40), enabling qualitative terms (e.g., marked, unmarked, abandoned, active) to be used quantitatively, and leading to more meaningful maps, comparisons, and summarization of data (Matero and Peters 2003).

Digitization Methodology

Despite budget constraints and reductions-in-force (RIFs), the NCDOT's Archaeology and Historic Architecture groups still handle a great deal of environmental review and fieldwork internally, not to mention the amount of work managed under contracts by on-call consultants. In coordination with the Office of State Archaeology (OSA), the cultural resource groups at the NCDOT are spearheading an effort to develop a statewide GIS-based cemetery map, one that would encompass not only cemeteries currently in use but also those like the Old Mallett Graveyard, the Andrews-Moore Slave Cemetery, and the Parker Family Cemetery. The information contained on the Cemetery Survey Form that the Department of Cultural Resources has been using since the 1980s has been transformed into a uniform attribute table for each of the 100 counties across the State. The State was then logically broken into 100 county layers, simply because of the potential number of cemeteries to be recorded and the unwieldy size of a single data layer encompassing the entire State.

Baseline data for each county layer was/will be generated by populating each of the attribute tables with known cemetery locations as depicted on the 959 USGS quadrangle maps that have been geo-referenced by the NCDOT's Photogrammetry Unit. With aerial and county parcel data overlaying the quadrangle maps, cemetery locations can be pinpointed fairly accurately, although there are instances where it is quite clear that the depicted cemetery is no longer in that location. For instance, new subdivisions or highway projects have been known to completely change the historic landscape (Figure 13). Infrastructure improvements (e.g., electrical substations) and the creation of new schools have also been known to occur on parcels containing the remains of our loved ones. Springfield Middle School in Wilson County and Glendale-Kenly Elementary in Johnston County were both built on locations of depicted cemeteries (Figure 14). Cemetery locations that are visually obscured on an aerial photograph are marked "Not Validated" and any fields left blank will hopefully be filled in over time. Others are simply marked as "Gone?" or "Moved?" As required by GS 65, those causing the removal of graves are to file that information with the county's register of deeds within 30 days of removal. Perusal of such records should reveal when the removal process took place, the parties conducting the removal, and where the burials were reinterred along with a map of both cemetery locations.

Contrary to the three examples discussed earlier, many cemetery locations, probably representing small family burial grounds, depicted on the maps commonly used by cultural resource specialists, may no longer mark an actual interment. If such locations were not to be recorded as former cemeteries, an integral aspect of the cultural landscape would be purposefully removed, one that would clearly aid in the understanding of how the surrounding property may have evolved.

Once the USGS quad maps and county parcel data have been reviewed, existing data from the records at OSA, the State Historic

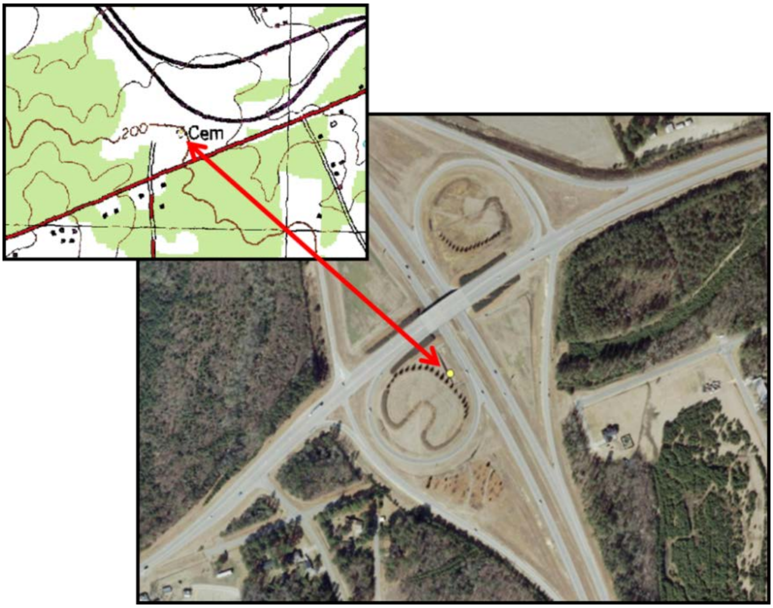


Figure 13. Bailey, N.C. Quadrangle (USGS 1978a) depicting a cemetery location and 2014 Aerial showing the US 264 Interchange with US 264A/Raleigh Road Parkway near the Town of Sims, Wilson County.

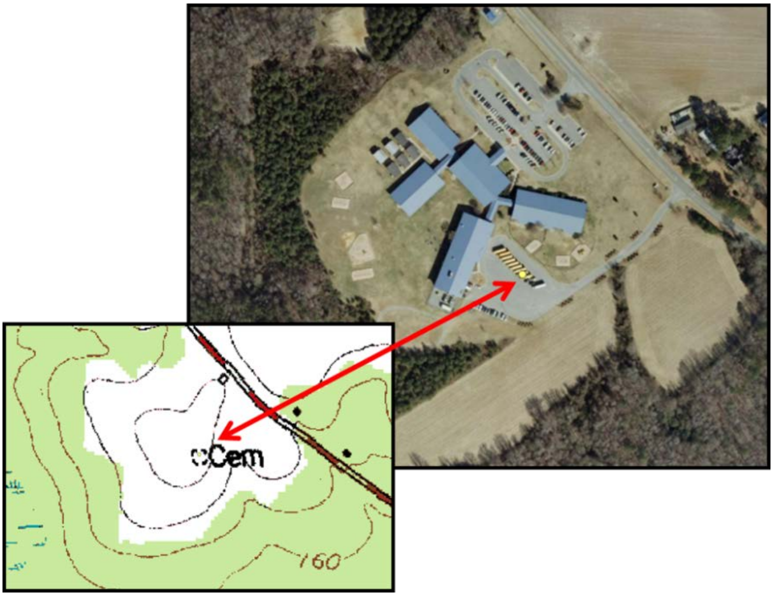


Figure 14. Kenly West, N.C. Quadrangle (USGS 1978b) depicting a cemetery location and 2014 Aerial showing the location of Glendale-Kenly Elementary School along Bay Valley Road near the Town of Kenly, Johnston County.

Preservation Office (NC-HPO), and the State Archives will be incorporated into the data layers, either to cover cemetery and other burial locations not depicted on the quad maps or by the parcel data, or to add information to existing features within each of the layers. Another step is to then cross-reference WPA cemetery survey records from the 1930s and 1940s with each of the data layers; this will be an extremely difficult task since much has changed over the past 70–80 years in terms of the landscape, features of which were often used to verbally describe where a cemetery was located. This task has been made a bit easier now that the WPA survey forms have become a part of the digital collections maintained by NC ECHO, "Exploring North Carolina's Cultural Heritage Online" (http://ncecho.org/). Over time, efforts will also be made to contact other agencies, departments, and organizations that may manage such resources (e.g., US Forest Service, military bases, and historic/genealogical organizations).

Results and Interpretations

As of mid 2015, cemetery locations have been identified on 759 of the 959 USGS quad maps (~79%). The first step of quad map and parcel data review has been completed for 62 counties; a review of the parcel data for a 63rd county (i.e., Montgomery County) remains to be done (Figure 15). Aside from Wilkes, Caldwell, Alexander, Burke, Catawba, McDowell, and Buncombe, every other county has been started in some fashion. For the most part, everything east of the Davidson-Randolph county line has been reviewed with the remainder of the State at least outlined.

In comparison to the NCDOT's previous ("old") cemetery data layer, the new county-level GIS cemetery layers offer much more detail per cemetery and reveal the locations of many "missed" cemeteries. Within the 62 completed counties, the NCDOT's "old" cemetery layer had recorded a total of 1,364 cemeteries. By reviewing each of the quad maps and the parcel data for those same 62 counties, 16,677 cemeteries were recorded, an increase of 1,123%. Neither Jones County nor Camden County had a recorded cemetery in the "old" GIS layer. Now, they have 116 and 87 cemeteries listed, respectively. Numerically, Johnston and Sampson counties have shown the largest increase; totals for Johnston County ballooned from 84 to 861 cemeteries (+777) whereas totals for Sampson County went from 59 to 827 cemeteries (+768). Overall, Onslow (22,100% [from 2 to 444]) and Currituck (21,700% [from 1 to 218]) counties have shown the largest percentage

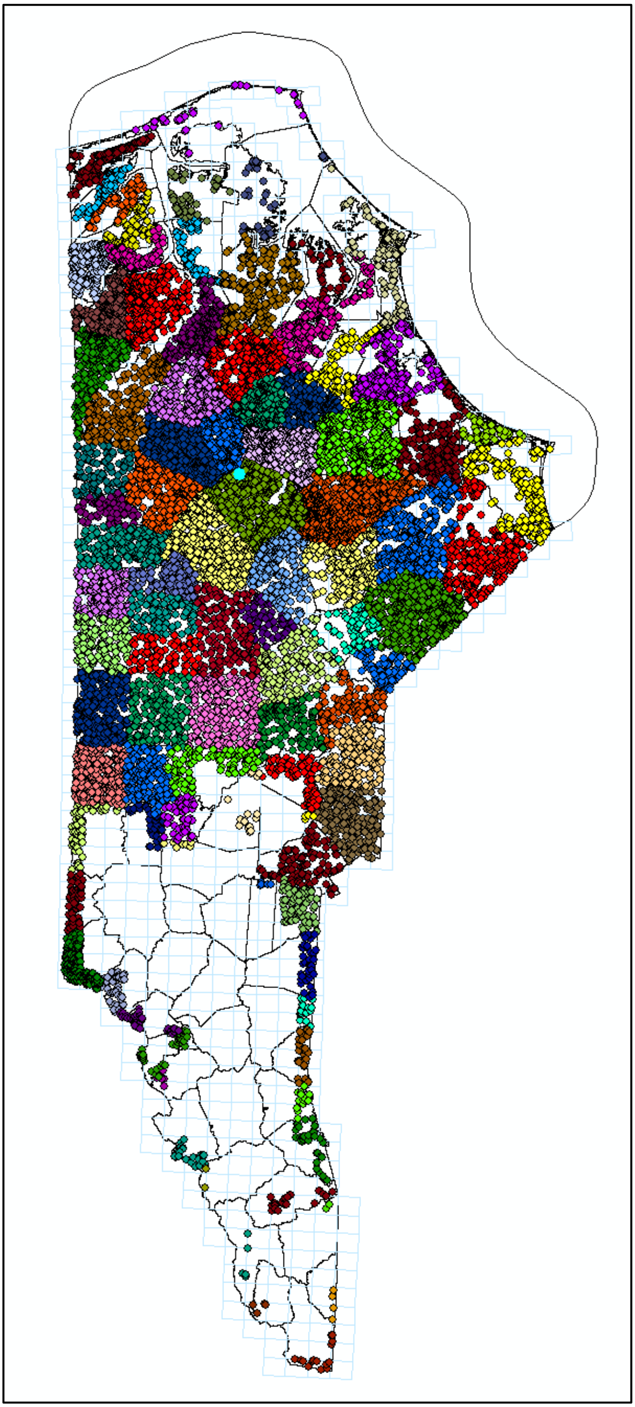


Figure 15. New NCDOT Archaeology & Historic Architecture Groups' county-level GIS cemetery layers.

Figure 16. Gravemarker of Thad Betts (1855–1898). Photo property of the author.

increase. Clearly, the “old” GIS cemetery layer was missing a lot of information.

The primary purpose for developing these layers was to not only increase the NCDOT’s knowledge during the transportation planning process, but also build and improve upon the scholarly approach taken in terms of cemetery/mortuary research. The visual and analytical capabilities of these county-level cemetery layers can only be truly known once all, or most, of the attribute fields have been filled in for each of the cemeteries, if that’s even possible. However, a sample area within a 5-mile radius around a single nineteenth-century burial outside the Town of Fuquay-Varina in Wake County was analyzed in order to test their utility.

At the heart of this 5-mile circle was, and still is, the grave marker for Thad Betts (Figure 16), who passed away in 1898 at the age of 43, and whose grave is covered by a 4-inch thick cement cap large enough to cover at least one or two other interments (Mohler 2008). Across the railroad tracks, just 500 feet down the road, is the Piney Grove Baptist Church Cemetery, containing well over 600 burials including members of Thad Betts’ family. Why was Thad buried where he was? Why wasn't he buried with the rest of his family? Were there other cemeteries nearby? Where were other families burying their loved ones at this time? These types of questions also led to the creation of the county-level cemetery layers. Within five miles of Thad Betts' grave are 52 additional cemeteries or burial locations. The fields in the attribute table for all 52 locations, which spanned both Wake and Harnett counties, were filled in by either visiting the cemetery itself or perusing various online resources in the hopes that someone else had already done the legwork. Of those 52, two locations had to be discarded, one because a parking lot got in the way and a second because its presence was based solely on GPR data (Shawn Patch, personal communication).

Four types of cemeteries are prevalent within that 5-mile radius (Figure 17). Seventeen are religious or church-affiliated cemeteries (34%). Twenty-three are family cemeteries (46%), followed by nine community (i.e., multiple families) cemeteries (18%). Lastly, there is one commercial memorial gardens (2%). Family, or family-based, community cemeteries account for nearly two-thirds of the cemeteries within the sample area. Temporally, the earliest interment within the sample area occurred in 1801 at the Collins Grove Baptist Church Cemetery; however, 13 of the 15 earliest burial locations reflect a strict family-oriented burial practice from the early 1820s through the early 1880s, at which point religious organizations (i.e., churches) began to flood the area, establishing their own cemeteries (Figure 18). Despite the rise in the number of churchyards and commercial endeavors, a Southerner's connection to his or her family and land persisted. Small family or community-based cemeteries continued to be established all the way up to the 1980s, indicative of a person's "desire to stake an eternal claim to one's home place" (Hinshaw 2013). Such continuous use and establishment of family-based cemeteries over time also belies an improved transportation network granting easier mobility and access, and notwithstanding one's love for their ancestral home, economic constraints may have also been a significant factor in determining where a loved one was buried. Such characteristics would not be readily attainable or visualized by simply clicking through websites like www.interment.net, www.findagrave.com, www.cemeterycensus.com, or www.billiongraves.com, which in themselves are great genealogical assets but their main purpose is to provide searchable online databases of peoples' loved ones. Through GIS, complicated queries, reports, and calculated summaries can best be processed in a visual format. Additional tables and queries of interest can also be brought into the software as new layers or combined with existing layers to answer future

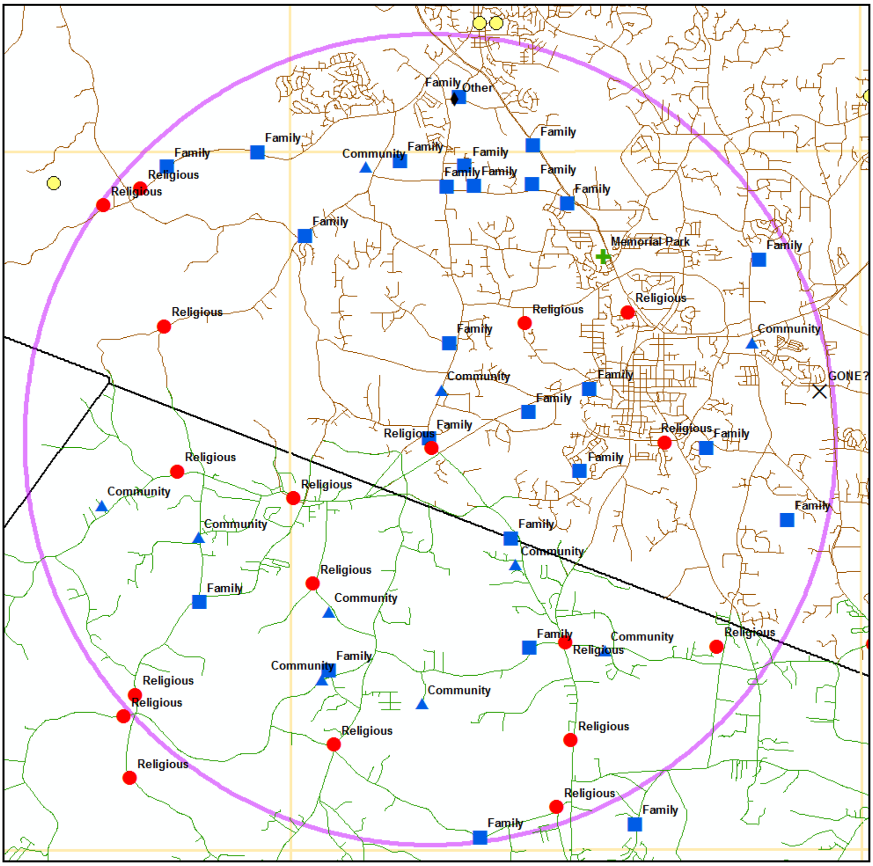


Figure 17. Cemeteries coded by type within a 5-mile radius of the Thad Betts gravesite in Wake County (to the north). Harnett County is located to the south.

queries. GIS maps can also provide enhanced visual references for site and resource issues, with the embedded information available for extensive analyses, comparisons, and calculations.

Final Thoughts

Burial grounds and cemeteries are among the most valuable of archaeological and historic resources. They are evidence of various settlement patterns, burial practices, cultural and religious influences, economic development, social relationships, and kinship patterns (Baugher and Veit 2014). They may also represent the only reminder of an influential person or group, be a significant example of landscape architecture, or simply be public space available for solitude, contemplation, and reflection.

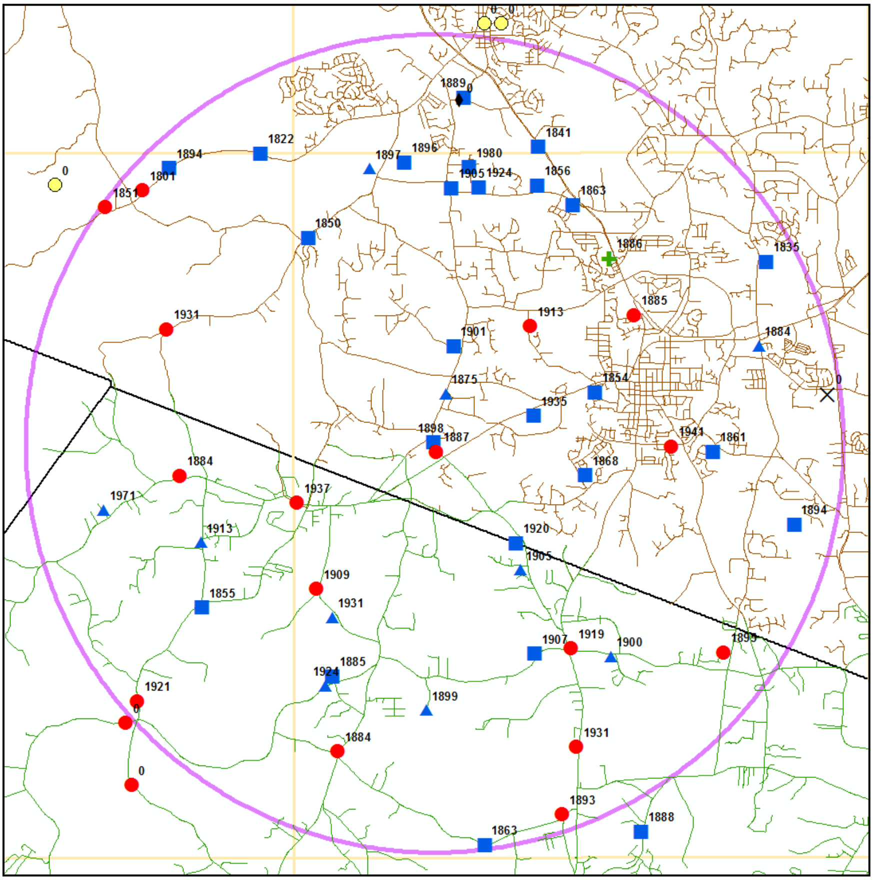


Figure 18. Cemeteries coded by type and labeled by earliest known burial, within a 5-mile radius of the Thad Betts gravesite in Wake County (to the north). Harnett County is located to the south.

Mortuary sites constitute an important and diverse feature of North Carolina's heritage, and hold exceptional and unique research potential. They are spatial focal points of multi-faceted socio-cultural practices. Few landscape features are as enduring as a cemetery, and as a result of such static land usage, they can provide a window into the past and an avenue for reconstructing historic landscapes (Meyer 1989). As a ubiquitous element of our landscape, many cemeteries or graves are often unmarked, making specific identification and interpretation difficult, if not impossible. Whether marked or unmarked, many have been abandoned and obscured from our collective memory (Bell 1994; Clauser 1994; Kavadias 2001; Linebaugh and Phillips 2001).

Historically, cemetery site selection was often rooted in regional, social, and cultural customs, and was influenced by settlement patterns, local terrain, transportation system quality, and economic constraints (Cottle 1997). The availability of land, social cohesion, distance from settlement centers, quality of transportation routes, ethnic makeup, and available modes of transport all had some influence on how the dearly departed were treated. The relationship between changes in transport modality, settlement and transportation network patterns, and cemetery siting, utilization, and current maintenance condition patterns can all be examined by combining historic research, field observations, and the analytical capabilities of geographic information systems (GIS) software.

The GIS digitization efforts of NCDOT's Archaeology and Historic Architecture Groups represent not only the Department's contribution toward the identification and documentation of cemeteries, graveyards, and burial sites across the North Carolina landscape but also an agency's internal attempt at bringing these resources out of the darkness and back into the light of day.

