GEOARCHAEOLOGY OF AN ERODED MISSISSIPPIAN MOUND: THE BELMONT NECK SITE (38KE6), WATEREE RIVER VALLEY, SOUTH CAROLINA

by

HEATHER D. BARTLEY

(Under the Direction of DAVID S. LEIGH)

ABSTRACT

The Belmont Neck site (38KE6) is a small, early Mississippian period platform mound and village site in the Wateree Valley, Kershaw County, South Carolina. The objectives were the following: (1) to determine geomorphology in the study area; (2) to determine the sources of mound fills; and (3) to determine the nature and extent of site formation processes. The objectives were carried out with methodology involving geomorphology, pedology, stratigraphy, and soil micromorphology. Results include the following. Micromorphology can be quite successful for detecting redistributed material from a destroyed mound or other earthwork, and the resulting data is useful for finding the maximum original possible size of a mound. The mound's maximum original height was 2 m high. The existence of a thin redistributed mound layer, at least 49 m in diameter, was confirmed with micromorphology. The main cause of erosion/destruction/height reduction of the mound is interpreted to be tillage erosion.

INDEX WORDS: geoarchaeology, geomorphology, pedology, micromorphology, site formation processes, Mississippian, platform mound, archaeology

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CHAPTER 1

INTRODUCTION

This research investigates the Belmont Neck site (38KE6), a small early Mississippian period platform mound and village site in the Wateree Valley, Kershaw County, South Carolina. The platform mound has possibly been substantially reduced in height during the past two hundred years.

The objectives of this research are the following:

1) to determine the subsurface and surface geomorphology in the vicinity of the site;

2) to determine the source of mound fill; and

3) to determine the nature and extent of both natural and cultural processes (especially the destructive processes) that have altered or obscured the Mississippian component of the site. Specifically, was the mound really as much as 3.4 m high in the early nineteenth century as indicated by Squier and Davis (1998)? If so, the mound has lost about 2.5 meters in height since then, and there should be a redistributed layer of mound fill spread out around the mound.

These objectives were carried out with methodology involving geomorphology, pedology, stratigraphy, and soil micromorphology. The results indicate the following. Micromorphology can be quite successful for detecting redistributed material from a destroyed mound or other earthwork. The Belmont Neck site itself is situated on a low alluvial terrace (T1) that occasionally floods, but it is allostratigraphically separated from a historic sedimentary unit situated in a large swale and on higher elevations closer to the river bank. The Belmont Neck mound was built on a low scroll bar ridge landform on the T1 terrace. The first stage of construction used soil from an artifact-rich area, probably from the village area, but soil of different colors for the second stage was deliberately acquired away from the occupation areas. No evidence of borrow pits was found, although the mound fill must have originated from the Bw or Bt and A horizons of an organic-rich low spot in the alluvial terrace (T1) or the floodplain. The midden soil of the first mound stage is much sandier than the rest of the mound layers, so it was acquired from a sandy surface horizon. Blanding definitely overestimated his reported height of 3.4 to 5.8 m in the early nineteenth century (Squier and Davis, 1998). The original height of the Belmont Neck mound was definitely no more than two meters high, based on the evidence. The mound was still about 1.7 m high in the 1930s, and it is 0.8 m high now. The existence of a thin (usually no thicker than the Ap horizon) redistributed mound layer, at least 49 m in diameter, was confirmed with micromorphology. The main cause of erosion/destruction/height reduction of the mound is interpreted to be tillage erosion over the past three centuries. Pedoturbation, slope wash, and soil creep were minor erosive factors. Other destructive factors include digging by looters and for construction of historic house foundations. There is no conclusive evidence of bulldozing at the site.

This research is of interest to geomorphologists, pedologists, micromorphologists, and geoarchaeologists because it could expand these scientists' knowledge of applications of their sciences to archaeology. Archaeologists, especially ones who study earthworks, would be interested in this research because it explores site destruction processes that can occur on earthworks, the affects of erosion on earthworks, and the gathering of earth science data that can help in the interpretation of archaeological sites.