Notes

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LUMINESCENCE DATING SANDHILLS CERAMICS: A REVIEW

by

Joseph M. Herbert and James Feathers

Abstract

In a recent article several archaeologists presented the results of an experiment designed to test the accuracy of luminescence dating of prehistoric pottery from the Sandhills of North Carolina. When results from two different dating facilities returned dates for the same pottery samples that were significantly different, conclusions were reached that the dates were unreliable, the dating method inaccurate, and the data useless for interpreting the age of the pottery. In the present article, we demonstrate that much of the disagreement in lab results is explained by the fact that the two facilities used different procedures, we show that most of the dates are reasonable estimates of the age of the pottery, and we illustrate how the results reveal the cultural components and occupation periods at the sites where the pottery was found.

In a previous volume of *North Carolina Archaeology*, Espenshade et al. (2014) presented the results of a pottery dating experiment undertaken by New South Associates, Inc., under contract with the North Carolina Department of Transportation (Patch and Espenshade 2011). For the experiment, halved pottery samples from three sites in the North Carolina Sandhills were submitted to two different luminescence laboratories, with results yielding divergent dates. Among the 52 samples submitted (26 to each lab), only 46 percent of the age estimates yielded values that corresponded in age at the 1-Ã error range, and only 73 percent of estimates corresponded at the 2-Ã range. Espenshade et al. (2014) interpret these findings as evidence of the unreliability of luminescence dating and conclude that these results call into question all luminescence-derived dates for Sandhills pottery. They reject as post hoc revisionism any attempts by the luminescence labs to explain discrepancies between their results. The ceramic sequence model for the Carolina Sandhills, built in part with luminescence data, is judged untrustworthy, and any future use of luminescence dating by archaeologists is declared professionally inadvisable.

The authors of the present article approach the science of luminescence dating and the results of this experiment from a different vantage point. Although we agree that the experimental results reported by Espenshade et al. (2014) raise important questions, we argue that procedural differences account for most of the variation observed between the labs' results, and we show that for most samples the data actually represent reasonable age estimates for the pottery. Potential sources of inaccuracy in luminescence dating are explained and their potential impacts on the results of this experiment are appraised. Causes for inter-lab differences are described and their effects evaluated. The sequence of the pottery types derived from the results of this experiment is considered, and the accuracy of each age estimate is evaluated in the context of regional chronometric data. Ultimately, we demonstrate that most of the age estimates for the pottery in this experiment agree with, and contribute substantially to, the regional ceramic sequence model for the Sandhills and the interpretation of the sites where the pottery was found. Because luminescence dating is rather technical, the reader is referred to Duller (2008) for a description of the method written specifically for archaeologists.

Different Vantage Points

The dating project undertaken by Patch and Espenshade (2011), which is summarized by Espenshade et al. (2014), included halving potsherds recovered from three Sandhills sites (31CD64, 31CD65, and 31CD871) and submitting one half of each sample to two different luminescence laboratories—the University of Washington Luminescence Laboratory and the Oxford Luminescence Dating Laboratory. In all, 26 samples from 25 potsherds were submitted to each lab; one potsherd having been quartered, with two samples from the same potsherd being submitted to each of the two labs. Original reports of the results from the two luminescence labs were not reproduced in the contract report, nor have they been published elsewhere, but these reports or the data submitted to the contractor were consulted for the present article and were summarized by Espenshade et al. (2014).[1] Before proceeding with a reinterpretation of the results of the experiment, it is essential to clarify some inaccuracies in the earlier article. Although characterized as a "controlled experiment" (Espenshade et al. 2014:87), the luminescence dating project undertaken by Patch and Espenshade (2011) did not reference any independently derived control sample of known age by which to measure the accuracy of the luminescence results, as for example tree-ring dates are used as a control to calibrate inherently inaccurate age estimates derived from radiocarbon assays. Sending portions of the same pottery sample to two different dating facilities is a useful way to test procedures, but is not a controlled experiment.

Espenshade et al. (2014) refer exclusively to thermoluminescence (TL) dating, when in fact optically stimulated luminescence (OSL) was the principal method employed by both the Oxford and Washington labs. OSL has several advantages over TL, with the principal one being that with OSL the signal is usually reset under less stringent conditions than TL, so that the possibility of the ceramics not being heated sufficiently to reset the TL signal may not be relevant to the OSL signal. Most of the Washington lab's ages were based on a combination of infrared-stimulated luminescence (IRSL), OSL, and TL, while the Oxford lab used OSL.

Espenshade et al. (2014:85–86) regard the divergent age estimates received for the 26 paired samples as evidence of the unreliability of luminescence dating, concluding that the data are useless for understanding the age of pottery types in the region.[2] The conclusion that the divergent estimates are unreliable derives from the assumption that inter-lab variation reflects inaccuracy. At some level this is true; if the two labs' age estimates do not agree statistically, then at least one of them must be inaccurate. However, it is important to recognize that the experiment conducted by Patch and Espenshade (2011) does not actually address the issue of accuracy. A distinction must be made between the precision of the age estimates and their accuracy. Lacking reference to independent information about the age of the 26 potsherds, the luminescence results for the paired samples cannot be used to evaluate the accuracy of the dates, but an evaluation of the source of inter-lab differences can provide information about the precision of the two labs' procedures, ultimately leading to improvements in the accuracy of future assays. As described in detail below, the two labs employed significantly different methods, and these methodological differences appear to account for most of the variance in age estimations between them. Thus, although discrepancies between dates may signal inaccuracy, there is no way to judge which, if either, of the dates is more accurate without referring to an independent source of age information. With regard to precision, had the two labs used identical methodological protocols, and identical instrumentation, the strength of the comparison would have been significantly enhanced. Fortunately, the degree to which inter-lab discrepancies result from methodological differences in measurement can be evaluated with reference to the specific protocols used, and it is also possible to assess the accuracy of these age estimates with reference to the larger body of chronometric data for the ceramics of the region, as will be described.

Espenshade et al. (2014:84, 86–87) criticize the luminescence labs' explanations for the divergence of their results as "post hoc" justifications of researchers trying to "explain away" unexpected dates. This objection inappropriately applies the concept of a post hoc fallacy. A post hoc logical fallacy is only committed when an event is identified as causal solely on the basis of its having occurred at a prior time. The explanation of subsequent events by reference to prior conditions is in no way fallacious, and to characterize reasoning of this sort in a pejorative sense is both inappropriate and disingenuous. Seeking explanations for results after the fact is an essential component of scientific reasoning and in the current application is simply a way of evaluating the causal conditions of observed effects.

In a similar spirit, Espenshade et al. (2014:86) typecast researchers who use luminescence dating as a "cavalier" band of "advocates," who presume on an a priori basis that the method "always works." This, of course, is nonsense. No dating specialist or archaeologist, no matter what method they are involved with, would agree with the premise that any particular dating method always works. Any date is an estimate based on a series of measurements. The estimate is calculated with an error term (stated at either 1-Ã or 2-Ã). The error term includes all random error associated with the reproducibility of the measurements and all systematic error that the dating practitioner is aware of and can quantify. If deriving a date estimate involves a large number of parameters, each of which must be estimated along with its own error term, the overall error can be relatively high because these errors are propagated. For this reason, errors are generally larger for luminescence dates than radiocarbon dates.

Despite these differences in perspective, to the extent that the experiment conducted by Patch and Espenshade (2011) provides an opportunity to review luminescence dating methods, explore systematic differences and constraints, and evaluate the accuracy of the dates in the context of regional ceramic data, their work represents a welcome contribution. No age estimate should be accepted at face value, and it is the job of the archaeologist to evaluate every date in conjunction with the dating specialist if necessary to determine if there is some systematic error that has not been taken into account. Certainly, the accuracy of any particular luminescence or radiocarbon age estimate cannot be presumed without evaluation and reference to other sources of information about the age of the artifact and the recovery context.

Table 1. Chronometric Information for Coastal North Carolina.

Dating Method	Sample Type	Count	Percent
Radiocarbon Dating	Wood Charcoal	94	39
Radiocarbon Dating	Nutshell or Annual	10	4
Radiocarbon Dating	Human Bone	12	5
Radiocarbon Dating	Shell	26	11
Radiocarbon Dating	Soot	5	2
Radiocarbon Dating	Sherd Organics	2	1
Luminescence Dating	Pottery (luminescence)	78	32
-	Not Specified	14	6
Total		241	100

One need only review the chronometric information for Coastal North Carolina to discover abundant examples of inaccuracy in routine radiocarbon dating of pottery (Table 1). For instance, about 39 percent (n=94) of the 241 dates associated with pottery from this region are radiocarbon assays for wood samples with unknown, and unknowable, biases due to the “old wood” effect (Dong et al. 2014; Geib 2008; Olsen et al. 2012; Schiffer 1986; Smiley 1998). When radiocarbon assays are run on charcoal derived from very old trees, results can predate by centuries the cultural event that produced the charcoal. In precontact times the Coastal Plain Southeast was characterized by open-canopied, fire-frequented forests dominated by longleaf pine (*Pinus palustris*). Early travelers (Nash 1895; Williams 1827, 1837) and scientists writing at the turn of the century (Bryant 1909; Chapman 1909, Harper 1911, 1914; Schwartz 1907) described these forests as essentially single-species stands of scattered, large longleaf pines intermixed with occasional oaks and clusters of small pines, together with grasses, forbs, and shrubs (Platt et al. 1988). In a study of the population dynamics of longleaf pine in an old-growth stand in Coastal Plain Georgia it was found that two thirds of longleaf pines were 50 years old or younger, but a third were much older, with some trees as old as 450 years (Platt et al. 1988). In a dendrochronological study of longleaf pine logs used to construct a crib dam on Little Rockfish Creek at Hope Mills, NC, ca. 1825 (many decades after the disappearance of presettlement old-growth stands), the average age of 21 cored trees was 145 years (Van de Gevel et al. 2009). As pine is the most commonly identified wood in paleoethnobotanical studies of carbonized plant remains from archaeological sites on Fort Bragg, it must be assumed that the “old wood" effect poses a significant risk for radiocarbon dating wood charcoal.

Another 12 percent of all dates from coastal North Carolina are radiocarbon assays on shell or human bone for which marine reservoir-effect correction factors are imprecisely known due to the lack of an appropriate, geographically proximate analog. Generally speaking, the radiocarbon date of a terrestrial sample such as a tree will be about 400 years younger than a marine shell of the same age (Stuiver and Braziunas, 1993). The reason for this is that the amount of ^{14}C in the atmosphere and in marine reservoirs is not the same. Disequilibrium occurs as there is a delay in exchange rates between atmospheric CO^2 and oceanic bicarbonate, and as the amount of ^{14}C in marine waters where shellfish grow is diluted by the mixing of near-surface water with upwelled deep water that is very old (Mangerud 1972). A reservoir correction must therefore be applied to any conventional shell dates to account for this difference, and the amount of disequilibrium is specific to each local marine environment.

Only four percent of coastal dates (n=10) are radiocarbon assays for nutshell, or short-lived plants, with only two percent (n=5) being assays of soot (Table 1). This says nothing of the uncertainty of affiliating pottery samples with spatially proximate datable organics and the temptation to affiliate one spatially associated potsherd with a carbon date, when in fact multiple potsherds of different types are justifiably associated with the same cultural event. Obviously, radiocarbon dating is fraught with inaccuracies arising not only from the "old wood" problem, but also from error inherent in the method of measurement and in the association of the age estimate with the past event in question.

Sources of Inaccuracy in Luminescence Age Estimates

Before considering the question of inaccuracy, it might be useful to briefly review the basics of luminescence dating and some potential sources of error. The luminescence signal is a function of natural radioactivity. When adsorbed, the energy from the radiation is stored at crystal lattice defects in some minerals. Release of the energy, by exposure to sufficient heat or light, results in luminescence. The total amount of stored energy is called the equivalent dose (measured in grays, Gy). When that is divided by the rate at which radiation is delivered to the sample, or dose rate (Gy/unit time), then the age since the energy was last released can be estimated (see Duller 2008).

One potential source of bias in luminescence age estimations is represented by post-depositional reheating. Patch and Espenshade (2011:744–755) report the results of an experiment, conducted by New South Associates, Inc., which measured the effects of wildfire on pottery. Several unfired clay test tiles were placed in an area that was subjected to controlled burning. Unfired test tiles were placed in several different micro-environments selected to vary fuel and oxygen conditions, with a few samples being buried. Results indicated that the unfired clay tiles located on the surface were subjected to temperatures hot enough to induce color changes, suggesting partial or initial conversion to ceramics. Patch and Espenshade (2011:745) reference several experiments conducted elsewhere in the U.S. that confirm the potential for wildfire to reheat potsherds, thus resetting the luminescence clock. They conclude that "…all TL dates on pottery from the Sand Hills should bear the caveat "or older" because we cannot know which results are actually reflecting the date of refiring by forest fire." They further state that "TL dating is not a prudent means of building a pottery chronology" and suggest that "researchers in the Sand Hills should treat TL results from pottery as highly suspect" (Patch and Espenshade 2011:755). We regard these conclusions as reactionary and the probability for ceramic refiring as exaggerated. That some of the unfired tiles in the Patch and Espenshade (2011) experiment were heated, as evidenced by a change in color, is not disputed, but whether they were heated high enough to reset the luminescence signal was not ascertained in the experiment. Surface color changes do not indicate whether the interior core of the potsherd, where luminescence samples are taken, was heated high enough to reset the luminescence clock.

In a similar experiment conducted by the Washington laboratory, a potsherd broken into four parts was subjected to different intensities of wild fire simulated by the U.S. Forest Service. The equivalent dose on all four pieces, one of which was not burned, was the same. In other words, the fires had no impact. This is not to say no fire does; the simulations involved fast moving fires, and ceramics generally have a fairly steep thermal gradient, so that even if the surface of a potsherd gets heated enough to change the surface color, the interior portion sampled in luminescence may not. On the other hand, a potsherd situated under a smoldering log or near a hot-burning stump could be reset all the way through. Consequently, it must be assumed that surface temperatures could under certain conditions exceed 500°C during wildfire episodes, re-setting luminescence clocks for sherds on the surface. We would add that wildfire in the Sandhills is assumed to have been frequent in precontact times (Frost 1993, 1998; Van Lear et al. 2005; Wright and Bailey 1982), as the predominant longleaf pine-wire grass ecosystem is a fire-adapted forest regime. Ironically, the frequency of wildfire in precontact times is one of the primary reasons why luminescence dating is so useful in the Sandhills. Peat cores collected from two sites on Fort Bragg that were analyzed for pollen indicate that frequent wildfire introduced charred plant remains into the soil column on an essentially continuous basis throughout the Holocene (Goman and Leigh 2003, 2004), making radiocarbon dating very problematic. We concur that there is no procedure that any luminescence lab can implement to identify if a given pottery sample has been subjected to post-depositional reheating, and given these circumstances we agree that the use of luminescence dating to establish a regional ceramic chronology for the Carolina Sandhills has limitations, and that researchers choosing this method should question the accuracy of age estimates for any sample submitted. This is simply good science. Nevertheless, we strongly disagree with the conclusion reached by Espenshade et al. (2014:96–97) that the risk involved with using luminescence dating in the Sandhills outweighs its benefits, and we regret the constraint they place upon themselves and other professionals by characterizing luminescence dating as wholly unreliable. Although the results of luminescence dating must be evaluated with the knowledge that each sample may have been affected by incidental post-depositional refiring, among other potential sources of error, assessing results against the larger set of chronometric data for the site, the locale, and the region provides a reasonable way to evaluate the accuracy of any estimate. Any regional set of ceramic age estimates, derived from either dating method, remains provisional as the quantity and quality of data are sufficiently indicative.

Partial ceramicization, as might occur if a pot was improperly fired, can also result in incomplete resetting of the luminescence clock, but this is assumed to be a relatively rare occurrence. A vessel not fired to 450–500°C, the temperature at which clay turns to ceramic, would soften or dissolve when wet and likely would not survive in the archaeological record. In theory, however, it is possible for vessels to be so tentatively fired that the surface is ceramicized, but not the core. There are different components to the luminescence signal, some re-set more easily than others, and one reason for using both OSL and TL is to test for re-setting of either the TL or OSL component. The TL signal is often dominated by a slowly bleaching component, whereas the OSL signal is often dominated by a fast-bleaching component, although OSL also has a slow-bleaching component.

Regarding anomalous fading, this is an often misunderstood phenomenon. Anomalous fading is the loss of signal through time that would not be expected based on the kinetics of the luminescence process. Although it is called anomalous for this reason, the cause of it—quantum tunneling—is well known. It is also known that it affects mainly feldspar minerals, not quartz. With fine-grain dating, such as that performed by the University of Washington for the New South Associates samples, feldspars were not excluded, so anomalous fading was expected. In fact, it was detected for the TL signal on every sample for which it was tested with one exception. It was not tested on samples that were too small to yield sufficient material (five in this study). However, the OSL signal did not appear to fade. All OSL measurements were preceded by an infrared stimulation (IR). IR will reduce the feldspar signal but it may not eliminate it. That it was eliminated was evident from the measurement of b-value, a ratio of signals from alpha and beta irradiation used to correct for the lower efficiency of alpha irradiation in producing luminescence. The b-value differs for quartz and feldspar, and all of these samples had OSL b-values in the range of quartz. This indicates the OSL signal was not coming from feldspar and therefore did not fade. OSL was not used in the Herbert et al. (2002) study and fading of the TL signal was a problem there and contributed to the high errors. That study, to which Espenshade et al. refer almost exclusively, was a pilot study, and luminescence methods have improved considerably since then. The high errors reported by Herbert et al. (2002) were not repeated in the New South report (Patch and Espenshade 2011), where the errors on the final age ranged from 4.1 to 11.4%, with a median of 6.8%.

Different Laboratory Methods and Results

Much of the discrepancy in age estimates between the Oxford and Washington labs can be accounted for by the measurement of the dose rate that was, in part, the result of systematic error by the Washington lab. The radioactive isotope of potassium, ^{40}K, is one of the major contributors to the dose rate in luminescence dating. There are different ways to measure it, usually by measuring total K and calculating ^{40}K by atomic abundance. Oxford used ICP to measure total K. Washington used flame photometry with some back-up checking by beta counting. During the time these measurements were made, the Washington lab was having trouble getting consistent results from the flame photometer. This was made apparent by comparison of some results with measurements using a portable X-ray fluorescence (XRF) devise. When

Oxford's ICP results became available, it was found that they agreed with the UW lab's XRF results. The Washington lab reanalyzed some of the New South K measurements on the flame photometer and got results that agreed with Oxford's. Adjusting the UW ages based on the K-measurement standards used by Oxford results in 52 percent of ages from the two labs corresponding at the 1-Ã level of confidence, and 80 percent at the 2-Ã level. The discrepancies in K concentrations were also mitigated by beta counting. Revising Washington's age estimates based on Oxford's K measurements and beta counting does not alter any date by more than 1Ã, but systematically shifts all estimates to a younger age, bringing them slightly closer to Oxford's ages. Such observations illustrate the importance of the replication of measurement standards and procedural protocols between labs.

A second issue involving dose rate concerns water absorption. Water absorbs radiation at a different rate than sediment or ceramic, and to produce an accurate age estimate, an accurate estimation of the sample's water content over time is required. Because this cannot be measured directly, an educated guess with generous error terms is advisable. At Washington this was estimated for the ceramics at 70 ± 30 percent of the saturated moisture value. The total content ranged from 6 to 12 percent. This compares with Oxford's assumption of three percent for all samples. Given the temperate climate in which the samples were found, Oxford's moisture values may be underestimated. Getting an accurate moisture estimate is an inherent problem in luminescence and is usually addressed by supplying large error terms (e.g., 30 percent) to cover all reasonable possibilities. When the same moisture content is applied to the results from both labs, the correspondence between the UW and OX sets of results improves to 56 percent within 1Ã, and 88 percent within 2Ã. This is closer to statistical expectations but still leaves three dates that are more than 2Ã apart.

In summary, none of the discrepancies can be attributed to problems with the luminescence method itself, but to problems in the application: imprecisely calibrated equipment, different assumptions about moisture, and different procedures. For this reason, the study undertaken by Patch and Espenshade (2011) was not well designed to evaluate inter-laboratory methodology, as there was no attempt to standardize the procedures and consequently labs followed very different procedures. It might be objected that no matter what the procedure, given that either procedure is valid, the same answers should be produced by any lab to which samples are submitted. This is generally true, but there are many variables to be estimated in luminescence dating, and if these estimations are derived by variant means, variation in these estimates should be expected. At best, the study tested consistency between laboratory methods.

Evaluating the Age Estimates for Pottery

Prior to evaluating the validity of the age estimates by referring to the pottery samples and the larger body of regional chronometric data, three observations may be made by simply arranging the Oxford (OX) and Washington (UW) dates by age (Figure 1). When the two labs' values are regressed, some dates appear to be too early, dates appear to be grouped, and some dates fall outside .95 confidence interval. First, there are some dates that appear to be simply too old. Dates for Samples 25 and 18, for example, are older than would be expected for any pottery from this region. Current estimates for the earliest examples of Stallings Island, currently assumed to be the first pottery-making tradition to emerge on the east coast, are about 2500 B.C. (Sassaman 1993). Washington's age estimate for Sample 25 (2739±462 B.C.), and Sample 18 (2538±2920 B.C.), suggest that there may be problems with these dates. Oxford's estimate for Sample 25 (2092±305 B.C.) is also quite early, further suggesting that this sample may be problematic.