This master's thesis presents a preliminary draft of a journal article (Chapter 3) with a separate introduction (Chapter 1), literature review (Chapter 2), and conclusions (Chapter 4). The draft of the journal article is organized into the following sections: introduction, study area, methods, results, discussion, and conclusions. Both the results and discussion sections are subdivided into the same subsections that organize the various types of results. These subsections consist of the following: geomorphological data, stratigraphy, redistributed mound layer data and micromorphology, mound fill sourcing, site formation and destruction processes, and Mississippian site location/environment (for the discussion section only).

CHAPTER 2

LITERATURE REVIEW

Geoarchaeology is an interdisciplinary field that applies earth science concepts and methods to solve archaeological problems (Waters, 1992). Three aspects of geoarchaeology are especially fundamental to archaeology: stratigraphy, landscape reconstruction, and site formation processes (Waters, 1992). These first two aspects are integral to the first objective of this research, to determine the surface and subsurface geomorphology of the area. The other two objectives of this paper's research are parts of the third aspect of geoarchaeology that is especially fundamental to archaeology: site formation processes.

Site formation analysis requires consideration of three processes: the cultural processes (behaviors) responsible for the original formation of the archaeological site, the cultural practices that alter or obscure the original behavioral signatures (including the actions of modern landowners, looters, archaeologists, or any people post-dating the original site occupation), and natural processes (Schiffer, 1987; Stein, 2001). The original cultural processes create a pattern of artifacts in space, and the latter two types of processes destroy, alter, obscure, or sometimes preserve that original pattern of the artifacts (Stein, 2001). The research in this paper focuses on the latter two types of processes, while the first type will be considered only by the archaeologists, except for the sources of the mound fills.

Archaeological sediments, sediments altered by cultural activities, contain information about human activities (Stein, 1985). Stein (1985) proposed a procedure for interpreting sediment history and identifying the agents responsible for sedimentary conditions. There are four stages in the life history of sediment: its source, its transport history, the environment of deposition, and post-depositional alterations. At each point in the history of sediment, the contribution of natural and cultural processes can possibly be reconstructed. To accomplish this reconstruction, selected attributes of the sediment are analyzed and compared to an off-site control that has not been altered or has been minimally altered by people (Stein, 1985). The general sediment source area can usually be determined by analyzing texture and composition and comparing to possible sources. The transport mechanism is also determined by texture and composition. To investigate the environment of deposition, both textural and compositional information and structure can be employed. Finally, post-depositional alterations are identified by noting evidence of turbations and vertical soil horizons (Stein, 1985). All of these observations can be obtained through excavations, natural exposures, trenches, or core transects.

Archaeological earthen mounds may be potentially exposed to several different destructive forces, including anthropogenic and natural forces. Anthropogenic forces include agricultural cultivation, bulldozing, erosion due to plowing, construction activity, and digging by looters. Natural forces include soil creep, pedoturbation, and erosion by water. No archaeological site is ever completely undisturbed by these and other processes, so recognition of these processes is critical during archaeological research (Padgett, 1997).

One of the anthropogenic destructive forces that mounds may potentially be exposed to is bulldozing. Unfortunately, mounds can easily be destroyed by modern earth-moving machines, and even by mule-drawn metal scrapers used in the nineteenth century (McKinstry, 1993; Morgan, 1999). However, earthen mounds are quite durable when not bothered too much by people, as evidenced by structures at Cahokia, Poverty Point, and Kolomoki (Morgan, 1999). Also, archaeologists can preserve existing mounds by planting vegetation, which substantially reduces erosion (Andropogen, 1989; Thorne, 1990; Miller, 2000).

Erosion due to plowing is one of the anthropogenic forces that can cause erosion to mounds and other earthworks. There has been an increasing awareness that erosion of hilly cultivated areas is not only due to water and wind, but also to tillage, also known as plowing (Olson et al., 2002). Tillage erosion is a progressive downslope movement of soil caused mechanically by tillage implements (Olson et al., 2002). Tillage erosion exposes subsoil or surface layers that may be highly erodible by wind or water, resulting in displacement of huge amounts of soil materials from the upper convex part of the slope to the lower concave parts (Olson et al., 2002). Since the Belmont Neck site has been cultivated at least since the late eighteenth century (Wagner, 2005b; Wagner 2005c), tillage erosion has been inevitable.

Soil creep is one cause of erosion on slopes. Soil creep is the very slow downslope movement of superficial soil, usually the soil within 20 cm of the surface (Easterbrook, 1993; Waters, 1992). It is the sum of many tiny, discreet movements of slope material (colluvium) under the influence of gravity (Easterbrook, 1993). Many of these movements are caused by expansion and compaction of soil, either due to wetting and drying or freezing and thawing (Easterbrook, 1993). Soil creep can be exacerbated by pedoturbation, which is the disturbance of soils by organisms, especially by animals and plants (Easterbrook, 1993; Johnson and Watson-Stegner, 1990; Hall and Lamont, 2003). Some pedoturbation involves the displacement of soil by organisms: the movement of roots of plants swaying in the wind; the growth and decay of roots (create voids that are filled by collapse); and burrowing by insects, rodents and worms (Easterbrook, 1993). These burrowing animals bring soil to the surface, which then moves downhill while the burrows collapse. A population of 150,000 earthworms in an acre of soil may raise 10 to 15 tons of casts to the surface annually (Holmes, 1955). Rates of soil creep range from fractions of millimeters to meters per year, depending on the slope angle, susceptibility of materials, the intensity of the processes, and amount of water present (Easterbrook, 1993). Pedoturbation occurs in all soils that have been inhabited by animals or plants, and this certainly includes the Belmont Neck site.

Erosion by water is another natural destructive process that can occur on mounds. It is caused by two main processes: raindrop impact and sheetwash, also known as overland flow (Knighton, 1998). First, impact of the soil by raindrops dislodges particles from the soil surface (Knighton, 1998). Then, sheetwash (the flowing of water over the ground surface) takes those particles, dislodges its own, and carries them all downslope (Knighton, 1998). Erosion by water is reduced when vegetation cover exists (Knighton, 1998; Miller, 2000).

Many archaeologists have noted that the mounds that they are excavating have experienced erosion, but many of them do not calculate original volume or dimensions (Vogel et al., 2005; Rodning, 2002). An exception is work done at the eroded and looted Beaverdam Creek site in Georgia (Rudolph, 1984; Rudolph and Hally, 1985). Researchers have calculated volumes of well-preserved mounds in order to calculate how many basket-loads of soil were needed to build the mound. Similarly, Erasmus (1965) experimented with making a platform mound and discovered how many basket-loads of soil were needed and how long it took.

As far as can be determined, only two geoarchaeological studies have been performed to quantify erosion of an archaeological mound or other earthwork. First, Olsen et al. (2002) investigated the eroded Mississippian mound M57 at Cahokia. Their objectives were to determine the extent of soil formation since the mound was built; to determine the timing, extent, and direction of tillage; and to determine the extent of soil loss from erosion. Fly-ash had been deposited there since the 1850s, so this material was used as a tracer for soil layers that had been exposed to the surface since the 1850s and for the extent of soil mixing (Olsen et al., 2002).

Using fly-ash as a tracer allowed detection of erosion of the mound and deposition of this material onto its footslope (Olsen et al., 2002). This is the only example of a study in which some substance was used as a tracer to locate the eroded material. In this thesis, a different type of tracer is used to locate the eroded material from a mound, microscopic yellow mound fill clods. Another recent study was the first to apply a quantitative diffusion model to the degradation of earthworks (O'Neal et al., 2005). A simple finite-differences diffusion model was applied at a circa 1800-year-old embankment and ditch at the Hopewell Mound Group in Ohio (O'Neal et al., 2005). Stratigraphic and geophysical data were used to validate the application of this model to the earthwork. This type of model has often been applied in the past to model the natural degradation and shape changes on geomorphic surfaces (O'Neal et al., 2005). The model's archaeological application is most useful for earthworks in which the dominant degradation processes are not a result of recent human activity, although this model is still useful for separating anthopogenic from natural degradation (from soil creep and sheetwash erosion) at other sites (O'Neal et al., 2005). Along with these two studies, the research in this thesis is among the first to apply quantitative methods to analyze the erosion and to attempt to discover the original dimensions of an archaeological mound or earthwork.