A second observation is that the data appear to be grouped (Figure 1). The OX dates appear to be arranged in three visually distinct sets: one set of seven dates younger than A.D. 1000, a second set ranging from A.D. 1 to 1000, and a third set older than 800 B.C. Each set is defined by a hiatus, with the oldest set of OX dates well separated from the middle-aged set by 800 years. The UW dates are similarly grouped, but with less definition between groups, as hiatuses punctuating group boundaries are of shorter duration. Three groupings are suggested: one set of seven dates younger than A.D. 1000, a second set containing dates ranging from 500 B.C. to A.D. 700, and a third group of older dates ranging from 2200 B.C. to 700 B.C. Although the three sets of dates vary somewhat between labs, the process of simple visual grouping reveals a pattern indicating that, in general, samples from the same site are grouped together (Table 2). The youngest set of dates (Group 1) was derived from site 31CD871, the middle-aged set (Group 2) was from site 31CD64 and site 31CD65, and the oldest set (Group 3) consisted mostly of samples from site 31CD65, with a second early component represented at site 31CD871. With no more complex analysis than simply arranging the dates by age, it may be concluded that groups of

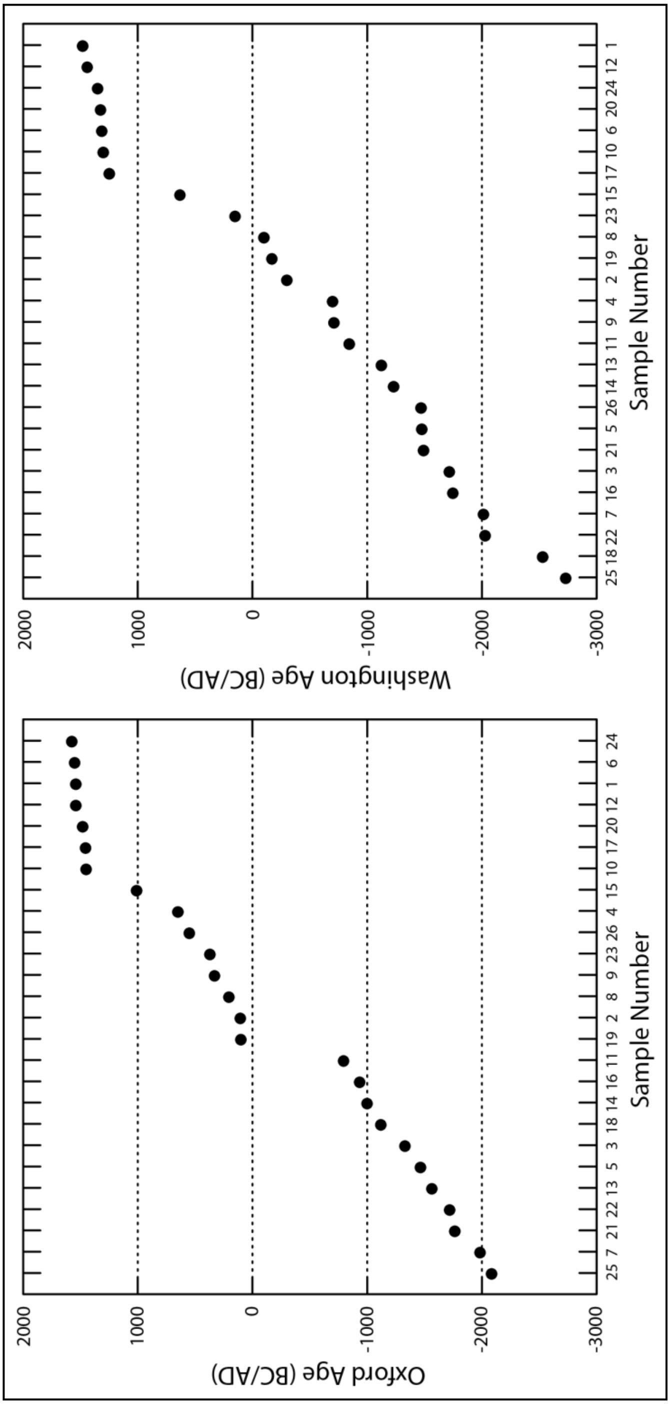

Figure 1. Oxford (OX) and Washington (UW) dates arranged by age.

Table 2. Twenty-Six Sample Dates Arranged in Three Age Groups.

Group 1		Group 2		Group 3	
Sample	Site-Vessel	Sample	Site-Vessel	Sample	Site-Vessel
1	31CD871-15	2	31CD64-4	3	31CD65-3
6	31CD871-19	4	31CD65-12[1]	5	31CD65-11
10	31CD871-17	8	31CD64-3	7	31CD65-18
12	31CD871-06	9	31CD64-2[1]	11	31CD65-1
17	31CD871-20	15	31CD65-15	13	31CD65-10
20	31CD871-07	19	31CD64-1	14	31CD65-2
24	31CD871-18	23	31CD64-7	16	31CD871-16
		26	31CD65-12[1]	18	31CD871-9[2]
				21	31CD871-4
				22	31CD65-4
				25	31CD65-7[2]

[1] UW dates included in Group 3.
[2] Samples UW identified as problematic.

dates are geo-spatially correlated and likely relate to specific cultural components.

A third observation concerns the identification of possible problem cases based on a regression of UW and OX dates, plotted with .95 confidence bands (Figure 2). Results indicate that there are seven samples (4, 9, 13, 16, 18, 21, and 26) with values plotted outside the .95 confidence interval. Two of these samples (13 and 21) are estimates for which the OX values are older than the UW values, and the remaining five have UW values that are older than OX values (Table 3). Among the seven values outside the .95 confidence band, four are also listed by Espenshade et al. (2014:91, Table 2) as not corresponding at the 2-Ã level.

The regression of OX and UW mean age estimates with the .95 confidence band may be a better identifier of problem dates than the assessment of the 2-Ã error-range overlap. The comparison of 2-Ã error ranges is strongly biased by the size of the error terms. The larger the error terms, the greater the probability that the 2-Ã ranges will overlap. For example, two dates with small error terms, say 30 years, with mean values that are only 70 years apart will fail the 2-Ã correspondence test. But two mean age estimates that are 500 years apart will pass the 2-Ã correspondence test if both estimates have error terms of at least 250 years. If two age estimates for the same potsherd are 70 years apart, we

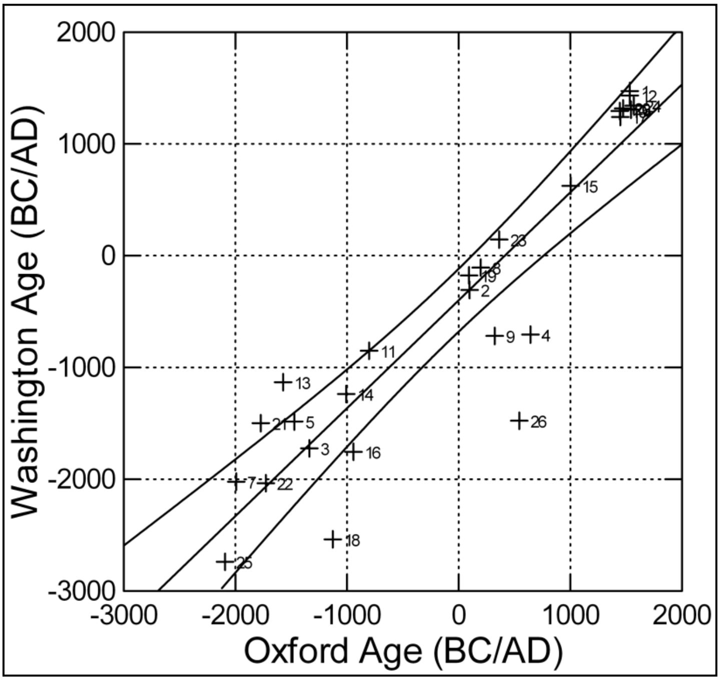

Figure 2. Regression of OX and UW dates, plotted with .95 confidence bands.

may judge this to be acceptable variation, but if the same sherd yields dates 500 years apart, we may not be willing to accept this degree of uncertainty. The amount of existing chronometric data must also be factored in; if very little chronometric data are available for the pottery type, then a date with a 500-year error term may be useful at some level. However, when commercial dating labs processing identical samples return age estimates several hundred years apart, it is reasonable for archaeologists to question the usefulness of the data. It therefore remains to be seen how the data from this experiment may be evaluated to provide useful information both for the archaeologists and the dating specialists.

In order to evaluate the accuracy of the luminescence age estimates provided by the Washington and Oxford labs, it is necessary to consider the data as they relate to pottery types. Espenshade et al. (2014) provide no discussion of the characteristics of the pottery samples, other than to summarize the range of age estimates for each pottery series, presumably based on a typological classification model proposed for the Sandhills that has been emerging over the last couple decades (Herbert and Mathis

Table 3. Sample Age Data, 2-σ Error, and .95 Confidence-interval Correspondence.

Sample[1]	OX Sample	OX date	OX 1-σ[2]	UW Sample	UW date	UW 1-σ[3]	OX-UW Age Difference	2-σ Correspondence	.95 Confidence Interval
5	X-3058	1472 BC ± 270	270	UW-1779	1484 BC ± 145	145	12	Yes	Inside
7	X-3060	1992 BC ± 290	290	UW-1781	2022 BC ± 247	247	30	Yes	Inside
11	X-3064	802 BC ± 190	190	UW-1785	851 BC ± 174	174	49	Yes	Inside
1	X-3054	AD 1533 ± 35	35	UW-1775	AD 1473 ± 31	31	60	Yes	Inside
12	X-3065	AD 1533 ± 35	35	UW-1786	AD 1433 ± 35	35	100	Yes	Inside
10	X-3063	AD 1443 ± 55	55	UW-1784	AD 1294 ± 62	62	149	Yes	Inside
20	X-3073	AD 1473 ± 45	45	UW-1794	AD 1317 ± 53	53	156	Yes	Inside
17	X-3070	AD 1448 ± 55	55	UW-1791	AD 1241 ± 51	51	207	Yes	Inside
23	X-3076	AD 363 ± 150	150	UW-1797	AD 144 ± 133	133	219	Yes	Inside
24	X-3077	AD 1568 ± 30	30	UW-1798	AD 1342 ± 57	57	226	No	Inside
14	X-3067	1007 BC ± 225	225	UW-1788	1238 BC ± 221	221	231	Yes	Inside
6	X-3059	AD 1543 ± 35	35	UW-1780	AD 1306 ± 56	56	237	No	Inside
19	X-3072	AD 93 ± 170	170	UW-1793	177 BC ± 167	167	270	Yes	Inside
21	X-3074	1772 BC ± 440	440	UW-1795	1499 BC ± 262	262	273	Yes	Outside
8	X-3061	AD 198 ± 120	120	UW-1782	107 BC ± 141	141	305	Yes	Inside
22	X-3075	1727 BC ± 270	270	UW-1796	2036 BC ± 273	273	309	Yes	Inside
15	X-3068	AD 1003 ± 85	85	UW-1789	AD 625 ± 95	95	378	No	Inside
3	X-3056	1337 BC ± 240	240	UW-1777	1724 BC ± 242	242	387	Yes	Inside
2	X-3055	AD 98 ± 175	175	UW-1776	307 BC ± 296	296	405	Yes	Inside
13	X-3066	1572 BC ± 255	255	UW-1787	1132 BC ± 181	181	440	Yes	Outside
25	X-3078	2092 BC ± 305	305	UW-1799	2739 BC ± 462	462	647	Yes	Inside
16	X-3069	942 BC ± 195	195	UW-1790	1755 BC ± 273	273	813	Yes	Outside
9	X-3062	AD 323 ± 105	105	UW-1783	718 BC ± 234	234	1041	No	Outside
4	X-3057	AD 643 ± 125	125	UW-1778	706 BC ± 217	217	1349	No	Outside
18	X-3071	1127 BC ± 210	210	UW-1792	2538 BC ± 290	290	1411	No	Outside
26	X-3079	AD 543 ± 125	125	UW-1800	1477 BC ± 279	279	2020	No	Outside

1996; Herbert et al. 2002; Herbert 1999, 2003, 2009, 2011; Herbert et al. 2015). Espenshade et al. (2014:94, Table 3) report age ranges for three pottery series (New River, Cape Fear, and Hanover) based on the luminescence data from the experiment (Patch and Espenshade 2011). According to their arrangement, the temporal spans for each series are vast, with the age ranges for the three pottery series overlapping greatly. Consequently, the authors conclude that the data are useless and question the validity of the current luminescence-based pottery sequence model (Espenshade et al. 2014:93). Unfortunately, the samples are not identified by number, temper and surface treatment characteristics are not described, and no information is provided about how samples were classified to series. Because of this, the results presented by Espenshade et al. (2014:94, Table 3) are simply unverifiable. If, however, we assume that the pottery series identifications presented in Espenshade et al. (2014:94, Table 3) are derived from the technical report of the project in which the luminescence experiment was performed (Patch and Espenshade 2011), then some important observations may be made. First, the pottery classification scheme presented in the contract report (Patch and Espenshade 2011) does not conform to the typological system that Espenshade et al. (2014) purport to critique (viz., Herbert et al. 2002; Herbert 2003). In fact, the contract report explicitly describes how and why their pottery classification scheme differs (Patch and Espenshade 2011:846–848). For example, Patch and Espenshade (2011) list several reasons why grog identified in the petrographic analysis was not considered to be sufficient grounds to classify potsherds to the Hanover series. At this point, it might be useful to briefly review the pottery sequence that has been proposed by the lead author of this paper as a provisional model for the Sandhills region.

A simple key for systematically sorting pottery for the North Carolina Sandhills is illustrated in Figure 3. This system is very similar to the one used in the *Southeastern Archaeology* article (Herbert et al. 2002) to which Espenshade et al. (2014) principally refer. This system has also been discussed in subsequent publications (Herbert 2003, 2009), and is slightly revised here to reflect more recent studies (Herbert 2011; Herbert et al. 2015). Like any pottery classification scheme, this one has some benefits and some limitations, and must be considered as an evolving model. It establishes mutually exclusive classes based on easily observable characteristics, but lacks nuance; it is robust, but inevitably lumps some variation in ceramic technique that might signal cultural differences. Its usefulness resides in the ease with which others can reliably replicate it and in its ability to sort pottery into groups with

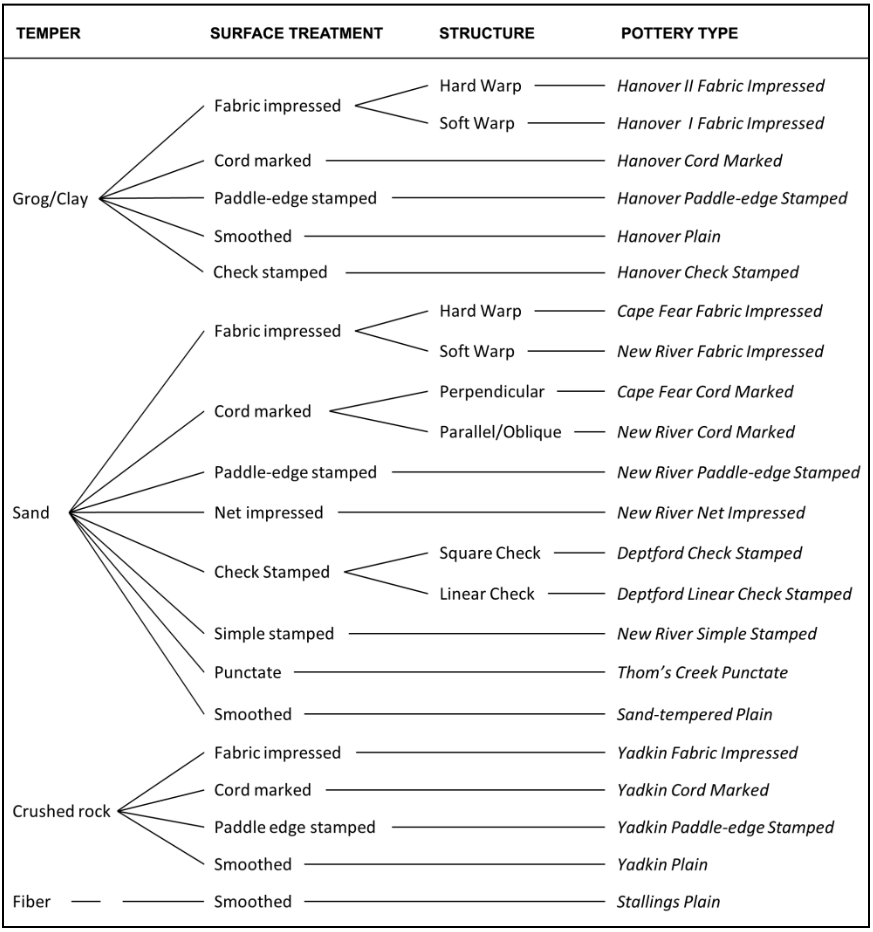

Figure 3. A simple key for systematically sorting pottery from the North Carolina Sandhills.

similar traits that are spatially and temporally grouped. Importantly, this classification scheme does not purport to identify perceived cultural or technological information. For example, these type definitions are not based on the performance characteristics of one sort of temper over another, the difficulty or ease with which different size grades of temper particle might have been sorted or included in the paste, or the visual effects that certain temper particles might have implied for cultural signaling (cf., Patch and Espenshade 2011:847). Referring as they do to the prehistoric potters' cultural perceptions, values, and judgments, such traits are interesting but ultimately unverifiable.

In the current study, one of the most important distinctions among pottery classes is the inclusion of grog temper. Focused studies have been undertaken to explore the variation that exists within the class of grog-tempered pottery from this region (Herbert and Smith 2010; Herbert et al. 2011, 2012, 2015), but for the current study it is enough to know that if a sherd includes grog in the paste it is classified as Hanover, and if it does not it is classified as something else. Grog can sometimes be difficult to identify, even using a binocular microscope with fiber optic incident light to view freshly broken cross sections. Fortunately, however, all of the pottery samples referred to in Espenshade et al. (2014) were thin sectioned and petrographically analyzed, with tabulated results reported in Patch and Espenshade (2011, Appendix C). By cross-referencing sample numbers appearing in Appendix C (Patch and Espenshade 2011, Volume 3) to vessel descriptions and photographs appearing elsewhere in the report, it was possible to associate the petrographic data with the sherd samples for each vessel that was luminescence dated. As a result, it was possible to determine the originally reported pottery type identifications for each luminescence-dated sample (Patch and Espenshade 2011), and it is assumed that these identifications were repeated in Espenshade et al. (2014). It was then possible to re-evaluate the classification of each sample in accordance with the typological scheme described above (Table 4). As specifically referenced in the contract report (Patch and Espenshade 2011:848), many sherds in which grog was identified in the petrographic analysis were purposefully classified to types other than Hanover, and consequently dates associated with these potsherds were misrepresented in the summary of type samples presented by Espenshade et al. (2014:94, Table 3).

It was also possible to accurately classify luminescence-dated specimens according to details in surface treatment that were very clearly illustrated with high-resolution digital images in Patch and Espenshade (2011). With the pottery reclassified according the scheme presented above (Figure 3), a very different result is obtained from the luminescence data than that presented by Espenshade et al. (2014). When the appropriate pottery type identifications are added to the plot of sample age estimates, the pottery types neatly arrange themselves in a comprehensible sequence (Figure 4). If, as Espenshade et al. (2014) suggested, the age estimates returned by the two labs are little better than guesswork, we should expect samples arranged chronologically by mean age to exhibit little or no grouping by pottery type. In fact, by using reclassified type information the set of age estimates provided by either

Table 4. Pottery Sample Traits for Temper, Surface Treatment, and Type Classification.

			Temper[1]		Surface Treatment[2]		Typological Classification	
Sample	Site	Vessel	Grog	Rock	Type	Structure	New South[3]	Herbert
1	31CD871	871-19	Yes	pyroxene+plag, qtz	Fabric Impressed	hard warp, medum weft, overstamped, weft 1-2mm	Cape Fear	Hanover II Fabric Impressed
2	31CD64	64-4	Yes	qtz	Cord Marked	oblique, heavy overstamp	?	Hanover I Cord Marked
3	31CD65	65-3	No	qtz	Cord Marked	narrow cord, close laid and spaced, over-stamped oblique	Cape Fear	New River Cord Marked
4	31CD65	65-12[4]	Yes	qtz	Fabric Impressed	wide hard-warp, fine-weft, overstamp	Hanover	Hanover Fabric Impressed
5	31CD65	65-11	No	qtz	Cord Marked	narrow cord, moderately spaced, heavy oblique overstamp	Cape Fear	New River Cord Marked
6	31CD871	871-15	Yes	qtz+pyroxine+?	Fabric Impressed	hard warp, oblique overstamped, some weft-free warp elements	Cape Fear	Hanover II Fabric Impressed
7	31CD65	65-18	No	none	Plain	smoothed-over cord marked	New River	New River Plain
8	31CD64	64-3	Yes	qtz+kspar+mafic	Fabric Impressed	soft warp	?	Hanover I Fabric Impressed
9	31CD64	64-2	Yes	qtz	Fabric Impressed	soft warp	?	Hanover I Fabric Impressed
10	31CD871	871-17	Yes	qtz+feldspar, pyroxene+plag	Fabric Impressed	hard warp, oblique overstamped, some weft-free warp elements	Hanover	Hanover II Fabric Impressed
11	31CD65	65-1	No	Qtz	Cord Marked	narrow cord, closely laid, overstamped parallel	New River	New River Cord Marked
12	31CD871	871-6	Yes	Qtz	Fabric Impressed	hard warp, oblique overstamped, some weft-free warp elements	New River	Hanover II Fabric Impressed
13	31CD65	65-10	No	Qtz	Cord Marked	medium cord, moderately spaced, oblique overstamp	Cape Fear	New River Cord Marked
14	31CD65	65-2	No	qtz+k-spar+zircon	Cord Marked	wide cord, close laid, overstamped parallel	New River	New River Cord Marked

Table 4 continued.