A key method in this thesis involves micromorphology, which is the method of studying soil or other regolith samples with microscopic techniques "in order to identify their different constituents and to determine their mutual relations, in space and time" (Stoops, 2003, p.5). Its aim is to study the natural or anthropogenic processes that are responsible for the formation or transformation of the soil in general or of certain features (Stoops, 2003). In the past, micromorphology has been used in archaeology or geoarchaeology in several ways. Micromorphology has been used in ethnoarchaeological studies under controlled conditions to prove how various human activities such as plowing and human burials affect the soil (French, 2003). It has also been used to analyze archaeological materials to discover what materials were used to make them (French, 2003). Micromorphology has also been used to examine *in situ* archaeological contexts, sediments, and occupation sequences in sites in order to answer questions about the sequences of use during and after the life of the archaeological structure and about the nature of post-depositional effects on the soil/sediment matrix (French, 2003). The research in this thesis uses micromorphological techniques to locate and recognize redistributed mound material and therefore identify the size and extent of a redistributed layer of soil originating from the mound.

This research uses allostratigraphy to understand the subsurface conditions at the site. Allostratigraphy is the differentiation of stratigraphic units based on bounding discontinuities (NACSN, 1983), which is useful when different geomorphic units have similar grain size and lithology and when single geomorphic units are heterogeneous. In such a case, lithostratigraphy would be useless in differentiating the units. Autin (1992) successfully used allostratigraphy to map Holocene alluvium in the middle Amite River of southeastern Louisiana. He found that allostratigraphy provides an objective method for definition of geologic units that contain genetically related, but heterogeneous sedimentary deposits. The technique differentiates alluvial sediments in a way that successfully integrates geomorphic, sedimentary, and pedological data into discrete stratigraphic units (Autin, 1992). Allostratigraphy is commonly applied in geomorphological studies (Blum & Valas, 1994; Peterson & Bell, 1995; Nemec et al., 1999; Holbrook, 2001).

The focus of this research is an archaeological site from the Early Mississippian period. The Mississippian cultural period of the southeastern United States stretched from circa A.D.

900-1500 (Bense, 1994). It was a time when both agriculture (especially of corn) and long range trade was widespread among the Native Americans (Bense, 1994). The chief governmental unit was the chiefdom, centered along a river valley. A chiefdom was a regionally organized society with a central decision-making hierarchy coordinating activities among several village communities (Hally, 1996). The capital of each chiefdom was characterized by at least one human-made, earthen platform mound upon which religious, social, and governmental activities were performed (Bense, 1994). Mississippian platform mounds were always constructed in multiple stages (Hally, 1996). These mounds in the southeastern United States began with a large earth-embanked rectangular building (Cable et al., 1999). After a period of occupation, this building was filled in and capped with earth; this was the first mound-building stage (Cable et al., 1999). Substantial structures were built on the summit of each succeeding stage of the mound, and new layers of earth were added with each stage (Cable et al., 1999). People dug mound fill by hand in the village and low-lying areas, leaving behind borrow pits (Demel and Hall, 1998; Morgan, 1999). These pits sometimes became ponds, which served as convenient water sources and, at some sites, as fish ponds (Morgan, 1999). At Cahokia, some pits were left to fill in naturally, whereas others were intentionally filled in with refuse in order to be used as new foundations for mound construction (Demel and Hall, 1998).

CHAPTER 3

GEOARCHAEOLOGY OF AN ERODED MISSISSIPPIAN MOUND: THE BELMONT NECK SITE, WATEREE RIVER VALLEY, SOUTH CAROLINA[1]

[1] Bartley, H.D., and D.S. Leigh. To be submitted to *Southeastern Archaeology*.

INTRODUCTION

This research is focused on using earth science concepts and methods to more fully understand a specific archaeological site, especially the site's natural context and site formation processes. Aspects of geomorphology, pedology, micromorphology, geology, and geography are applied, making the research interdisciplinary and geoarchaeological in nature. This research investigates the Belmont Neck site (38KE6), a small early Mississippian period platform mound and village site in the Wateree River Valley, Kershaw County, South Carolina. The platform mound has possibly been substantially reduced in height during the past two hundred years.