			Temper[1]		Surface Treatment[2]		Typological Classification	
Sample	Site	Vessel	Grog	Rock	Type	Structure	New South[3]	Herbert
15	31CD65	65-15	Yes	qtz	Fabric Impressed	wide hard warp, fine weft, overstamped; very shallow with extensive post-stamped smoothing	Hanover	Hanover Fabric Impressed
16	31CD871	871-16	No	qtz+feldspar+mafic	Cord Marked	no photo; no decription of overstamping pattern	Cape Fear	New River Cord Marked
17	31CD871	871-20	Yes	pyroxene+plag, qtz, feldspar	Fabric Impressed	hard warp, weft 1-2mm	Cape Fear	Hanover II Fabric Impressed
18	31CD871	871-9	No	qtz+kspar+musc.	Cord Marked	parallel overstamped, s-twist	New River	New River Cord Marked
19	31CD64	64-1	Yes	qtz	Cord Marked	heavy overstamp, oblique	?	Hanover I Cord Marked
20	31CD871	871-7	Yes	qtz	Fabric Impressed	hard warp, oblique overstamped, some weft-free warp elements	New River	Hanover II Fabric Impressed
21	31CD871	871-4	No	qtz	Cord Marked		New River	New River Cord Marked
22	31CD65	65-4	No	qtz	Simple Stamped	wide rib, shallow application	Cape Fear	New River Simple Stamped
23	31CD64	64-7	Yes	qtz	Fabric Impressed	soft warp	?	Hanover I Fabric Impressed
24	31CD871	871-18	Yes	qtz+kspar+musc.	Fabric Impressed	hard warp, weft 1-2mm	Cape Fear	Hanover II Fabric Impressed
25	31CD65	65-7	Yes	qtz	Cord Marked	narrow cord, moderately spaced, very shallow, oblique overstamp	Hanover	Hanover I Cord Marked
26	31CD65	65-12[4]	Yes	qtz	Fabric Impressed	wide hard warp, fine weft, overstamped	Hanover	Hanover Fabric Impressed

[1] Temper characteristics were derived from petrographic data (Patch and Espenshade 2011, Appendix C).
[2] Surface treatment characteristics determined from photographs (Patch and Espenshade 2011).
[3] New South Associates, Inc., pottery type classifications could not be determined in all cases.
[4] Samples 4 and 26 are portions of the same sherd. UW lists them as 4 and 27, OX lists as 4 and 26; the OX sample number sequence is used in this paper.

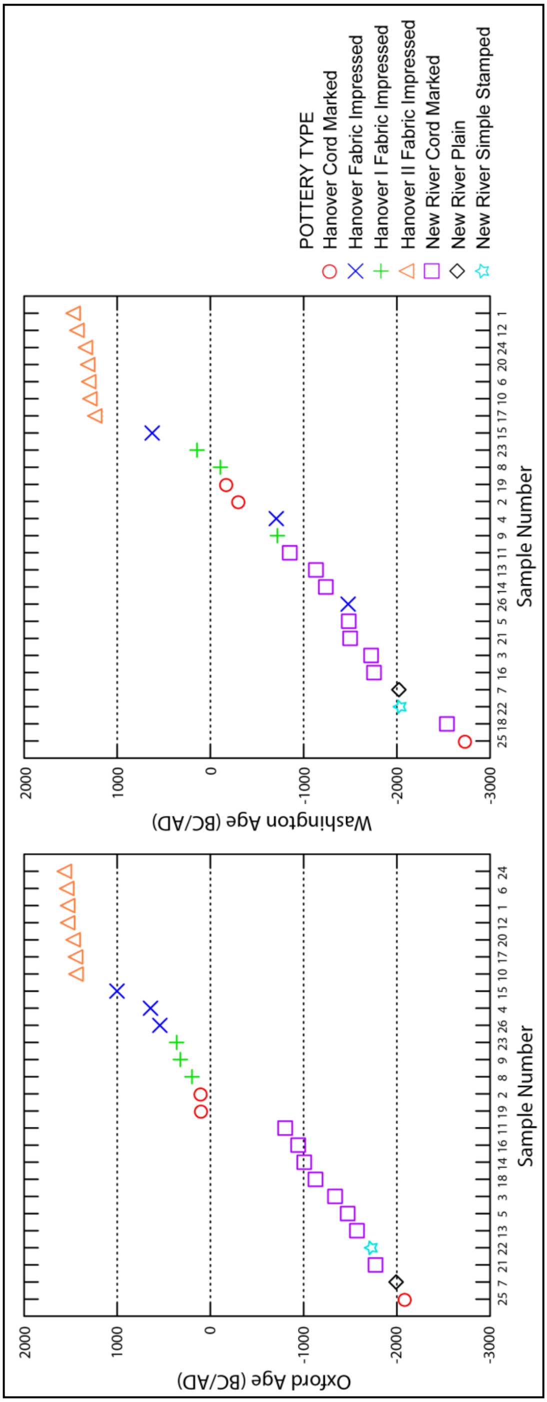

Figure 4. Pottery type identifications added to the plot of sample age estimates.

Oxford or Washington arrange most of the samples in similar order, with dates grouping by type in a sequence that agrees very closely with the current provisional ceramic sequence model for the region. Chronological arrangements based on each lab's results are not identical, however, and there are some cases that appear to be out of sequence, raising questions about certain dates. Further information may be gathered by situating the dates and pottery types in the context of the larger body of regional chronometric data.

Evaluating Results with Regional Data

Perhaps the most powerful means of evaluating the luminescence results is to situate them in the context of all relevant dates associated with pottery from sites in the Coastal Plain region of North Carolina. Among the 243 radiocarbon and luminescence dates compiled for coastal North Carolina (Herbert 2011, Appendix A), 59 are described as being associated with Hanover pottery and 19 are associated with New River pottery. Among the 59 dates related to Hanover potsherds, 14 are radiocarbon dates for organic remains from contexts that included not only Hanover pottery, but also other types of pottery. Similarly, among the 19 New River dates three were associated with more than one pottery type. Given the uncertainty of the association of the target pottery type with the dated event, dates associated with more than one pottery type were excluded from the comparative data. The resulting database includes 45 Hanover dates and 16 New River dates. For most of these, surface treatment types were also recorded so that the pottery series and type could be identified.

When the independent sample of Hanover dates, together with the set of dates provided by the Oxford and Washington labs, are arranged in chronological order and grouped according to pottery type, it is evident that the OX and UW dates for types are arrayed in a sequence similar to that seen in the regional data (Figure 5). Both the OX and UW dates for the seven Hanover II Fabric Impressed (rigid warp) samples group with other coastal samples of this type at the late end of the range, post-dating A.D. 1000. Washington's results place this set of dates slightly older than Oxford's (for reasons discussed above). The average difference in age between the seven OX and UW dates for Hanover II Fabric Impressed samples is 162 years, with the range for Oxford dates being A.D. 1443–1568 and the range for Washington being A.D. 1241–1473. The seven pottery vessels in this set appear to represent a single Late Woodland component excavated from a single area at site 31CD871. Three radiocarbon dates (cal. A.D. 1240–1380, cal. A.D. 1420–1480, and

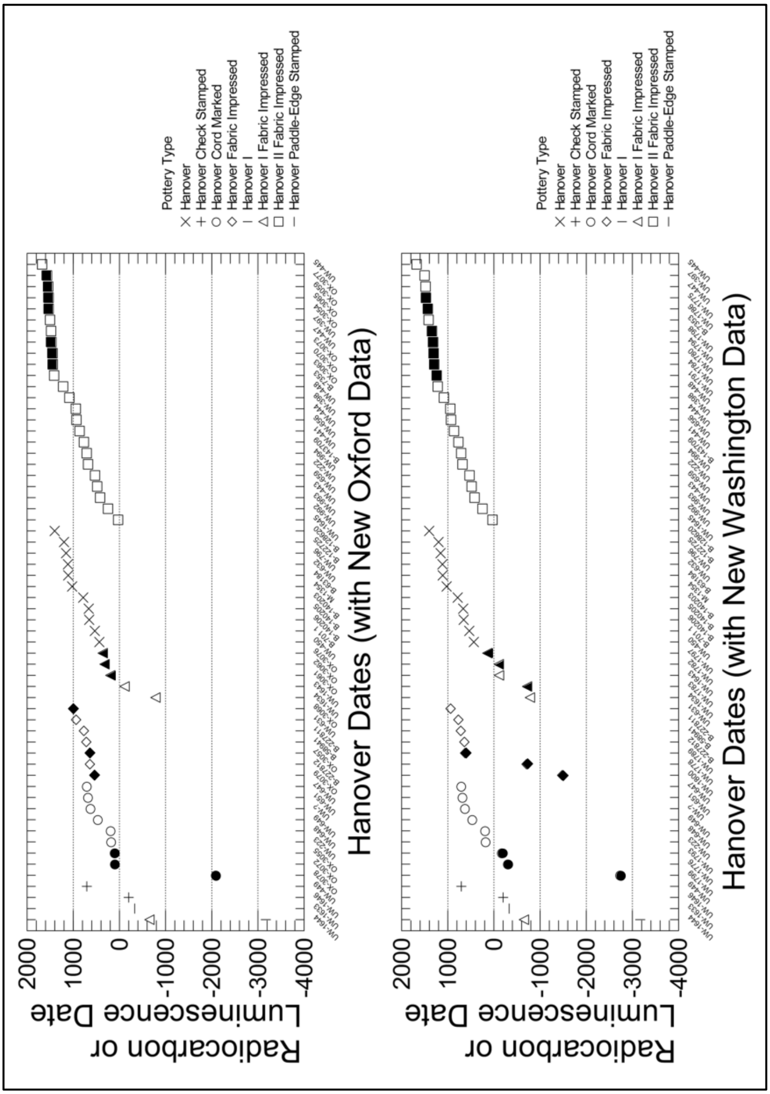

Figure 5. Existing dates for Hanover series pottery, including new data provided by the Oxford and Washington labs (filled symbols), grouped according to type. Symbols depict luminescence means or radiocarbon intercepts.

cal. A.D. 1450–1650) for charcoal from spatial contexts likely associated with the luminescence-dated Hanover samples provide independent data confirming the luminescence age estimates, but they do not improve the resolution of the estimated age of the occupation (Patch and Espenshade 2011).

A slightly older set of three dates were returned for two Hanover Fabric Impressed vessels whose fabric impressions were so shallow and eroded that their structure could not be determined. Samples 26 and 4 (UW-1800 and UW-1778, OX-3079 and OX-3057, respectively) were quartered parts of the same potsherd, with each lab receiving two quarters. Oxford's dates for the two samples from the single pot were 100 years different (A.D. 543±125 and A.D. 643±125) and Washington's estimates were 771 years different (1477±279 B.C. and 706±217 B.C.). The two dates for the one potsherd and the second potsherd with similar fabric impressions group with others of this sort from the Coastal Plain (Figure 5). Oxford's age estimates for these three samples range in mean age from A.D. 543–1003, with one of the Washington estimates (A.D. 625±95) also in this range. Two of Washington's estimates for the three samples, however, were very much older. Problems with these samples make it impossible to be certain of the age of the two vessels comprising this set, although the regional data indicate pottery of this types should be expected to date to the latter half of the Middle Woodland period (ca. A.D. 400–800).

Three Hanover I Fabric Impressed (flexible warp) vessels from site 31CD64 comprise the next oldest set (Figure 5). Oxford's estimates for these three samples (A.D. 198±120, A.D. 323±105, and A.D. 363±150) and two of Washington's estimates (A.D. 144±133 and 107±145 B.C.) indicate a Middle Woodland age for these vessels. One UW date (718±234 B.C.) is earlier than the others, but is grouped with two other coastal dates for pottery of this types (UW-1634, 780±280 B.C., and UW-1644m 650±400 B.C.), both of which were vessels recovered from sites 31HK1540 and 31HK1620, respectively, on Fort Bragg (McNutt and Gray 2009). Ultimately, there are too few dates associated with Hanover I Fabric Impressed to determine the age of this type with certainty; however, the dates acquired in the present experiment contribute to the evidence indicating this is a Middle Woodland pottery type.

Three Hanover Cord Marked vessels from two sites were dated in the present experiment (Figure 5). Two of the samples from site 31CD65 indicate Middle Woodland ages that group with other coastal dates for this pottery type, although at the early end of the range. Sample 25 from site 31HK871 was dated very early in the Woodland era by both labs (OX-3078, 2092±305 B.C., and UW-1799, 2739±462 B.C.). Both of these dates are earlier than expected for Hanover pottery of any type and indicate a potential problem with this sample.

Among 10 age estimates provided for New River vessels, only the set of eight New River Cord Marked sherds comprise a sample large enough to evaluate the relative accuracy of the dates (Figure 6). Sample sizes for one New River Simple Stamped and one New River Plain potsherd are too small to conclude more than that these types appear to be Early Woodland in age, predating 400 B.C.

The set of eight age estimates provided for New River Cord Marked vessels from 31CD65 (n=5) and 31CD871 (n=3) are well grouped, with the average difference of 396 years between Oxford's and Washington's mean dates (Figure 6). The range in mean ages provided by Washington, 2538–851 B.C., is very similar to the range of Oxford estimates, 1992–802 B.C., with one early outlier in the UW date set (UW-1792, 2538± 290 B.C.) for Sample 18 from site 31CD871, possibly representing a problem sample.

In general, these results demonstrate that the luminescence data from this project are indeed effective in situating the pottery types they represent within the regional ceramic sequence. Not only do the dates confirm and contribute to the regional prehistoric ceramic sequence, they also add substantially to the interpretation of the specific cultural components and ages of occupation at the three archaeological sites on Fort Bragg federal military reservation from which samples were drawn. Given the substantial cost to the NC-DOT for data recovery excavations at these three sites, and for dating 52 pottery samples, it is gratifying that the luminescence data can be used in a constructive way, not exclusively to attempt to indict the dating method. It is hoped that the present analysis will restore confidence in luminescence dating for use with pottery from coastal North Carolina and elsewhere in the southeastern U.S. Issues concerning inter-laboratory replicability raised by Espenshade et al. (2014) are significant, however, and it is important that the problems exposed by the experiment are not glossed. For that purpose we review problem assays, their possible causes, and potential solutions.

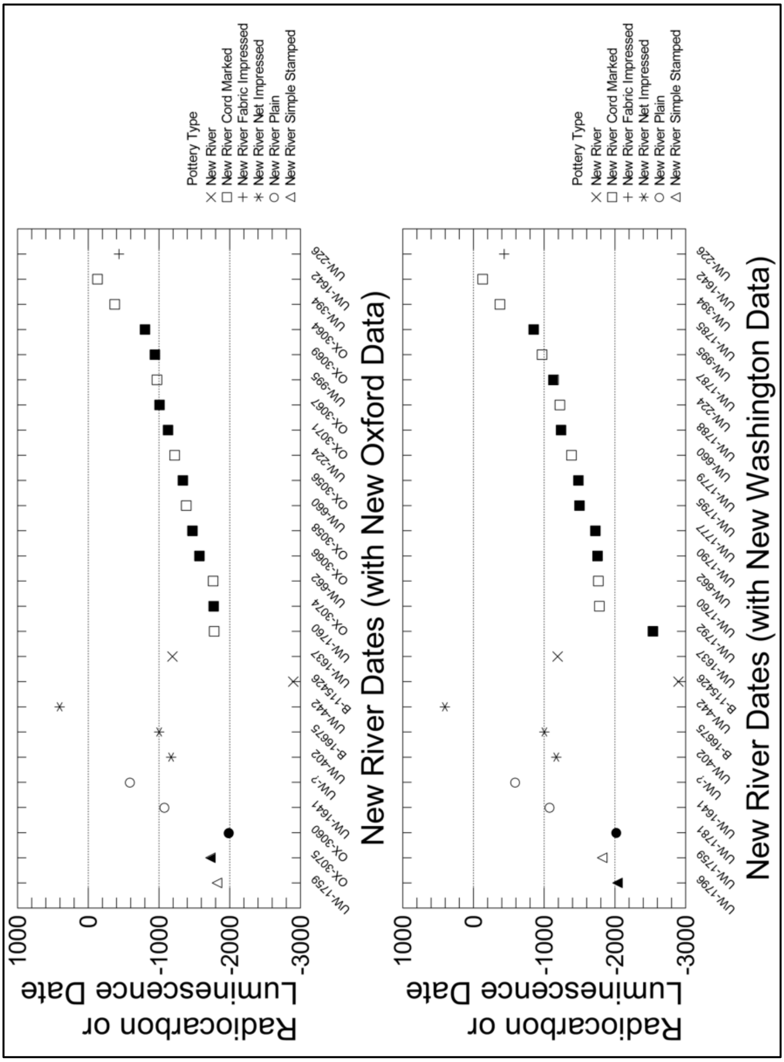

Figure 6. Existing dates for New River series pottery, including new data provided by the Oxford and Washington labs (filled symbols), grouped according to type. Symbols depict luminescence means or radiocarbon intercepts.

Discussion

Eleven of the 26 samples yielded dates that prompted specific consideration (Table 5). The regression plot of results from the two labs shows that dates for seven pottery samples (4, 9, 13, 16, 18, 21, and 26) fall outside the .95 confidence interval, indicating that there are significant inter-lab differences for these seven samples. Four of the seven have 2-Ã error ranges that do not correspond, and another three (6, 15, and 24) are within the .95 confidence interval, but have 2-Ã error ranges that do not correspond. In addition, there is one sample (25) that violates neither the .95-confidence interval nor the 2-Ã correspondence rule, but is older than expected for Hanover Cord Marked pottery, given other chronometric data from the region. This section provides some discussion of these 11 samples.

All values for the Late Woodland Hanover II Fabric Impressed pottery samples from both labs fall within the .95 confidence intervals, are tightly clustered (Figure 2), and appear to range in age from A.D. 1241 to 1568. Two of the samples (6 and 24), situated inside the confidence interval but differing by more than 2-Ã, can be brought within 2-Ã simply by adjusting the moisture content so that it agrees between UW and Oxford. No other particular problem affects these two samples. The UW moisture content was based on measured water absorption and an assumption of 80 percent saturation, based on the temperate climate. The estimated moisture content for these samples is 8–9 percent compared to the 3 percent assumed by Oxford. Assumed moisture content is a built-in systematic bias in luminescence dating, but the difference between Washington's and Oxford's assumptions makes only about 1 percent difference in age, although it was enough to bring the two assays into statistical agreement at 2-Ã. If moisture content assumptions applied by Washington are assumed to be more accurate, the UW date range (A.D. 1241–1473) for this set of seven vessels may be the best age estimate for this component.

Of the eight dates that cluster in the Middle Woodland age range, three fall outside the .95 confidence interval (Figure 2). For each of the three samples (4, 9, and 26), UW dates are considerably older than OX dates, and differ by more than 2-Ã. The problem for these dates (the paired Sample 4/26, UW1778/UW1800, and Sample 9, UW178) could be in the equivalent dose measurements, reflecting procedural differences between labs. The Oxford lab measured the equivalent dose on extracted coarse-grained quartz. The Washington lab measured equivalent dose on polymineralic fine-grains. One problem with fine-

Table 5. Eleven Samples that Prompted Specific Consideration.

Sample	Vessel	OX Lab. #	OX date	UW Lab. #	UW date	Type	.95 confidence	2-σ correspondence	Regional Age Data Correspondence OX	Regional Age Data Correspondence UW
4	65-12*	X3057	AD 643 +/- 125	UW1778	706 BC +/- 217	Hanover Fabric Impressed	No	No	Yes	Yes
6	871-15	X3059	AD 1543 +/- 35	UW1780	AD 1306 +/- 56	Hanover II Fabric Impressed	Yes	No	Yes	Yes
9	64-2	X3062	AD 323 +/- 105	UW1783	718 BC +/- 234	Hanover I Fabric Impressed	No	No	Yes	Yes
13	65-10	X3066	1572 BC +/- 255	UW1787	1132 BC +/- 181	New River Cord Marked	No	Yes	Yes	Yes
15	65-15	X3068	AD 1003 +/- 85	UW1789	AD 625 +/- 95	Hanover Fabric Impressed	Yes	No	Yes	Yes
16	871-16	X3069	942 BC +/- 195	UW1790	1755 BC +/- 273	New River Cord Marked	No	Yes	Yes	Yes
18	871-9	X3071	1127 BC +/- 210	UW1792	2538 BC +/- 290	New River Cord Marked	No	No	Yes	No
21	871-4	X3074	1772 BC +/- 440	UW1795	1499 BC +/- 262	New River Cord Marked	No	Yes	Yes	Yes
24	871-18	X3077	AD 1568 +/- 30*	UW1798	AD 1342 +/- 57	Hanover II Fabric Impressed	Yes	No	Yes	Yes
25	65-7	X3078	2092 BC +/- 305	UW1799	2739 BC +/- 462	Hanover Cord Marked	Yes	Yes	No	No
26	65-12*	X3079	AD 543 +/- 125	UW1800	1477 BC +/- 279	Hanover Fabric Impressed	No	No	Yes	Yes

grains is that feldspars are not excluded, and thus a potential for anomalous fading exists. The Washington lab measured equivalent dose with TL, OSL and IRSL, cross-checked for fading on TL, and measured b-value on all three types of assay as a means of evaluating fading in OSL. As explained above, none of the OSL signals for this study appeared to fade. When the Washington lab reports ages, it provides an evaluation of the degree of confidence in the dates. Where the OSL and TL agree, more confidence in the age can be assumed, and where they do not agree problems are suspected. One of the big advantages of luminescence dating is in the structure of the data which allows evaluation of consistency, and thereby reliability; the age is not just a number.