The objectives of this research are the following:

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The focus of this research is an archaeological site from the Early Mississippian period. The Mississippian cultural period of the southeastern United States stretched from circa A.D. 900-1500 (Bense, 1994). It was a time when both agriculture (especially of corn) and long range trade was widespread among the Native Americans (Bense, 1994). The chief governmental unit was the chiefdom, centered along a river valley. A chiefdom was a regionally organized society with a central decision-making hierarchy coordinating activities among several village communities (Hally, 1996). The capital of each chiefdom was characterized by at least one human-made, earthen platform mound upon which religious, social, and governmental activities were performed (Bense, 1994). Mississippian platform mounds were always constructed in multiple stages (Hally, 1996). These mounds in the southeastern United States began with a large earth-embanked rectangular building (Cable et al., 1999). After a period of occupation, this building was filled in and capped with earth; this was the first mound-building stage (Cable et al., 1999). Substantial structures were built on the summit of each succeeding stage of the mound, and new layers of earth were added with each stage (Cable et al., 1999). People dug mound fill by hand in the village and low-lying areas, leaving behind borrow pits (Demel and Hall, 1998; Morgan, 1999). These pits sometimes became ponds, which served as convenient water sources and, at some sites, as fish ponds (Morgan, 1999). At Cahokia, some pits were left to fill in naturally, whereas others were intentionally filled in with refuse in order to be used as new foundations for mound construction (Demel and Hall, 1998).

STUDY AREA

The study area is located within Kershaw County, South Carolina, along the Wateree River (Figure 1) surrounding the Belmont Neck site, which itself covers an area of 8.26 hectares (Cable et al., 1999). I focus on an area about one kilometer in diameter. The Wateree River is a tributary of the Santee River, which flows into the Atlantic Ocean. The Wateree's headwaters are the Catawba River, which originates in the Blue Ridge Mountains of North Carolina (Wagner, 2003).

The study area is located in the Upper Coastal Plain, which is characterized by sandy sediment. The edge of the Piedmont (the Fall Line) lies 4 km northwest of the site; it has characteristic bedrock of granite, gneiss, schist, gabbro, quartzite, amphibolite, migmatite, and argillite (USDA, 1973). The headwaters of the drainage basin extend into the Blue Ridge Province, which has characteristic metamorphic bedrock of biotite schist, hornblende schist, gneiss, muscovite pegmatite, and quartzite (USDA, 1973).

The 30-year average annual precipitation at the Wateree Dam weather station, 1971-2000, is 97.74 cm, with the highest monthly average of 10.17 cm occurring in June (NCDC, 2004). The 30-year average annual temperature at the Camden 3W weather station is reported as 15.6°C, with an average January temp of 5.1°C and an average July temperature of 25.4°C (NCDC, 2004).

The Belmont Neck site is located in the interior of a meander bend of the Wateree River (Figure 2; SCDNR, 2004). The site is just 0.38 km from, and about 6 m above, the typical low-water level of the river. The site is located inside the meander bend on the northern interface between two mapped soil series: the silty Chewacla closer to the river and the silty Congaree at slightly higher elevations in the center of the meander loop (Mitchell, 1990). A mature hardwood bottomland forest (dark green area in Figure 2) occupies the areas mapped as Chewacla, which is largely backswamp, and the Congaree soil of the area hosts a 19-year-old stand of pine trees (red area in Figure 2). The site is just 23 km river distance downriver from the Wateree Dam, which was installed in 1920 (Duke Power Staff, 2004).

The Belmont Neck site is the first known capital of the Mississippian-period chiefdom of Cofitachequi (Wagner, 2003b). This Mississippian component has an occupation date of circa A.D. 900-1300 (Cable et al., 1999). It is a single-mound center with a village, and the mound may have been built on a low ridge (Cable et al., 1999). Unfortunately, the mound has undergone erosion and modification, especially in the past few centuries. In the early nineteenth century, the mound reportedly stood between 3.5 and 5.8 m high (Squier and Davis, 1998), but even the 3.5 m might be an exaggeration. In 1848, Squier and Davis (1998) quoted a letter from William Blanding, M.D., of Camden, SC: “In the bend of the river… is a mound, perhaps fifteen feet [4.6 m] high. Little is known respecting it, having been for many years the site of an overseer's house." Since Blanding was giving an estimate, he might have been 3 ft in error on either side of his estimate, so the mound could have been between 3.4 m and 5.8 m high then, given that error range. A slave overseer's house was probably built upon the mound sometime between 1772 and 1796 because of the commercial indigo production practiced at the Belmont Neck field at this time (Wagner, 2005b; Wagner 2005c). In 1820, a different wooden farmhouse was moved to the mound and placed on tall pier foundations (Daniels, 2004). A photograph taken in the 1930s shows the house on top of a gentle rise that I estimate to be 1.4 to 1.9 m high (Figure 3). At the present time, the mound stands only 0.75 to 1.00 m above the surrounding land, probably due to occupational and agricultural activities (Cable et al., 1999). However, when dealing with eroded mounds, a substantial part of the mound may still exist under the ground surface. Sediment from the top of the mound may have moved down the sides and spread over the surrounding ground, raising the elevation of the ground in the surrounding area and hiding the base of the mound (Cable et al., 1999). Field excavations in Summer 2004 have shown that there is about one meter of mound material remaining in the highest part of the mound.