Samples 4/26 and 9 are problem samples for which the TL age was younger than the OSL age, even after correcting for fading. This raises a red flag that something is not right. As it turns out, the TL ages agree with the Oxford ages; but, it is not known why the OSL overestimated the age for fine-grains. One possibility is that the signal was by a slowly bleaching component that was not reset with heating. One might ask why the Washington lab did not use the coarse-grain procedure that Oxford used. Although Washington routinely uses the coarse-grain procedure for dating sediments, an advantage of using fine-grains is that there is less reliance on the external dose rate (gamma and cosmic radiation). The external dose rate is often not well known for ceramics and can contribute half the dose rate for coarse grains, but only about a fourth for fine grains.

For these three samples, 4/26, and 9, the TL age from fine-grains calculated by the UW agrees at 1-Ã with the coarse-grain quartz OSL assay of Oxford, but the fine-grain OSL age calculated at UW does not agree with the Oxford results. The UW analysis assumed the OSL was the more reliable age because of TL fading, thus the discrepancy with Oxford. However, we do not think the discrepancy with these samples is due to the equivalent dose. The TL equivalent dose probably is not reliable. Rather, the problem is with the dose rate. These samples were among those with the largest differences in dose rate between UW and Oxford. The reason might be equilibrium in the uranium decay chain, something that can be accounted for, at least in part, by the alpha counting performed at Washington but not by ICP used by Oxford (Olley et al. 1996). Disequilibrium is common in ceramics, but less so in sediments. There was no difference in the external dose rate measured on associated sediments between Washington and Oxford, but there were differences in the internal dose rate. We think this is the problem for one other discrepant sample (15), where the difference in dose rate between the two labs is also high. For ceramics, direct measurements of radioactivity such as alpha counting are recommended rather than methods such as ICP, which only measure the concentration of the parent radionuclide. Sample 15 also exhibited a large difference in dose rate between the two labs and violates the 2-Ã correspondence rule. Although Sample 15 falls within the .95 confidence interval (Figure 2), it is the youngest sample in the Middle Woodland cluster and appears to be an outlier. Disequilibrium might also be the source of the inter-lab discrepancy for Sample 21, a New River Cord Marked specimen discussed below.

Among the eight Hanover potsherds composing the Middle Woodland (Hanover I) age set, three different surface treatment types are represented, possibly relating to different cultural components. Three of the samples (8, 9, and 23) are Hanover I Fabric Impressed, with flexible warp fabric impressions, and all three are from site 31CD64. The range of mean age estimates for these three samples is 718 B.C. to A.D. 363. The very early date (718 B.C.) is the UW estimate for Sample 9, which as discussed above is thought to have been subject to disequilibrium in the uranium decay chain. If the UW date for Sample 9 is dropped from the sequence, the estimated age range for these three samples is 107 B.C to A.D. 363, which conforms to expectations for the age of the Hanover I Fabric Impressed type. However, the discrepancy may result from disequilibrium in the uranium decay chain. In this instance, Oxford results may underestimate the age.

Two samples (2 and 19), also from site 31CD64, were Hanover Cord Marked type. The range of mean dates for two samples is 307 B.C. to A.D. 98. The remaining three samples (4/26 and 15) were all from site 31CD65 and exhibit a surface treatment type that is difficult to characterize. Samples 4 and 26 were portions of the same potsherd designated as Vessel 12 (Patch 2011:573, Figure 9.20). Although the surface treatment is identified as a hard-warp, narrow weft, fabric impression, upon close inspection it appears to have been over-stamped with a paddle edge (possibly cord marked). The range of mean age estimates for these samples is 1477 B.C. to A.D. 1003, but as discussed above there were problems with Washington’s assays for the paired sample (4/26). If these very early dates are dropped, the range of mean estimates is A.D. 543 to 1003, but again it seems likely that the Oxford dates may underestimate the actual age of these samples. What these data illustrate is that there are two Hanover I components represented at 31CD64 by Hanover I Fabric Impressed and Hanover Cord Marked, and at 31CD65 a Hanover I component is represented by sherds with indeterminate fabric impressed, or paddle-edge stamped, surface treatment.

The remaining 11 samples composing the oldest set of dates are Early Woodland New River specimens. Eight of these are New River Cord Marked, with five from 31CD65 and three from 31CD871. The range of mean age estimates for these eight samples is 802–2538 B.C. The oldest date in this set, 2538 B.C. is for Sample 18 from site 31CD871 (UW-1792, 2538±290 B.C., and OX-3071, 1127±210 B.C.). Although the age estimates for Sample 18 are within 2-Ã, they are outside the .95 confidence interval. The cause of the discrepancy is not clear, as dose rates between the two labs did not differ at 1-Ã, and there was statistical agreement (within 1-Ã) of TL, IRSL, OSL in the UW results. Three other New River Cord Marked samples (13, 16, and 21) have values that fall outside the .95 confidence interval (Figure 2), although 2-Ã correspondence is not violated (Table 3). For Samples 13 and 21, the OX age estimates appear to be too old, and for Sample 16 the UW estimate seems to be too old.

Conclusions

So what should the archaeologist take away from this experiment and the different interpretations of results presented in this paper and in Espenshade et al. (2014)? We hope that the reader, after considering our arguments, will not dismiss luminescence dating out of hand, as Espenshade et al. (2014) recommend. But we also hope that archaeologists understand that dating results from luminescence or any other method cannot be accepted uncritically, and this means that archaeologists must understand what measurements go into determining a date, and how to evaluate them. Dating, probably the most important component of any prehistoric study, should not be a black box exercise. Archaeologists need to learn about luminescence, just as they have learned about radiocarbon.

We have tried to provide a critical review of the luminescence dates provided by the two labs. Although there are discrepancies between them, on the whole the results from either lab taken alone fit well within pre-exisiting knowledge of the regional pottery sequence and therefore contribute to refining the culture chronology of the Sandhills. Dating is never an independent endeavor, despite what some may say. Dates are always compared with pre-existing knowledge (accounting for the popularity of Bayesian statistics), and this measure, however coarse, is a test for evaluating accuracy when comparative results from another lab are not available.

This is not an invitation to throw out dates that don't agree with expectations. No date should be thrown out without good reason. For example, the unexpected pre-Clovis radiocarbon dates at Meadowcroft Rockshelter have never been thrown out, despite many attempts to disprove them, and they will continue to stand until that proof is forthcoming (an appropriate use for luminescence dating, by the way). In the same way, the old dates reported on some of the sherds in this study should not be categorically thrown out because they do not fit the current chronology. They just remain anomalous until further information is obtained.

We also have tried to account for the discrepancies between the two labs. We think they either relate to differences in laboratory procedures or are sample specific. There is no evidence that they indicate anything wrong with the method. Luminescence dating has a good track record and has provided a lot of useful dates, including many for this study. Which lab should an archaeologists use? There are many in the world with different strengths but very few that could be considered unreliable. What method should be employed (fine-grain vs coarse-grain, ICP vs alpha counting, OSL vs TL)? It really depends on the problem being addressed and the nature of the samples. Contacting the laboratory before sending samples is a good way to address these concerns.

Luminescence dating has many advantages, not the least of which is the ability to directly date ceramics without relying on associated material. It is worth exploring and there is much to be learned by applying it to regions like the Sandhills, where some samples might be tricky. Rather than regarding anomalies as indicative of the failure of the method, we encourage archaeologists as well as dating laboratories to regard them as opportunities to learn.

Notes

[1] The lab results are referenced in the bibliography (Feathers 2008; Schwenninger 2008) and copies may be obtained from New South Associates, Inc., or the NC-DOT. The data reported in the article by Espenshade et al. (2014) include one error: Oxford date X3077 (Sample 24, Vessel 871-18) is reported as AD 1003±30, but the lab results for this sample were reported as AD 1568 ±30, and the corrected date is used throughout this article.

[2] Ironically, Patch and Espenshade (2011) relied on OSL dates to establish the relative age of sediments from which the potsherd samples were recovered, apparently regarding those results as acceptable.

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IMMUNOLOGICAL ANALYSIS OF CLOVIS AND EARLY ARCHAIC HAFTED BIFACES FROM THE NORTH CAROLINA SANDHILLS

by

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Abstract

Immunological or blood protein analysis is a method for extracting and identifying ancient animal proteins preserved within microfractures of stone tools or other artifacts. Cross-over immunoelectrophoresis (CIEP) has been applied successfully in the analysis and interpretation of protein residues on archaeological materials for more than 25 years. Here, we report the results of CIEP on a sample of 11 Early Archaic hafted bifaces and one Clovis hafted biface recovered from the Fort Bragg military installation in the North Carolina Sandhills. Four of the 12 artifacts produced positive reactions to available antigens. These reactions include Galliformes (i.e., quail, grouse, or other gallinaceous fowl) on a large Clovis hafted biface, cat on a Hardaway Side-Notched hafted biface, deer and rabbit from a Big Sandy/Rowan hafted biface, and, perhaps most notably, bovine from a Hardaway-Dalton hafted biface. The identification of bovine (presumably *B. bison*) on a Hardaway-Dalton is particularly interesting given its context from site 31HK118 (Sicily), a large lithic scatter that has produced numerous Paleoindian and Early Archaic tools and sits along the spine of the major watershed divide of Fort Bragg. While additional immunological analyses are needed to verify this finding, the implications of bison hunting may be significant for understanding Early Archaic settlement. Likewise, the association of gallinaceous fowl with Clovis highlights the findings of other immunological studies and suggests that a broad range of animal species was targeted by Clovis hunters.

Inferences concerning human subsistence behaviors based on evidence of extant or extinct fauna, particularly for the Paleoindian and Early Archaic time-periods in North Carolina, are virtually non-existent. This is particularly true for the Coastal Plain and Sandhills physiographic zones where a combination of a hot, subtropical climate, acidic soils, shallow site burial, and a lack of protected dry environments means that little, if any, faunal remains are preserved from the late Pleistocene/early Holocene. Lacking faunal evidence, we must pursue other approaches to evaluate human/animal relationships in the archaeological record –

particularly for animals that are extinct or no longer found in the region (e.g., Seeman et al. 2008).

One form of analysis that is potentially useful for gaining insight into this aspect of prehistoric economies is the extraction and identification of blood protein residue from lithic artifacts. This form of analysis has been applied for over two decades (Dorrill and Whitehead 1979; Gerlach et al. 1996; Hyland et al. 1990; Jenkins et al. 2013; Kind and Cleevely 1969; Kooyman et al. 1992, 2001; Loy 1983; Loy and Dixon 1998; Newman and Julig 1989; Newman 1990; Newman et al. 1996; Petraglia et al. 1996; Seeman et al. 2008; Shanks et al. 2001, 2004; Yohe and Bamforth 2013) and complements other types of specialized studies of residues (e.g., Eastman 2012; Reber 2008). Blood protein analysis is not without its critics and skeptics, as some question the preservation of blood protein and the accuracy of immunological identification techniques (Fiedel 1996; Grayson and Meltzer 2015; Vance 2011).[1] Nonetheless, residue studies have shown potentially promising results that align with general expectations for prehistoric fauna and that may be useful in modeling prehistoric behavior. While we acknowledge the potential for ambiguity and contamination, we believe the potential of this research is real and should be pursued as part of an interdisciplinary approach to inferences about prehistoric cultures.

Below, we present the results of an immunological study on both recently excavated and previously curated hafted bifaces from the Fort Bragg military installation. Protein residue analysis was performed using cross-over immunoelectrophoresis (CIEP) on 11 Early Archaic hafted bifaces and one Clovis hafted biface. The specific objectives of the research are: (1) to determine if protein residues are preserved in stone tools from Fort Bragg; (2) to identify likely animal species indicated by immunological analysis; and (3) to consider the implications of residue results for the food economies and subsistence-settlement strategies of Paleoindian and Early Archaic hunter-gatherers in the North Carolina Sandhills. While the sample size is small, the results of this analysis have broad implications for future application to existing archaeological collections and newly collected specimens. Results of this study include potential evidence of *B. bison* in the North Carolina Sandhills during the earliest part of the Early Archaic (ca. 12,500–11,300 cal B.P.), along with a surprising diversity of small and large mammals, such as deer, hare, cat, and ground-feeding birds. Our inclusion of Late Paleoindian or transitional Paleoindian/Early Archaic points, namely Hardaway-Dalton and Hardaway Side-Notched, as part of the Early Archaic sequence follows Daniel (1998) who argues that these points represent a more local or regionally adapted and settled population in central North Carolina relative to the ephemeral presence implicated by fluted points (e.g., Moore and Irwin 2013).

Study Area

The artifacts tested here came from archaeological investigations at Fort Bragg, a large U.S. Army installation located in the unique Sandhills physiographic province (Figure 1). The Sandhills province is a long, narrow belt of sandy uplands along the interior Coastal Plain stretching from North Carolina to Georgia (Bartlett 1967; Russo et al. 1997). Edaphic conditions heavily influence the area's ecosystem and archaeological record. Well-drained, coarse grained, low-nutrient, quartz-dominant sands predominate. These largely Cretaceous period sediments were deposited in ancient deltaic settings and now cover an eroded, hilly terrain. Conditions allow for a xeric longleaf pine forest with a savannah-like grass floor and shrub-oak understory, a community uniquely adapted to the permeable soils as well as a naturally frequent fire regime (Peet and Allard 1993). Seepage springs, pocosins, and small streams are common on the otherwise dry landscape.

The archaeological record of the Sandhills consists of thousands of low to moderate density lithic and ceramic sites that cluster on re-occupied landforms within a heavily utilized landscape. Ephemeral occupations and a limited range of activity are suggested by only moderate artifact diversity. Site density is relatively high. The medium to coarse sands allow for some degree of relative stratigraphy between Archaic and Woodland deposits despite generally limited sedimentation through eolian activity, colluvial slope-wash, and localized alluvium within floodplain settings. The acidic nature of the sand allows for little substantive organic preservation. Features, as well as faunal and botanical material are rare. Limited residue studies have been attempted, including blood protein (McNutt and Gray 2009) and an organic residue analysis of pottery (Reber 2008).

Methods

The immunological technique used in this analysis is cross-over immunoelectrophoresis (CIEP) (Kooyman et al. 1992; Newman 1990; Newman et al. 1996). This test has been used extensively in the field of forensic science for over 50 years. Studies have shown that residues can adhere to tool surfaces or within stone microfractures during their original use and can survive for long periods of time (Abbas et al. 1994;

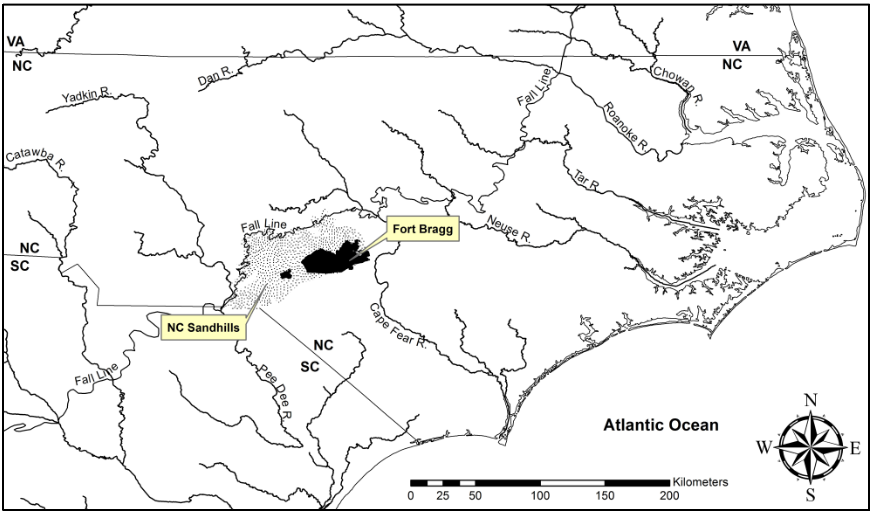

Figure 1. Map showing the geographic location of the North Carolina Sandhills and Fort Bragg.

Shanks et al. 2001; Sensabaugh et al. 1971a, 1971b). The principle of CIEP is that all animals produce antibodies (immunoglobulins) that recognize and bind with foreign proteins (antigens) as part of the body's defense system. The ability of these proteins to precipitate antigens from solution is one of their best known properties (Johnstone and Thorpe 1982), and it is this ability that is tested in CIEP.

The medium used in this test is high electroendosmotic (EEO) agarose (Sigma Chemical Company, St. Louis, MO). A 1% solution of agarose is prepared in a barbital buffer solution and is boiled to dissolve agarose. The solution is allowed to cool slightly; then, 15 ml of solution is poured onto the hydrophilic side of a Gel Bond sheet (80x100 mm) (Mandel Scientific Company, Toronto, ON) and allowed to set. A short period of storage at 4ºC helps to produce a firm gel (Royal Canadian Mounted Police, Methods Manual 1983). Wells are made using a gel cutter, and plugs are removed by suction. Wells are 1.5–2 mm in diameter and 5 mm apart.

Five microliters (5µl) of the antigen (unknown residue extract) is placed in the right hand or cathodic well, and 5µl of antibody (antiserum) is placed in the left hand or anodic well. Appropriate positive and negative controls for each antiserum, prepared in 5% ammonia solution, are run with each gel. The gel is placed in an electrophoresis tank containing barbital buffer, pH 8.6, and triple thicknesses of filter paper are used as wicks to connect the ends of the gels to the buffer in the tank. Electrophoresis is carried out for 45 minutes at 130v. Under these conditions, antigens migrate toward the anode while antibodies are carried by electroendosmosis toward the cathode. Thus, because the two reactants are placed in wells aligned with the migrational axis, electrophoresis will bring them together in a concentrated form to a central position between the two wells. If the unknown sample contains proteins corresponding to the species antiserum against which it is being tested, an extended lattice forms as the result of cross-linking, and an immunoprecipitate will form where they reach equivalent concentrations (Arquembourg 1975). Strong positive reactions (a white line of precipitate) can be observed directly by observing the gel over the light box. Weaker reactions, which are more common in archaeological samples, are more readily observed if the gel is dried and stained with Coomassie Blue R250 stain.

Antisera used in this analysis were obtained from commercial sources and, except where noted, are prepared specifically for use in forensic medicine. These antisera are solid phased absorbed, where necessary, to eliminate cross-reactivity. All antisera used are polyclonal, that is they recognize epitopes shared by closely related species. For example, anti-deer serum will elicit positive results with other members of the Cervid family such as deer, moose, elk, and caribou. Immunological associations do not necessarily bear any relationship to the Linnaean classification scheme, although they usually do (Gaensslen 1983). These have all been tested against related and non-related species by the manufacturers and have been shown to be specific to the taxa indicated. Table 1 shows the antisera used and the relationship of antisera used in CIEP to other members of each family.

Possible residues were removed from the artifacts by the use of a 5% (v/v) 0.880 ammonia solution (Dorrill and Whitehead 1979; Kind and Cleevely 1969). Artifacts were placed in plastic weight boats and 0.5 cc of the 5% ammonia solution applied to each using a syringe to direct it on areas with possible residues. Initial dis-aggregation is carried out by floating the weight boats and contents in an ultrasonic cleaning bath for five minutes. Artifacts were then turned over in the solution and returned to the ultrasonic cleaning bath for another five minutes. The resulting ammonia solutions were carefully removed with a pipette, placed in a numbered plastic vial, and refrigerated prior to further testing. Residues removed from the artifacts were tested against all the antisera

Table 1. Animal Antisera Used and Most Probable Species Identified.

Antisera	Source	Probable Species
Deer	MP/Cappel Biomedical	Deer (all species), elk, antelope, and caribou
Bear	Forensic Medicine	Grizzly, black, or brown bear
Chicken	Forensic Medicine	Chicken, grouse, turkey, quail, and other gallinaceous fowl
Bovine	Forensic Medicine	Bison, cow
Dog	Forensic Medicine	Dog, fox, coyote
Elephant	Cedarlane	Elephant, mammoth, mastodon
Rabbit	Seri Serological	Rabbit and hare
Cat	Seri Serological	Bobcat, mountain lion, panther, cat
Duck	Nordic Immunological	Duck (all species)
Turkey	Nordic Immunological	Turkey (possibly grouse or quail)

shown in Table 1. The results obtained in the analysis are discussed below.

Sample

Twelve hafted bifaces recovered from Fort Bragg were submitted for CIEP analysis (Figure 2). Eight artifacts consisted of previously curated specimens while four were obtained from a recent large-scale survey of Fort Bragg. The latter were recovered from subsurface context (i.e., shovel tests) and were not handled or washed prior to immunological testing. The remaining eight were collected from the ground surface and were likely handled and/or washed prior to curation at Fort Bragg. All 12 hafted bifaces are made of fine-grained metavolcanic stone typical for the Early Archaic and likely imported from sources in the North Carolina Slate Belt (Steponaitis et al. 2006). It is likely that all of the artifacts tested were used prehistorically. Most show evidence of resharpening, some extensively, and one is reworked into a scraper. These are specialized tools made from high-quality, non-local stone that were likely curated to some degree.

Results

Out of the 12 hafted bifaces submitted for analysis (Figure 2), four returned positive results for tested antisera (Figure 3 and Table 2), a

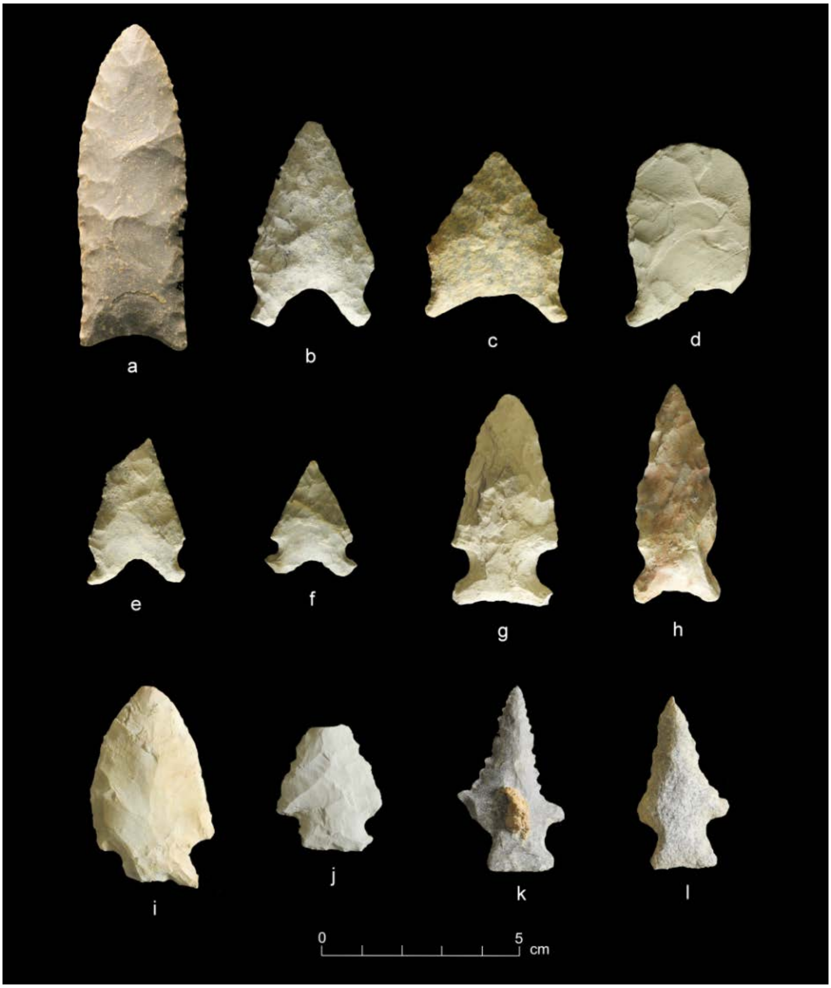

Figure 2. Paleoindian and Early Archaic hafted bifaces from Fort Bragg submitted for immunological analysis: (a) Clovis; (b–d) Hardaway-Dalton; (e–f) Hardaway Side-Notched; (g) Big Sandy; (h) Rowan; (i–j) Kirk Corner-Notched; and (k–l) Kirk Stemmed/Serrated.

relatively high rate of protein preservation.[2] The positive results include deer and rabbit on an Early Archaic Rowan point, bovidae residue on a Hardaway-Dalton point, residue of cat from a Hardaway Side-Notched point, and residue of gallinaceous fowl from a large Clovis point.

A positive result to deer antiserum may indicate the presence of any member of the Cervidae family, but there are no cross-reactions with other families. The most likely source of protein is the white-tailed deer,

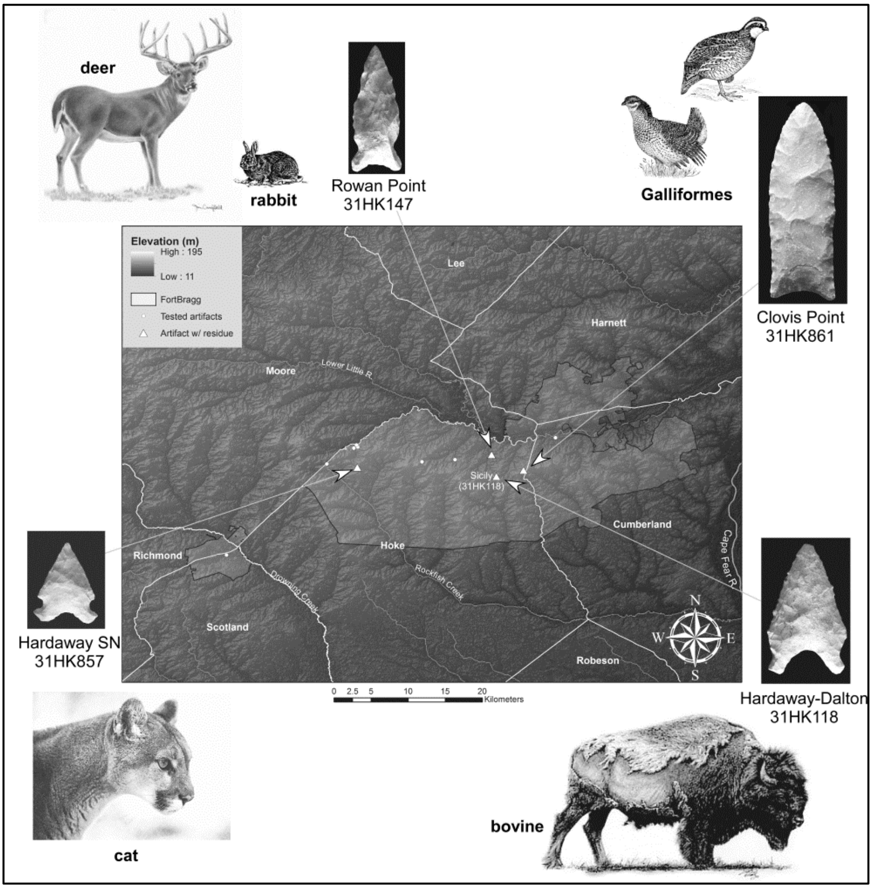

Figure 3. 30-meter digital elevation map (DEM) of Fort Bragg showing the locations of tested artifacts and immunological results. Bird species within the order Galliformes indicates residue of gallinaceous fowl (e.g., grouse or quail).

though prehistorically elk may have been present in the area (Lefler 1967; Logan 2009; Swanton 1979). The positive result to rabbit antiserum may indicate the use of rabbit blood and/or sinews as a binding medium. The eastern cottontail is a likely source of this protein. The positive result for bovine antiserum may indicate the presence of bison or cow; cross-reactions with other families do not occur with this antiserum. The positive result to chicken antiserum may indicate northern bobwhite quail, ruffed grouse, or other related gallinaceous fowl. A negative result to turkey antiserum was found on this artifact. The presence of any member of the Felidea family is indicated by the positive result to cat

Table 2. Immunological Results for Tested Early Archaic Hafted Bifaces on Fort Bragg.

Site #	Artifact	Specimen ID[10]	Cultural Affiliation	Context	Residue
31HK861[2]	Clovis	a	Paleoindian	surface	**Galliformes[1]**
31HK118[3]	Hardaway-Dalton	b	Early Archaic	surface	**Bovine**
31HK1413[7]	Hardaway-Dalton	c	Early Archaic	surface	Negative
31HK31[3]	Hardaway-Dalton	d	Early Archaic	surface	Negative
31HK857[4]	Hardaway Side-Notched	e	Early Archaic	surface	**Cat**
31HK744[6]	Hardaway Side-Notched	f	Early Archaic	25-30 cmbs	Negative
31CD479[5]	Big Sandy	g	Early Archaic	surface	Negative
31HK147[3]	Big Sandy/Rowan	h	Early Archaic	surface	**Deer, rabbit**
31SC147[8]	Kirk CN	i	Early Archaic	40-50 cmbs	Negative
31HK3569[9]	Kirk CN	j	Early Archaic	surface	Negative
31HK3527[9]	Kirk Stemmed/Serrated	k	Early Archaic	30 cmbs	Negative
31HK3554[9]	Kirk Stemmed	l	Early Archaic	60-75 cmbs	Negative

[1] Artifact tested positive using chicken antiserum and indicates protein residue of related species (e.g., grouse or quail) within the order Galliformes.

[2] No report, site form on file at Fort Bragg Cultural Resources Management Program (CRMP).

[3] Loftfield (1979)

[4] No report, site form on file at Fort Bragg CRMP.

[5] Clement et al. (1997)

[6] Idol and Pullins (2001)

[7] No report, site form on file at Fort Bragg CRMP.

[8] Millis et al. (2014)

[9] Millis et al. (2013)

[10] See Figure 3.

antiserum. A likely source for this protein may be the bobcat, though mountain lion may have been present prehistorically.

Taphonomic and environmental influences on protein preservation are difficult to interpret and notably inverse from our expectations. Unwashed, unhandled artifacts recovered from buried contexts tested negative for proteins, despite an expectation for potentially greater residue preservation. All positive results came from artifacts exposed on ground surfaces at the time of discovery that were subsequently handled in the laboratory. While the latter may suggest that protein residues were introduced post-recovery or through exposure, the results are consistent with prehistoric fauna that would be targeted for subsistence. The results are also consistent with those from a recent large-scale study of 142 temporally diagnostic hafted bifaces and other lithic tools from South Carolina and Georgia. These include artifacts recovered from buried contexts with positive residue identifications on unhandled specimens and negative evidence of soil contamination (Moore et al. 2015). Thus, there is no reason to reject the detection of residues or the animal families identified, though future studies would benefit from CIEP analysis of soils to test for contamination. As noted above, the tools show evidence of edgewear and/or resharpening, hence the absence of protein on some is not likely attributable to lack of use. The role of patination in protein preservation is unknown, however most of these specimens are patinated. Despite its age, the Clovis point (made of fine-grained spherulitic rhyolite) shows the least amount of patination and tested positive for protein.

In addition to the results summarized above, a single, complementary protein residue study of Fort Bragg artifacts is worth review. McNutt and Gray (2009) submitted 16 artifacts for CIEP analysis to a separate laboratory (Yost and Puseman 2009). The artifacts were recovered from controlled excavations at depths ranging from 27 to 57 cm below surface. Three artifacts tested positive for protein, and reactions revealed three likely species: deer, bay anchovy, and human. The latter was attributed to soil contamination based on soil sample results. The former two showed no such contamination evidence. Bay anchovy is an unexpected resource for Early Archaic cultures occupying the Sandhills. The anchovy belongs to the Engraulidae family and cannot be an indicator of what would seem a more likely marine resource—the anadromous shad that run up the Cape Fear River into the Sandhills in the spring. McNutt and Gray (2009) cautiously interpret the anchovy protein as evidence of long-ranging Early Archaic settlement activity.

Discussion and Conclusions

The results of this study hint at substantial diet breadth and the presence of bison in the Sandhills during the Early Holocene. Neither of these findings is insignificant. With evidence of four or five taxonomic families of animals on only four bifaces, the implications for diversity in diet and hunting practices are noteworthy and warrant further research. The presence of similarly varied genera in a recent study in South Carolina and Georgia supports the proposition of richness in Late Pleistocene and Early Holocene diets (Moore et al. 2015). Evidence for quail or grouse on the Clovis biface contributes to an understanding of dietary diversity in Clovis populations. Meanwhile, the immunological evidence for bison reported here adds to a small but important historical record of this species in the state of North Carolina and the Southeast region (Byrd 1967:236; Lefler 1967; Logan 2009; Swanton 1979:324-328).[3] Information on artifact residues may allow us to move beyond assumptions of reliance on deer and mast throughout prehistory and expand the range of subsistence behavior considered.

Moore et al. (2015) report evidence of bison exploitation on Paleoindian through Middle Archaic hafted bifaces from South Carolina and Georgia, but none for Late Archaic, Woodland, and Mississippian hafted bifaces. Whether or not this represents evidence for extirpation of bison by the mid-Holocene, a demographic shift in bison population, or support for the adage "absence of evidence is not evidence of absence" is unknown. However, based on the findings of Moore et al., it is interesting to speculate that bison recorded by early explorers may not be the result of a continuous presence derived from late Pleistocene populations in the Southeast, but rather may represent a late migration of small groups of bison out of the Great Plains (Haines 1970; Van Horne 2012) quickly extirpated by early colonial period hunters (Moore et al. 2015). The glaring lack of faunal evidence for bison in Late Archaic or Woodland Period shell middens in the Southeast is more easily explained if all vestiges of remnant Pleistocene populations were gone by the early mid-Holocene.

Notably missing from the study by Moore et al. is any evidence for extinct megafauna. Speculatively, this may suggest that large megafauna were regionally extinct by the time of Clovis, were hunted infrequently, or perhaps more likely, that our sample size of Paleoindian hafted bifaces is not yet large enough to detect the presence of these animals. The analysis of a single Clovis hafted biface from the North Carolina Sandhills does little to address the lack of evidence for exploitation of Pleistocene megafauna. Immunological analysis of additional Paleoindian hafted bifaces within existing collections could help address these very important questions.

The results of residue studies like CIEP may be employed in modeling prehistoric settlement and subsistence economies. One example of the relevance of this kind of information involves the organization of settlement during the Early Archaic. Moore and Irwin (2013) recently postulated a mobility pattern extending through the Sandhills along interfluvial ridges between physiographic zones. A savannah-like environment in the xeric pine forest may have supported large herbivores, such as bison. Moore and Irwin present evidence for intensive inter-riverine settlement, with watershed divides serving as conveyance corridors between high-quality toolstone sources in the Piedmont and resources in the Coastal Plain. Large base-camp sites on Fort Bragg may be associated with butchering of these bison and other animals along such a corridor. One such base-camp site is represented in an artifact tested here from 31HK118 (Sicily site), a large lithic scatter that has produced numerous Paleoindian and Early Archaic tools and that rests along the spine of the major watershed divide of Fort Bragg.

Though tantalizing, the results presented here are from only a very limited number of artifacts. Future immunological studies should incorporate a protocol for collection and analysis of much larger numbers of artifacts that minimize chances for contamination through the use of *in-situ* recovery during routine archaeological survey, as well as through the careful examination of curated collections. Such studies have the potential to advance research on lithic implements beyond stylistic and technological traits and to allow evaluation of specific subsistence strategies and settlement configurations for early hunter-gatherers.

Notes

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[1]For a discussion of these criticisms see the online supplemental for Moore et al. (2015).

[2] Other similar studies have shown rates as low as 6 percent (Yohe and Bamforth 2013) and as high as 56 percent (Gerlach et al. 1996).

[3]But see Ward (1990) for a critical assessment of this historical evidence.

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"ALLAH" WAS LOST BY THE PUBLIC HOUSE AND WALL: A PENKNIFE WITH THE ISLAMIC *SHAHADAH* FROM COLONIAL BRUNSWICK TOWN

by

Thomas E Beaman, Jr. and Jennifer L. Gabriel

Abstract

Sometime between 1726 and 1776, a small brass penknife was lost or discarded near the Public House and Public Wall at Brunswick Town. What makes this penknife unique is the Arabic script embossed on each side of the knife, with quotes from the *Quran* reading "There is No God but God" and "Muhammad is his messenger." This well recognizable phrase from the Islamic faith is the *Shahadah*, or statement of faith. The presence of this small but unique penknife speaks not only to the network of global trade of material goods, but also to the material evidence of people of various nationalities and beliefs that may have reached even small regional ports during the eighteenth century.

"This [penknife] is an example of the way in which a single artifact reflects the time and space processes of the world cultural system." (Stanley A. South [2010:22])

For the archaeologist, ideational insights into the beliefs of a studied people can be the most difficult level of interpretation to reach. This is perhaps due to the more fundamental, functional interpretations sought in research designs, the limited field explorations of many sites (especially in cultural resource management work), or the often nearly inadequate time many archaeologists have to complete their post fieldwork analyses and reports. However, even in the best circumstances for excavation and interpretation, few of us actually do—or can—reach beyond the material world into a cognitive one.

When an artifact related to an identifiable religious belief and practice is recovered in context, it allows us as archaeologists to begin to gain deeper insights into our studied subjects, specifically a material link to belief in an intangible spiritual world or being. Many cultures around the world have specialized architecture and artifacts for spiritual belief and practice. In the sixteenth, seventeenth, and eighteenth-century colonial worlds on the western side of the Atlantic, such material culture generally speaks to a very limited range of religious beliefs. Be it personal artifacts such as rosary beads, crucifixes, and medals of Saints found on Spanish colonial sites, Jesuit rings of French Canadian settlers, sets of decorative tin-enameled tiles depicting various Biblical scenes, or popular decorative motifs such as the “Adam and Eve” design on a tin-enameled plate or on the guard of a small sword or dagger (cf. Gabriel 2013:139–140), despite the specifics of denomination all have spiritual links to the Abrahamic based religion of Christianity.

There is presently a small but growing body of literature that speaks to the practice of Islam, another Abrahamic based religion, in the southeastern United States. This has been noted primarily in African-American communities with strong African roots, such as the coastal communities of the Gullah Geechee in South Carolina and Georgia. To date, belief and practice of the Islamic faith have been documented primarily through orientation of burials in cemeteries. For example, Matternes and Smith (2014:64) observed in the Belleville Cemetery of Crescent, Georgia, that “Islamic roots in the African-American community were also reflected in grave orientation. Following Muslim tradition, graves were oriented so the decedent faced Mecca (Imam 2011). In McIntosh County, this translated into a more north-northeast to south-southwest grave orientation, as reflected in some local graves including that for Faye ‘Ameedah’ Moran in the Belleville Cemetery.” Honerkamp and Crook (2013) noted similar patterns in their documentation of a Geechee graveyard in the nearby Hog Hammock Community on Sapelo Island, Georgia, one of the collective locations of the largest populations of Muslims in early North America (Gomez 2011:103). A total of 375 gravestones and markers oriented directly due-east to due-west to face west Africa, symbolic links to the direction of prayers toward Mecca, their native homelands, and the rising sun (Bailey 2000:158).

Islamic beliefs were often in competition with other African religious beliefs, especially prior to the nineteenth century. Historical evidence tends to indicate that most enslaved Africans held to more regionally traditional, non-Islamic beliefs (Gomez 2011:110). This has made the identification of “Islamic-specific” artifacts nearly impossible. Traditionally deemed religious artifacts such as marked colonowares, raccoon baculums, pierced coins, and blue and green beads could potentially speak to numerous localized African religious traditions, as they have been found in many locations of enslaved Africans throughout the southeast (Singleton 2011:175–177).

This study seeks to add to this growing body of literature, not in regard to burial traditions, but with the recovery of a single, unique artifact found in a rural eighteenth-century British colonial context that is clearly linked to belief in the Islamic faith. A small penknife with embossed Arabic script was recovered by Stanley South in his 1960s excavations at Brunswick, a small, trans-Atlantic port town in southeastern North Carolina (Figures 1 and 2). Easily recognized as a product of the colonial sphere of international trade, the interpretation of the script derived at the time of its recovery spoke of Allah (South 2010:21–22). Though the presence of this knife at Brunswick is not debated as related to trade, a recent reinterpretation of the Arabic script has yielded a different but more common interpretation of Islamic faith. The penknife is then used to argue for the need to expand present interpretations of people and activities at eighteenth-century port Brunswick, which are still largely based in South's excavations of the 1950s and 1960s.

Historical and Archaeological Background of Brunswick Town

The archaeological site of the town and port of Brunswick Town is often introduced to or becomes familiar to most archaeology students in graduate school, usually through Stanley South's development of the Brunswick Pattern of Refuse Disposal and the Carolina and Frontier artifact patterns. The rich and diverse history of the 50-year settlement made the site an excellent archaeological laboratory for studying eighteenth-century British colonial culture, and allowed South to develop these scientific patterns.

Brunswick was a colonial-era port town located along the western banks of the Cape Fear River, 12 miles south of present-day Wilmington, North Carolina. In 1725, Maurice Moore, from the Goose Creek area in South Carolina, received a land grant from Royal Governor George Burrington to establish a shipping port focused on the export of naval stores to supply England, the new American colonies, and the West Indies. Settled in 1726, the town quickly attracted other prominent society members from the Goose Creek area, as local plantation owners built town houses in Brunswick, which served as a commercial, social, cultural, and political regional center for the largely rural populous. It grew rapidly in importance and became the seat of government in New Hanover County.

Figure 1. The penknife today, after several different episodes of conservation since its recovery. The hand of the author is used to provide scale. Despite the small size of the penknife, the Arabic text is very legible.

Figure 2. Stanley South's original photo of the penknife prior to conservation. South cleverly used mirrors to show the Arabic text and embossed on both sides of the knife in a single image.

Along with Wilmington, the Port Brunswick district became one of the major transatlantic commercial centers in North Carolina, specifically in the export of naval stores products and the importation of material goods for the Cape Fear region of southeastern North Carolina. The success of the port might be the reason that Spanish privateers launched an assault and captured Brunswick in September 1748. These privateers held the town captive for three days until the destruction of one of the two Spanish ships, *La Fortuna*, which allowed the British colonial residents to retake the town.