Limited archaeological investigations had previously been performed at the site (Cable, 1999; Wagner, 2001; Wagner 2003a). Surface collection was undertaken in 1985. In 1998, surface collection, mapping, and dispersed shovel test excavations were undertaken in order to define the site boundaries and describe the spatial organization and occupational history of the site. The topography of the site was mapped (Figure 4), and then a single 1x2 m, 77-cm-deep test unit was excavated on the northeast slope of the rise (Cable et al., 1999). In March 2001, a 1x2 m test unit was excavated on the highest part of the mound, but it was only excavated down slightly below the base of the Ap horizon (plow zone) to 30 cm below the ground surface (bgs).

METHODS

Fieldwork for this research occurred in summer 2004 and January-March 2005 (Wagner, 2005). The prime investigator of the site, Dr. Gail E. Wagner of the University of South Carolina's Department of Anthropology, oversaw all excavations. All artifacts found in soil samples were labeled and placed into the care of the prime investigator.

All available aerial photos of the study area were examined for visible landforms, lateral river channel migration, and vegetation in the study area. Significant landforms in the study area are scroll bars, examples of which can be seen as pale curving lines in the red-colored (color infrared) fields east and northeast of the Belmont Neck site (Figure 2). As a river meander bend migrates laterally outward, deposition on the inside of the curve often produces "a series of scroll bars in an alternating ridge and swale pattern" (Brierley, 1996, p.272). The swales are long, curved areas of relatively low topography bordered by ridges and often filled with vertical accretion deposits laid down by overbank sedimentation (Brierley, 1996). Most of the available aerial photos are black-and-white at 1:20,000 scale and __ resolution, with one 1981 photo at 1:40,000 scale and __ resolution. There is also a collage of 1994 color infrared (CIR) Digital Orthophoto Quarter Quadrangle (DOQQ) photos at 1:24,000 scale and one-meter resolution.

Subsurface stratigraphy was revealed in several ways. The presence of sensitive archaeological materials, along with closely spaced (3.3 m) commercial pine trees, precluded excavation of a long backhoe trench. Therefore, a north-south oriented 0.8-km-long transect of trenches and cores (Figures 2 and 4) was comprised of: (1) a series of three hand-excavated one-by-two-meter test units on the mound to preserve all archaeological data; (2) Giddings cores with the corer mounted on an all-terrain vehicle (ATV) to maneuver within the pine trees; (3) a ~0.10-

km-long series of four backhoe trenches in the hardwood bottomland forest north of the mound; and (4) hand augering in a few remaining locations where access restricted backhoes. An additional 0.23-km-long east-west transect of Giddings cores was centered on the excavation units and mound.

The south-north transect, about 0.8 km long, was oriented perpendicular to the river, extending from the river through the mound to a point about 0.4 km south of the mound (Figures 2 and 4). It fell within a roughly south-north aisle of pine trees that traverses the mound. This transect was placed perpendicular to the river in order to best capture geomorphic surfaces between the river and the site.

The ATV-mounted Giddings probe allowed easy access and core retrieval among the pine trees. The Giddings cores were placed at close (2 m) intervals at the mound's center with increasing (4, 8, 16, and then 32 m) intervals away from the mound to the north, south, east, and west. Some cores were placed between holes laterally in the sequence in order to find boundaries of interesting and complex soil features. All core and auger holes were dug down at least to the uppermost, archaeologically sterile Bw or Bt horizon. Cores were named according to the direction and number of meters away from the mound's center; i.e., N2m is the core 2 m north of the mound's center. The origin point for the naming of the core holes on the north-south transect was the northwest corner of the archaeological test unit N332E428E1/2 (named for the site coordinates of its southwest corner). The northwest corner of the unit was at N334m, E429m. The east-west origin point was set at S8.65m (8.65 m south of the N-S origin point) in order to fall within a pine tree aisle. A measuring tape was laid down starting at each origin point, and the core locations were marked accordingly.

The transects were surveyed for both location and elevation with Sokkia EDM$^{(R)}$ digital surveying equipment. Allostratigraphy was used throughout the transects to differentiate stratigraphic units based on bounding discontinuities (Autin, 1992; NACSN, 1983). Special care was taken to distinguish a redistributed mound layer, which would be visible above a bounding discontinuity in the vicinity of the mound. The soil was described in all subsurface profiles by methods consistent with those of Soil Survey Division Staff (1993).

No suitable material was found for radiocarbon or optically stimulated luminescence (OSL) dating. The average rate of lateral migration by the river (0.1 to 0.2 m/yr) was estimated based on OSL data provided at a location about 4 km upstream (Figure 2) across from Mound A at the Mulberry site (38KE12; Whitley and Leigh, 2005). The rates of Holocene and historic sedimentation were estimated based on the stratigraphy and the presence of archaeologically datable artifacts. In order to determine if flooding had occurred since the Wateree Dam was emplaced upriver in 1920 (Duke Power Staff, 2004), the landowners were queried, their archives were used, and the stream gage records were investigated. The closest stream gage upriver is the "Wateree River near Camden, SC", gage (USGS #02148000), which is 10.7 km river distance upriver of the Belmont Neck site and 11.9 km river distance downriver from the Wateree Dam (USGS, 2006).

Two places on the south-north transect were used as control sections. These were areas that had neither experienced mound-building nor had been the site of a Mississippian place of habitation. Like the mound, both control sections have been plowed, but unlike the mound, neither have experienced any other type of anthropogenic alteration. The southern section, Control #1, importantly, also has the same type of pine tree vegetation as the mound. Making sure to sample similar topographic units (i.e., the higher topographical areas, which are the crests of scroll bars), the two control sections of the transect were compared to the non-control section.

In order to determine the source of the mound fill, the following methods were used. The basket-laid mound fill probably had very close possible sources, including the subsoils and middens in the area. Subsoils in the area were probable sources of the yellow mound fill (YMF). The subsoil *in situ* below the mound fill could not have been a possible source because it was not scraped off, as evidenced by an intact Ab horizon above it. However, this YMF is still used as a surrogate possible source in place of other nearby subsoils that were not sampled by cores. Samples of the YMF and the subsoils acquired from the excavation unit and from cores were compared using particle size analysis and soil micromorphology. Micromorphology compared the microscopic fabric, color, grain size, composition, and other features (Courty et al., 1989; Stoops, 2003). The black portion of the mound fill was compared to the two organic-rich layers immediately below the mound fill using particle size analysis, soil color, and soil micromorphology. In addition, during the Giddings coring of the mound area, the depth and elevation of the top of the subsoil were recorded.

Basic questions of mound construction were also addressed. Was the mound built on a natural rise? This and other questions were addressed by examining the orientation of mound layers in relation to the natural allostratigraphic layers beneath and by comparison to the control sections.

In order to determine the nature and extent of site formation (and alteration and destruction processes) the following methods were used. The transects, especially the three excavated units on the mound, were examined. The lateral extent of the mound fill, the depth of the Ap horizon (plowzone) and plow scars, the occurrence of roots, the occurrence of looters' holes, and any evidence of pedoturbation were noted (Stein, 1985; Johnson, 1990; Canti, 2003). Also, several ways the mound could have lost height were diagrammed, and then the data from the transects, especially from the test units and soil cores, were compared to these scenarios. These scenarios were (1) tillage erosion and a subsequent redistributed mound layer, (2) bulldozing, (3) movement of mound material into adjacent borrow pits, and (4) tillage erosion at work on a mound built on a natural ridge.