When the social and political center began to migrate north to Wilmington, Brunswick enjoyed a temporary renewed political fluorescence in the 1750s and 1760s when Royal Governors Arthur Dobbs and William Tryon resided at Russellborough, a large mansion and small plantation on the northern end of the town. In 1765, Russellborough was also the site of a successful resistance of the Cape Fear citizens against the Stamp Act, the first armed resistance against the British colonial practices.

One of the major keys to the historical and archaeological interpretation of Brunswick was a detailed map of the town, dated April 1769, by Swiss cartographer Claude Joseph Sauthier. Considered as accurate as an aerial photograph, Sauthier's map of Brunswick illustrates 49 occupied households, making Brunswick the sixth largest town in North Carolina in the late colonial era, as compared to the 125 households shown on the map of neighboring Wilmington, the third largest town (Beaman 2013). In September of the same year, the Cape Fear region was hit by a major hurricane, which led to the abandonment of heavily damaged town structures, including the Courthouse. Shortly thereafter, raids by British troops and local Tory activity resulted in several town structures being burned. By that point, many residents of Brunswick had fled for the protection of nearby Wilmington and never returned. By 1776, the town was mostly deserted and had lost its formerly prominent social and political influence in the Cape Fear region.

The ruins of Brunswick lay forgotten until 1862, when the area was scouted as an ideal location for an earthen defensive works to protect the Cape Fear region during the Civil War. Fort Anderson's construction began later that year and would cover, disturb, and destroy a number of colonial ruins. Fort Anderson came under attack during the war and was bombarded by Federal forces for three days. It fell on February 18, 1865, leaving only earthen mounds that for almost a century stood as a quiet, physical reminder of a divided past.

Again, the port town fell away from memory until the late nineteenth century when local historian James Sprunt investigated the ruins of Russellborough and documented its archaeological importance. Beginning 1951, historian Lawrence Lee wrote the first definitive history of Brunswick. He also reconstructed the lot plan from deed records, generally located town ruins, and did light archaeological explorations that demonstrated great potential for more detailed investigations. After the site was donated to the State of North Carolina in 1955, Director of Historic Sites William S. Tarleton hired Stanley South to develop the archaeological site into a public historic park. Between 1958 and 1968, South and his crew of African-American offseason shad fishermen worked to identify and map 60 colonial-era ruins, and excavated 23 of them, before Stanley moved south and began his explorations in South Carolina (Beaman et al. 1998). Together, these men explored the rich social, economic, political, and archaeological history of the port town, its lot plan, and its importance as a historic site. It continues to operate today as one of 27 North Carolina State Historic Sites, and boasts over 35,000 visitors annually.

The Penknife

Recovery and Interpretations

Of the many discoveries were made during South's excavations, the penknife with Arabic script certainly is one of the most unique. The knife was found in 1960 during excavation of the yard space near the Public House and Public Wall on Lot 27, just slightly north of the port district of Brunswick Town (Figure 3). Its provenience is documented as unit S13, stratum A, which South (1960) described as a "colonial midden layer" (Figure 4). A quickly derived mean ceramic date of 1747.6 from 1,165 calculable sherds (cf. South 1977:201–218), and 180 pipe stems with mean dates of 1753, 1750, and 1755 (by Binford's [1962], Hanson's #10 [1971], and Heighton and Deagan's [1972] formulas, respectively) provides a temporal context for stratum A of the Public Wall. Each of these dates place this layered feature, as well as the likely deposition of the knife, roughly in the middle of the 50-year occupation of the town and near 1748 when the Spanish attacked and captured the town.

The knife itself is made of brass, cast as a single piece. The body of the knife is only 2½ inches in length, and the length of the wrought iron blade from its attachment point measures 1¾ inches. Each side of the

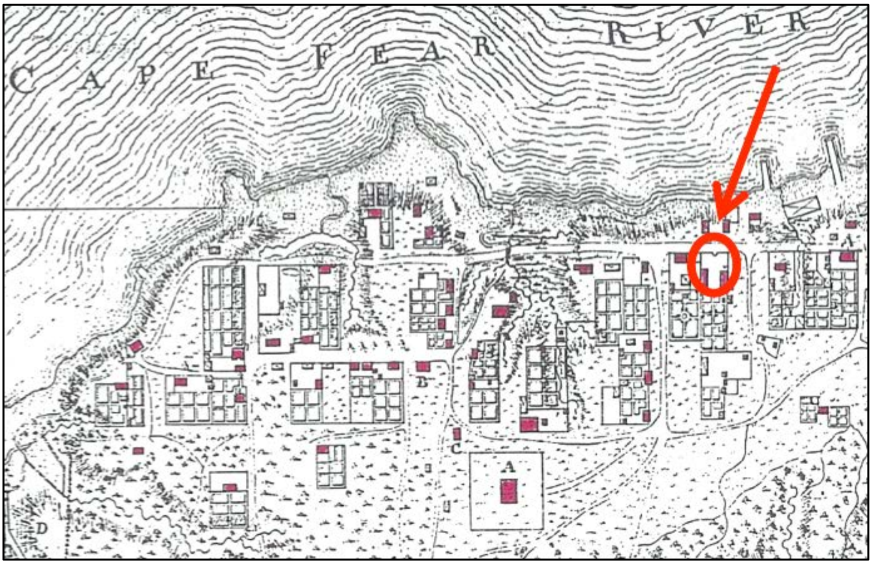

Figure 3. The historic core of Brunswick Town, as shown on Claude Joseph Sauthier's map of the town from April 1769. The circled area denotes the Public House and Public Wall where the penknife was recovered.

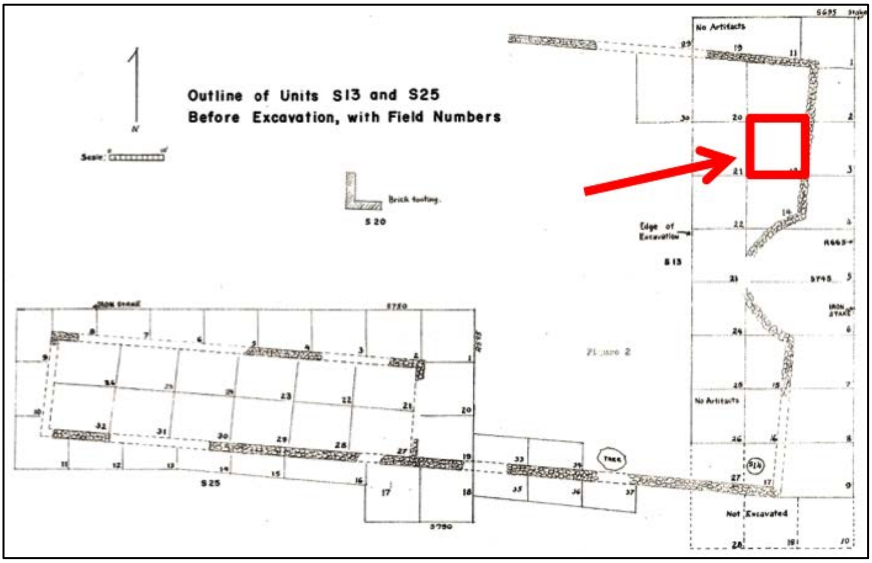

Figure 4. South's excavation plan of the Public Wall (S13) and Public House (S25). The circled area adjacent to the Public Wall denotes test unit 13, where the knife was recovered.

Figure 5. Close-up views of the knife with the original text translation by Dr. Muhsin Mahdi.

body contains embossed decorative flourishes around its edges and has a flat panel with a border along the opening edge. This panel contains embossed Arabic letters on both sides. Dr. Muhsin Mahdi of the Oriental Institute at the University of Chicago was the original translator of this text in the 1960s. As noted in Figure 5, from a picture of the knife sent by South, he interpreted one side to read, "There is no god but God," and the other as "Allah the Divider" (South 2010:21–22). Dr. Mahdi also noted this was a type of Arabic script commonly found on the Malay Peninsula in southeast Asia, which was major export center of Asian porcelain through Singapore and other regional ports, in which both the British and Spanish had economic interests.

The phrase "There is no god but God" is a very recognizable phrase because it is part of the *Shahadah,* one of the five pillars of the Islamic religion. The *Shahadah* is the first and arguably the most important because it is the declaration of Islamic faith. For both the Sunni and the Shia (or Shiite) sects, the utterance and belief in the complete phrase allows one to become a Muslim and to convert to Islam. It also speaks to a fundamental concept of Islam known as the *tawhid,* or the doctrine of Oneness in the Islamic religion, the monotheistic ideal that God is one and unique, and has no partners such as in the Christian trinity of Father, son, and holy spirit.

However, Dr. Mahdi's translation of the phrase "Allah the Divider" was a much more difficult phrase to understand historically and contextually. Of the 99 names of Allah in the *Quran,* none of them refer to Allah as any type of division or separator. Without a full recounting, a sample of these titled names in the *Quran* describe Allah as "The Exceedingly Compassionate," "The Exceedingly Merciful," "The King," "The Sovereign," "The Peace," "The Holy," "The Divine," "The

Figure 6. The modern translation of the knife as translated by Mr. Sahal Jama Mohamed.

Purifier," "The Giver of Honor," and 90 others, but no "Divider" (Ali 2001).

Curiosity over this phrase prompted an inquiry and request to Arabic language instructor Sahal Jama Mohamed of Raleigh, North Carolina, for a retranslation of the knife script. We provided the same image of the knife sides that South sent to Dr. Mahdi over 50 years prior, and did not reveal Dr. Mahdi's translation. Mr. Mohamed returned with a different translation, with supporting linguistic evidence for the new translation. Shown in Figure 6, in Mr. Mohamed's translation one side states "There is no god except" and the name "Muhammad," while to reverse reads "messenger of God." Contextually, this is the full statement of the *Shahadah* that states that there is no god except God and Muhammad is his messenger.

Mr. Mohamed also noted the absence of vowels and accent marks on the knife script. He noted that Arabic is a language that uses mainly consonants, and in many cases, vowels are omitted in written text and are often implied or understood when reading Arabic. The accent marks were likely omitted due to the limited space. When asked of his level of confidence in his translation, Mr. Mohamed observed that Arabic text from the *Quran* had not changed since its completion in the seventh century AD (or roughly the past 1300 years). While there are over 5,000 spoken forms of Arabic across Africa and Asia, all read the same text, written in the same way, from the *Quran*.

Possible Points of Manufacture and Origin

The observations on the penknife's script in traditional Arabic text by Mr. Mohamed also call into question its points of manufacture and origin, which Dr. Mahdi had placed in the Malay Peninsula of southeastern Asia. Unfortunately, multiple episodes of conservation on the copper case and iron blade of the penknife over the past 55 years make sourcing the elements problematic at best. This question is also complicated by the fact that larger ceremonial daggers that bear the *Shahadah* are historically and at present commonly found throughout the Old World where the Islamic faith predominates religious beliefs. However, it seems penknives with this text are not common, as neither museum examples nor ones for sale were found through Google searches or on eBay.

So, where is the penknife from, and how did it get to the small port of Brunswick in southeastern North Carolina? At first glance, it might seem unlikely that such an artifact would be found at a rural colonial port town in America. As noted by South (2010:22), the foreign nature of this artifact allows us to consider Brunswick in a broader spectrum as interconnected members of the world trade network that was operating during the eighteenth century.

The origin of the knife is presently unknown. With British power seated in India and the establishment of the successful East India Company, trade between the company and much of the British colonial sphere definitely occurred in the seventeenth through nineteenth centuries. Imported Oriental porcelain that originated in the Far East has been found in nearly every excavated house ruin at Brunswick, indicating a well-established trade network and presence of world travelers and visitors from different cultures. Despite the different script interpretation, its creation on the Malay Peninsula may not be ruled out. It could also have a possible West African origin, which was often visited by sailors and ships that participated in the Atlantic triangle trade of enslaved Africans, cash crops, and manufactured goods.

The Port Brunswick shipping register also lists many imports to and exports from the British ports of Bristol and London, as well as many ports in the Caribbean. While we cannot be certain, it is possible that this knife was accidentally dropped or lost by a foreign sailor while delivering trade goods from the East Indies or the Caribbean. It is equally possible that a British sailor could have acquired the knife during a visit to the East Indies, West Africa, or a Caribbean port, and then dropped or lost it while at port in Brunswick.

Another possibility for the knife's origins that must be considered is from the Spanish Attack in 1748. The Spanish successfully captured Brunswick for three days until the colonists surprised the Spanish raiders and drove them back to their ships. It is possible that sometime during that time period, a Spaniard dropped the knife that could have been acquired from the Far East, Africa, or in the Caribbean. We recognize the Spanish, much like the British, also had worldwide trade ties for the exchange of material goods.

Conclusions

At this time, we can only make a few conclusive statements about the Arabic knife. The new translation of the knife with the text of the *Shahadah* reveals that whoever carried this knife was likely devout in his Islamic faith. We also can speculate that it was not made in southeastern North Carolina, and its appearance at Brunswick is most likely a direct result of the global interconnectedness of the trade networks that were operating in the eighteenth century, in which Brunswick was an active Mid-Atlantic participant. It is also a popular item on display, viewed and discussed by visitors in the interpretive museum at the Brunswick Town/Fort Anderson State Historic Site.

This penknife also highlights the need for archaeologists studying Brunswick and other similar previously investigated archaeological sites to respectfully look beyond and build upon the original archaeological interpretations, especially those prior to the 1960s. While Lee, Tarleton, and South contributed an invaluable wealth of historical and archaeological information about Brunswick, the archaeology of their era focused primarily on the white male property owners whose town homes were the subject of their investigations. While these pioneers well discussed the upper status residents and their households, little to no material or interpretive consideration was given to larger anthropological topics of gender (in the role of women), ethnicity (such as the presence of enslaved Africans), middle or lower class status associated with the port and shipping community, or when possible, other ideational ideas about religion, as well as how people understood their eighteenth-century world and their place within it.

While the original research by Lee, Tarleton, and South was an outstanding starting point to understand the development of Brunswick, it is now time to reexamine the individuals of the past who either lived at or visited the port town. Archaeological evidence, such as the penknife described in this study, point to a large, thriving community that included many members of different ethnicities, genders, social and economic statuses, and religious beliefs. Playwright William Shakespeare (1974:381) tells us in *As You Like It* that "All the world's a stage, And all the men and women merely players; They have their exits and their entrances; And one man in his time plays many parts." If we take this statement at its words, it is no comedy to undertake our responsibilities as modern researchers respectfully building on the work of our predecessors, and to try to give historical voice and understand the many parts played by the lesser known but equally important members of the eighteenth-century community at Brunswick.

Notes

Acknowledgments. This study is not the sole effort of an individual but a collaborative endeavor of many, for which the authors thank for their valuable encouragement and assistance, and hope this final product reflects well on their efforts. Mr. Sahal Jama Mohamed, Arabic Language Instructor, Raleigh, North Carolina, graciously donated his services in the retranslation of the embossed script on the penknife. Joseph Haigler, Religion Instructor at Wake Technical Community College, suggested Mr. Mohamed as a translator and provided great contextual understanding in the importance of the *Shahadah* to members of the Islamic faith. Matt Matternes of New South Associates, Inc., provided great resources and discussions on identifying Muslim burials in historic and modern cemeteries. We are also grateful for the support and assistance from Jim McKee and Shannon Walker of Brunswick Town/Fort Anderson State Historic Site, for providing access to the penknife for closer observation and photography that made this research possible.

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Editorial advice was generously provided at different stages of this study by Linda F. Carnes-McNaughton (Fort Bragg Cultural Resources), John Mintz (NCOSA), and Pam Beaman, for which it is much improved. Additional thanks go to R.P. Stephen Davis, Jr., Editor of *North Carolina Archaeology*, for providing the technical support necessary to see this manuscript into print.

This article is dedicated to the memory of Jennifer L. Gabriel-Powell, whose promising professional odyssey of archaeological research was prematurely ended by her untimely passing. Her love for Brunswick Town/Fort Anderson State Historic Site and historical archaeology are evidenced by her contributions to this study, as well as her original works on the George Moore and Wooten-Marnen households.

Figures. Figures 1, 5, and 6 were taken by Beaman as part of the research on the penknife, with Figures 5 and 6 created for this publication. Excerpt from the Sauthier map of Brunswick used in Figures 3 is from the North Carolina State Archives. Figures 2 and 4 are from the Brunswick Town/Fort Anderson image collection, Historic Sites Archaeology Files, Office of State Archaeology Research Center, Raleigh. All images are reproduced here with appropriate permissions.

Disclaimer. Even with the tremendous support and assistance of the individuals acknowledged above, the authors assume full responsibility for any factual errors and the interpretations presented in this article.

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PREHISTORIC USE OF STILLHOUSE HOLLOW CAVE, WATAUGA COUNTY, NORTH CAROLINA

by

Thomas R. Whyte

Abstract

Archaeological investigations in Stillhouse Hollow Cave (31WT374), a small rockshelter/cave in western Watauga County, North Carolina, revealed evidence of at least Late Archaic and Late Woodland period seasonal habitation and possibly ritual use. Late Archaic remains include a cluster of bifacial thinning flakes of primarily Mount Rogers rhyolite, likely resulting from the completion of an Appalachian Stemmed knife. Late Woodland remains include a hearth containing carbonized wood, maize kernels, and beans. Associated with this hearth were a few stone artifacts and most of the sherds of one vessel—a limestone-tempered jar with a rectilinear-stamped exterior and a punctated thickened rim. A bean from the hearth was radiocarbon dated to A.D. 1295–1450.

In June 2013 and May-June 2015 the author, with assistance of Appalachian State University (ASU) Field Archaeology students and with support from the ASU Department of Anthropology, conducted test excavations in a recently discovered rockshelter/cave near Valle Crucis in Watauga County, North Carolina. Stillhouse Hollow Cave (31WT374) is a west-facing concavity created by solution weathering of a horizontally arching Cranberry Gneiss outcropping (Figure 1). Its elevation is 865 m (2840 ft) above mean sea level. The steep, west-facing slope of its setting is currently vegetated in upland hardwood forest and surrounded by a dense thicket of rhododendron. Stillhouse Hollow Creek, 30 m below the cave, flows westward for 400 m to a bend in Watauga River. The site was labeled a cave because of the existence of a dark, low recess (approximately 32 m^2) at the left rear (Figure 2); however, most of the protected space is partially lit and would typically be classified as a rockshelter. The floor area of this space is approximately 140 m^2. The maximum height of the ceiling at the mouth of the shelter is 2.5 m, the maximum ceiling height on the interior of the large atrium is 2 m, and the maximum height in the dark space of the cave at the left rear is 0.75 m.

The floor of the cave at the time of archaeological investigations was a dry silty loam with abundant tabular roof fall varying from large

Figure 1. Eastward view of Stillhouse Hollow Cave.

boulders to very fine gravels. The floor gently slopes down to the left (7%) when facing the cave and slopes very gently down from the rear of the cave to the mouth (2.5%). Remarkably, there was no evidence of vandalism in the form of excavation; however, a shallow Y-shaped trough was observed just within the drip line in the center of the cave mouth (Figure 3). This trough appears to be recent and anthropogenic but of unknown function. Glass beer bottles, a makeshift wooden bench, a modern wooden ladder, a tarp, and other modern litter were observed on the surface. In addition, one stone triangular projectile point and two prehistoric pottery sherds were found on the surface within the shelter.

Methods of Investigation

Just beyond the dripline and roughly parallel to the cave mouth, a datum and grid baseline were established along a compass declination of 40^{o}. With reference to this baseline, five one by one-meter excavation units were identified and delineated. These were designated with the following coordinates: 4R1, 4R4, 6R4, 9R0.5, and 9L0.5 (Figure 2) and were excavated in 10 cm arbitrary levels measured from the highest corner of the unit at the surface. Units 4R1, 4R4, and 9L0.5 each were excavated in three levels to a depth of 30 cm. Unit 6R4 was excavated in four levels to a depth of 40 cm. Unit 9R0.5 was excavated in five levels to a depth of 50 cm. Following excavation and documentation, each

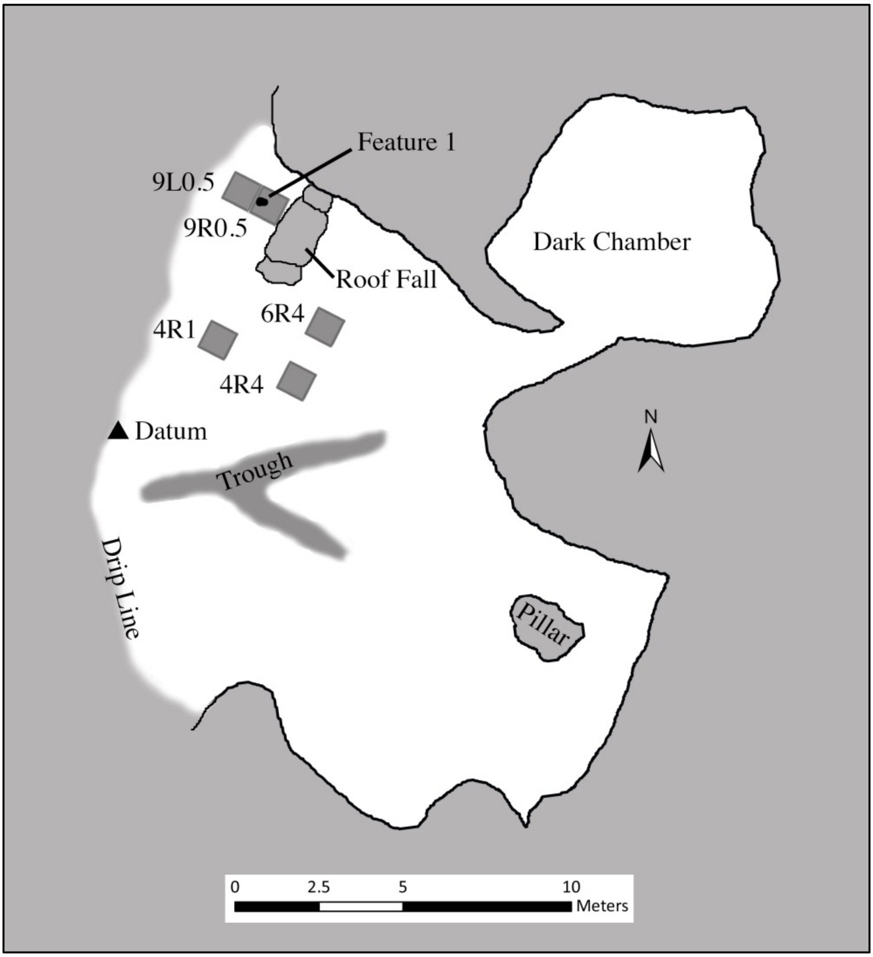

Figure 2. Floor plan of Stillhouse Hollow Cave.

excavation unit was lined with black plastic. An aluminum beverage can was then placed in the corner of each for rediscovery by metal detecting. Then, each unit was back-filled to the surface with rocks and sand collected from the shelter floor and from off-site sources.

All excavated fill was wet-screened through nested 1/4-inch (6 mm) and 1/8-inch (3 mm) mesh. Artifacts and biological remains recovered by the 1/4-inch screen were collected from the screens at the site. All sediments recovered by the 1/8-inch screen were packaged, transported to the laboratory, dried, and sorted.

Figure 3. Y-shaped trough in Stillhouse Hollow Cave.

Results

Stratigraphy and Contexts

The three excavation units clustered near the center of the shelter (4R1, 4R4, and 6R4) exhibited similar vertical profiles consisting of a weak A-horizon of medium brown silty loam extending to a depth of 8 cm. Underlying this is a compact, yellow brown silty loam and gravel extending to an undetermined depth beyond 30 cm. Infrequent and small bits of wood charcoal were observed throughout the profile. Large tree roots extended horizontally through the base of the A-horizon.

The paired units located in the lowest part of the sheltered space (9R0.5 and 9L0.5), where the ceiling is highest and the shelter receives the most light, exhibited a different soil profile. There, the A-horizon is considerably thicker (about 20 cm) and darker, and underlain by an E-horizon of unknown thickness. Here, too, large tree roots extended horizontally through the base of the A-horizon (Figure 4).

One prehistoric archaeological feature (Feature 1) was identified near the center of 9R0.5 (Figure 4). This was a concentration of carbonized plant matter underlain by oxidized soil. Roughly oval in plan view, it measured 25 cm by 27 cm. The carbonized plant matter was first observed at a depth of 17 cm below surface and extended to a depth of

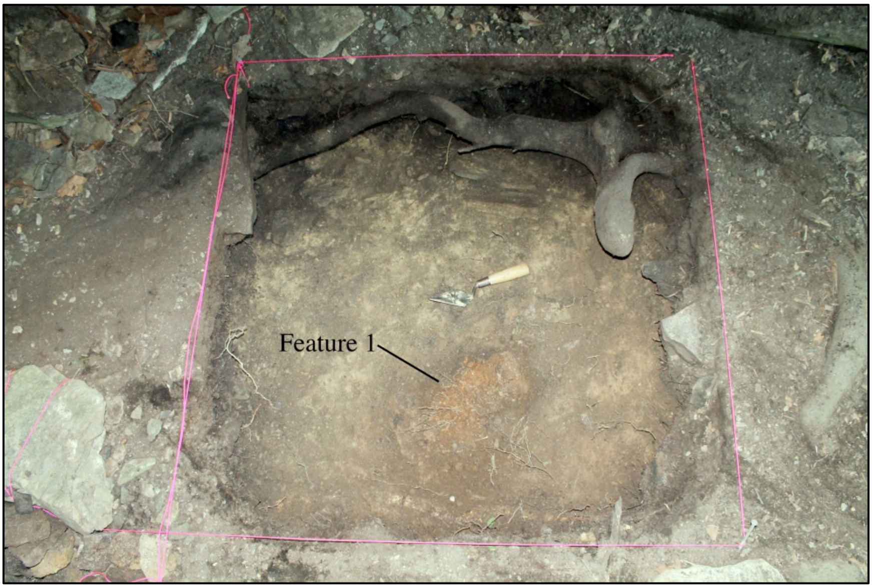

Figure 4. Feature 1 in Unit 9R0.5 at 20 cm, Stillhouse Hollow Cave.

20 cm. The oxidized soil appeared at that depth and disappeared at a depth of 23 cm below surface (Figure 4). This feature was identified as a hearth and was associated with numerous ceramic vessel sherds typologically assigned to the later part of the Late Woodland period (A.D. 1200–1500).

Artifacts

Prehistoric artifacts recovered from Stillhouse Hollow Cave include 293 ceramic sherds, 506 lithic artifacts, and a few fire-cracked rocks. The majority was recovered from units 9R0.5 and 9L0.5 in association with Feature 1 and an earlier cluster of lithic debitage found below Feature 1.

Ceramic Artifacts. Two pottery sherds were found on the surface near the center of the shelter. One, a vessel body sherd tempered with crushed biotite schist, has an eroded net or cord marked exterior, and smoothed interior. The other is a grit-tempered body sherd with a smoothed-over cord or fabric marked exterior. These likely date to the Early or Middle Woodland period. The remaining 291 sherds were recovered by excavation—two from 4R1, five from 4R4, two from 6R4, 131 from 9R0.5, and 151 from 9L0.5. The eight sherds (seven body and one neck) recovered from the more centrally located excavation units

Figure 5. Rectilinear stamped, limestone tempered pottery from Stillhouse Hollow Cave.

(4R1, 4R4, and 6R4) are tempered with crushed quartz and are either plain, scraped, or marked with a looped net on the exterior. These were recovered from various depths between the surface and 30 cm and appear to represent Middle or Late Woodland wares.

Most of the sherds recovered, all from 9R0.5 and 9L0.5 between the surface and a depth of 20 cm, are 263 fragments of a limestone tempered, rectilinear stamped jar (Figure 5) that appear to be contemporaneous with the hearth, Feature 1. Tempering particles, some leached and some intact, range between 1 and 5 mm in maximum dimension. The vessel appears to have had an opening diameter of approximately 24 cm and a body diameter of approximately 36 cm. Vessel wall thickness ranges between 4.9 and 7.4 mm. The folded rim has a rounded lip and a fold height of 21 mm. The vessel interior was scraped, possibly with a serrated mussel shell. Oblique rim punctations form a chevron that angles to the left (Figure 5). Whereas punctations on similar pottery from other sites in the region were often made with feathers (Whyte et al. 2011), these appear to have been made with a twig.

The rectilinear stamping pattern combines elements of Dickens' (1976) A and C broad types defined for the Pisgah series (Figure 5). Sets of 10 or more parallel lands and grooves, approximately 1.4 mm wide, are separated by two perpendicular grooves measuring between 2.6 and 3.5 mm wide and a third row of checked grooves. The carved paddle or stamp was generally applied with the design angled to the rim.

This vessel compares well with several identified from fragments recovered at the nearby Ward site (31WT22), a Late Woodland palisaded village on the Watauga River 2 km downriver (Senior 1981). Originally identified as Mississippian period "Pisgah Series" pottery (Purrington 1983; Senior 1981), this ware, because of its limestone tempering, shares affinities with the Late Woodland Radford series (Evans 1955).

Other kinds of pottery recovered from 9R0.5 and 9L0.5 include 11 gneiss-tempered sherds with knotted net impressed exteriors and scraped interiors. This combination of traits indicates a Late Woodland period ware with similarities to the Dan River series (Coe and Lewis 1952). Two schist-tempered sherds, one of which is a thickened rim with chevron punctations, indicate another Late Woodland period vessel. One neck sherd that is tempered with soapstone and smoothed on both surfaces likely represents a Burke series vessel (see Keeler 1971 and Moore 1999). Mississippian Burke series sherds are often found in small numbers on sites in Watauga County and appear to be evidence of temporary excursions to or through the region in the terminal prehistoric period.

Lithic Artifacts. A few small burnt rocks, six chipped-stone bifacial tools, one flake tool, 521 pieces of debitage, and one small flake of soapstone were recovered. Most are debitage recovered from 9R0.5. One medium-sized isosceles triangular arrow point of Knox chert was collected from the surface at 6R3 (Figure 6a). A large triangular projectile point of quartzite that had been recycled into a drill was recovered from the A-horizon in 9R0.5 (Figure 6b). Also recovered from that provenience were a vein quartz projectile point tip and a vein quartz biface fragment that may have been part of a projectile point. The E-horizon of the unit also yielded the base of a Morrow Mountain spearpoint made of vein quartz (Figure 6c), a vein quartz drill tip (Figure 6d), and a small soapstone spall that may have come from a vessel.

The majority of lithic artifacts, recovered mostly from Level 3 (E-horizon) of 9R0.5, just beneath the hearth, are 467 flakes of Mt. Rogers Rhyolite. All of the flakes retaining a striking platform clearly represent bifacial thinning (i.e., platforms are multifaceted, ground, and lipped and the bulbs of percussion are slight). In addition, 14 bifacial thinning flakes of blue-gray bedded Knox chert were found with this cluster of Mt. Rogers rhyolite flakes. These existed as a closely spaced cluster and appear to represent a single episode of bifacial thinning. None of the flakes exhibits cortex, indicating that the parent artifact was a bifacial preform brought to the site for further reduction. The Mt. Rogers

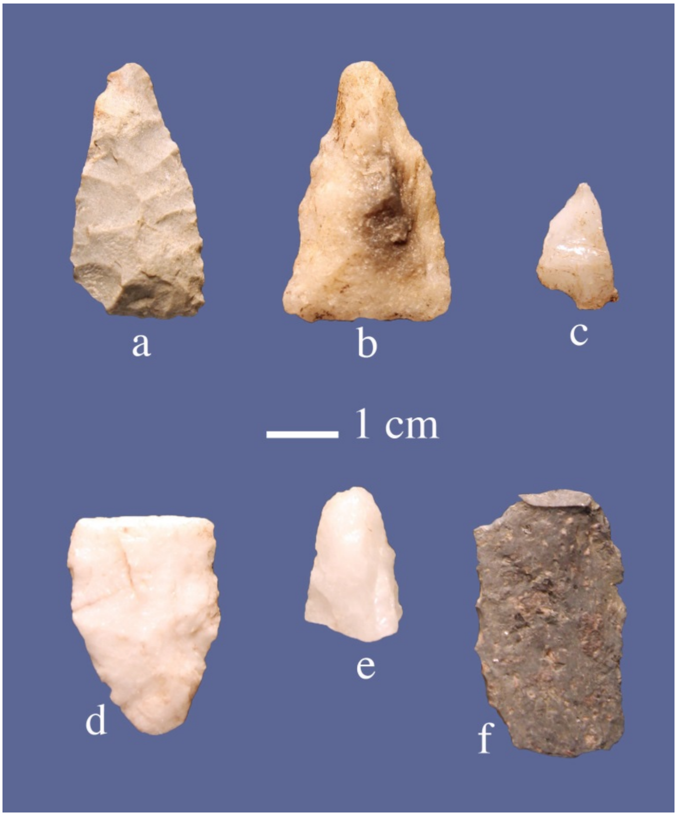

Figure 6. Stone tools from Stillhouse Hollow Cave.

rhyolite flakes appear to have resulted from the further reduction of a preform, and a preform tip or corner fragment was found among the flakes. Large stemmed knives of the Late Archaic period (Savannah River and Appalachian Stemmed types) are the most common finished artifacts of Mt. Rogers rhyolite found in the region; in all probability, one of these was finished or nearly finished at the site.

Archaeofaunal Remains

Animal remains recovered are very few (239 specimens), possibly because few were deposited to begin with, but more likely because they were deposited on the surface where they were immediately subjected to various taphonomic processes. Moreover, unless they were burnt and associated with the hearth feature, they likely represent natural death and deposition. This is especially the case for the 23 terrestrial snail shells and shell fragments recovered. That nearly 60% of vertebrate specimens are burnt indicates more favorable preservation of burnt specimens lacking collagen. Due to fragmentation, only 58 (24%) vertebrate specimens were minimally identifiable to the class level.

Mammalian remains recovered include a maxillary premolar, maxillary molar, and parts of phalanges of White-tailed Deer (*Odocoileus virginianus*), a maxillary incisor and molar of a Woodchuck (*Marmota monax*), various bones and teeth of Eastern Chipmunk (*Tamias striatus*), an incisor of a tree squirrel (*Sciurus* sp.), and a molar of a vole (*Microtus* sp.). Only the squirrel incisor and deer phalanges are burnt. The unburned rodent remains likely represent naturally intrusive fauna. The unburned deer teeth may represent the contributions of occasionally denning carnivores.

One calcined specimen, a long bone fragment, was identified as large bird. Coming from the context of Feature 1, this likely represents human deposition. A second specimen identified as large bird bone was recovered from Level 5 of 9R0.5.

Six small burnt fragments identified as turtle (order Testudines) shell were recovered from Feature 1. As one of these was identified as part of the plastron of Eastern Box Turtle (*Terrapene carolina*), it is likely that all six represent that species and possibly one individual turtle. That they are burnt and associated with the hearth feature implies human deposition.

Archaeobotanical Remains

Plant remains associated with human activity at the site include unburned maize cobs found on the surface that likely were deposited in recent times by humans or nonhuman scavengers such as rats and raccoons. Subsurface carbonized plant remains most likely resulted from prehistoric fires and include scattered bits of wood charcoal found in the upper levels of all excavation units and a dense concentration, amounting to nearly 400 grams, within the Late Woodland period hearth in 9R0.5. The wood charcoal from this feature, constituting 99% of plant material by weight, consists mostly of a mix of hard and soft wood twigs and sticks. Some fragments are only partially carbonized. One immature acorn, resembling that of a Red Oak (cf. *Quercus rubra*), that likely had been attached to twigs gathered for fuel was included among the carbonized plant material.

Five halves of carbonized bean seeds (*Phaseolus vulgaris*) were recovered from Feature 1 (Figure 7). Also associated with this feature were 65 carbonized maize kernels and kernel fragments (Figure 7) and

Figure 7. Carbonized bean seeds (top) and maize kernels from Stillhouse Hollow Cave.

three pieces of carbonized hickory nutshell. The beans and maize kernels may have been dried seeds offered to the fire. No other parts of the plants (pod or cupule) were recovered, and it is doubtful that beans or maize in cooked form would have remained intact after burning.

Interpretations

Site Component Age

Various sources of data indicate the existence primarily of Late Archaic (ca. 4000 B.P.) and Late Woodland (A.D. 900–1500) cultural components. Recovery of a Middle Archaic (ca. 7500 B.P.) projectile point (Figure 6c) in 9R0.5 suggests the possibility of earlier components below the deepest point (50 cm) of the 2015 season excavations. This artifact may have been brought up from a deeper stratum via bioturbation. Alternatively, it may be an older artifact that had been found at the site or elsewhere and reused in the Woodland period (see Whyte 2014).

A Late Archaic component is indicated not by typology but rather by the cluster of large Mount Rogers rhyolite and Knox blue-gray bedded chert bifacial thinning flakes found beneath the hearth in 9R0.5. Excepting incidences of secondary recycling, these materials were used almost exclusively in the Late Archaic period in the Appalachian Summit (Whyte 2007, 2014).

Two medium-to-large triangular arrowpoints (Figure 6a–b) were recovered that, along with schist-tempered pottery, may indicate an Early or Middle Woodland component. One, made of quartzite, was recovered from the A-horizon in 9R0.5 and had been recycled into a drill. Considering its spatial association with the Late Woodland period hearth, this artifact, resembling an Early Woodland Greenville type (Kneberg 1957), may have been scavenged and recycled in the Late Woodland period. The other, a chalcedony arrowpoint resembling in size, shape, and material a Greenville or Garden Creek type (Keel 1976), was found on the surface at 6R3, approximately 2 m south of the Late Woodland period hearth (Figure 6a).

A Late Woodland component is typologically indicated by limestone tempered, rectilinear stamped pottery associated with Feature 1. The rectilinear stamping designs compare well with Dickens' (1976) broad designs A and C that he regards as later (ca. A.D. 1250–1450) forms of stamping. Broad-design stamping was also observed on ceramics from the nearby Katie Griffith site (31WT330) that were radiocarbon dated (via adhering residues) to cal. A.D. 1295–1410 (Beta-410022). Exactly the same calibrated age range (conventional radiocarbon age = 600 $\pm$ 30; calibrated 2σ result = A.D. 1295 to 1410) resulted from the ^{14}C-dating of a bean fragment (Beta-410023) recovered from Feature 1 of Stillhouse Hollow Cave (Figure 7, top row, left). This date is consistent with those reported by Baumann et al. (2015) for sites to the west in Tennessee.

Human Activity at the Site

Human activities indicated by material remains and contexts within the rockshelter include: stone tool maintenance, manufacture, and use; food preparation or offering; and perhaps temporary residence. These activities may have varied among the different temporal components. For example, only evidence of stone tool manufacture, and specifically a phase in the reduction of two or more bifaces, is evident for the Late Archaic period component. Burnt animal remains recovered from within and around the Late Woodland period hearth (Feature 1) include an array of species likely representing human food waste. Associated pottery and domesticated plant remains may indicate food preparation and consumption. Alternatively, they may have entered the deposits by way of human offerings to spirit beings associated with the landscape (see Claassen and Compton 2011 and Whyte 2007). Indeed, Witthoft's (1949:32) review of Cherokee ethnohistory reports that they fed dried maize kernels and beans from the previous harvest to the fire in late summer before the new corn could be eaten (also see Cridlebaugh 1985). Moreover, the central roles of caves and rockshelters in human burial and in the creation and spirit stories of southeastern natives are well documented (Claassen and Compton 2011; Whyte 2005, 2007, 2013). In sum, the beans, maize, and possibly the entirety of Feature 1 may be what remain of a prehistoric example of what was historically observed among the Cherokee. It is doubtful that viable seed or food would have been burned otherwise.

Whyte (2003) has suggested that during the Little Ice Age (after AD 1400) human visitation to these elevations was probably seasonal. Late Woodland period evidence at Stillhouse Hollow Cave likely represents a brief seasonal visit by a small number of individuals traversing through the region or visiting the uplands for resource harvesting. The presence of a few Hickory nutshell fragments (cf. *Carya tomentosa*) among the fuel remains in Feature 1, if they represent human food, indicates a seasonal *terminus post quem* of September when the fruits of this species ripen and fall to the ground. The charred deer, squirrel, and turtle remains recovered are consistent with this interpretation. Moreover, seasonal use of the higher elevations of the Appalachian Summit would have been most fruitful for humans in late summer and fall when forest mast was mature for harvesting (Whyte 2007).

Summary and Conclusion

Test excavations at Stillhouse Hollow Cave indicate relatively undisturbed and stratigraphically distinct prehistoric archaeological components dating primarily to the Late Archaic and Late Woodland periods. Evidence includes features and artifact clusters extending down from the surface to at least 30 cm. Earlier Archaic period components may exist beyond 50 cm in depth, especially at the shelter opening. In addition, isolated pottery sherds and one arrowpoint indicate Early Woodland and possibly Middle Woodland and Mississippian period use of the site. Most of the archaeological evidence was discovered at the well-lit opening of the shelter. However, no subsurface testing was undertaken in the dark space of the cave for fear of disturbing bats and prehistoric human remains.

Prehistoric items recovered include stone tools and debitage, burnt rocks, pottery sherds, animal remains, and carbonized plant remains. Plant and animal remains suggest late summer or early fall seasonality for the Late Woodland component. Late Woodland site activities in evidence are hearth construction and use, cooking, and consumption of hunted (deer and squirrel) and gathered (turtle) animals. Carbonized bean and maize seeds may represent food or ritual offerings. Late Archaic period activities indicated by the evidence concentrated in 9R0.5

are late-stage bifacial thinning of Mount Rogers rhyolite and Knox chert tool preforms.

Permanent village occupation above 2500 ft above mean sea level in the northern Appalachian Summit before A.D. 900 and after A.D. 1400 remains to be confirmed (Whyte 2003). The archaeological remains in Stillhouse Hollow Cave appear to represent temporary seasonal visits in which small groups of humans at various times found the shelter to be a convenient place for brief occupation and perhaps an appropriate place for embedded ritual activities. Similar evidence has been found at nearby sites such as Church Rockshelter No. 1 (31WT155) (Whyte 2013).

At the time of this writing, this relatively hidden and secluded site enjoys adequate protection by its owners and those of adjacent properties. Caves are exceptionally rare in western North Carolina, as the region lies east of the karstic Ridge and Valley province where solution cavities have formed in the Knox Group dolomites. Because of their rarity and the roles that caves have played in the mythic landscapes of southeastern Indians, they tend to contain various evidence of prehistoric human use, but especially that of ritual and human burial (Claassen and Compton 2011; Whyte 2007; Whyte and Kimball 1997). While no human remains have yet been found in Stillhouse Hollow Cave, there is a possibility that they exist below ground, especially in the dark space at the left rear of the concavity. Because of this possibility and the scientific potential of the site, Stillhouse Hollow Cave warrants further protection but only limited additional archaeological investigation.

Notes

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