Was the mound really as much as 3.4 m high in the early nineteenth century, as indicated by Squier and Davis (1998)? If so, the mound has lost almost two meters in height since then, and there should be a redistributed mound layer on the site. This hypothetical redistributed mound layer was investigated and quantified using the following methods. First, several possible original volumes of the platform mound were calculated, and then the possible scenarios of how this volume of earth material could be spread around the mound were explored. Most Mississippian platform mounds have the geometrical shape of a frustum of a pyramid with a square or rectangular base, also known as a truncated pyramid (Lewis et al., 1998; Morgan, 1999; Math Forum, 2005). A few known platform mounds have circular bases, and some of the largest quadrilateral-based mounds were in the shape of one or more smaller frustums on top of a larger frustum (Lewis et al., 1998; Morgan, 1999; Math Forum, 2005). Mississippian conical and ridge-topped mounds are relatively rare and, because of their shape (i.e., the absence of a flat top), cannot be classified as platform mounds (Demel and Hall, 1998; Lewis et al., 1998; Morgan, 1999). Since the Belmont Neck mound is small, has a rectangular base, dates to the Mississippian period, and is the only mound at this site, its original shape almost surely was a frustum, and its volume is given by the following:

$$V = h(Ab+As+sqrt[Ab*As])/3, \qquad \text{(Equation 1)}$$

where *h* is the height of the mound, *Ab* is the area of the base, *As* is the area of the flat summit, and *sqrt* is square root (Math Forum, 2005). The two crossing perpendicular transects were used (1) to determine the lateral extent of the *in situ* mound material, and (2) to find and determine the lateral extent of the hypothetical redistributed mound layer.

Hypothetical mound volumes were calculated for frustum-shaped mounds of varying heights and with a range of base angles, but all having the same basal dimensions: the extent of the first mound stage, 48 m by 39 m. The range of base angles chosen was 25° to 38°. Sixteen base angles (Table 1) were extracted from early mound stages in the archaeological profiles of Mississippian mounds in the Southeast (Hally, 1978; Polhemus, 1987; Smith, 1994; King, 1996). These early mound stages were preserved in the archaeological record because later mound stages covered them and extended beyond their edges, protecting them from erosion. Care was taken to choose only archaeological profiles which were parallel to the sides of the mounds, since a profile diagonal to the sides would show distorted base angles. Also, the base angle was measured from the part of the outer edge of the mound stage away from the ground, because the part of the mound stage closest to the ground curves outward and has a shallower base angle that does not reflect that of the mound stage as a whole. In addition, one base angle was taken from an intact 10-m-tall Mississippian frustum-shaped mound in the Wateree Valley, at the Adamson site (Table 1; derived from Cable et al., 1999). These seventeen base angles ranged from 20.5° to 48°, but to remove the outliers, the chosen range was taken from the mean (31.6°) minus one standard deviation to the mean plus one standard deviation, which is 25° to 38°. The upper limit of the base angle of the Belmont Neck mound would be 45° because that is the steepest angle of a stable slope when composed of previously disturbed silty clay loam (OSHA, 2006).

The volume of the *in situ* mound layers were calculated using actual soil profile information and the Surfer® computer program. The kriging method was used for interpolation, and the grid line spacing was 5 cm. Volumes of the redistributed mound layer (RML) were calculated using actual soil profile information and the Surfer® computer program. The kriging method was used for interpolation, and the grid line spacing was 5 cm to 10 cm. The combined volume of the *in situ* mound layers and the RML were then compared to the calculated volumes of mounds of various heights and basal angles in order to determine which original mound heights were possible. This comparison was done because it was impossible to directly calculate the height given the base angle and basal area using Equation 1. Also, the thicknesses of the Ap horizons close to and far from the mound were compared to give evidence for whether a significant amount of material from the eroded mound had been added to the upper soil in the mound's vicinity.

Identification of the redistributed mound layer was achieved using micromorphology. Oriented clods were taken from the Giddings cores and from the west wall of the excavated test unit N332E428E1/2. The clods were air-dried and then oven-heated at 90°C and impregnated with 3M Scotchcast® epoxy resin. Thin sections were made on 5.08 cm by 7.62 cm glass slides using standard techniques (Murphy, 1986) at the University of Georgia Department of Crop and Soil Science. The soil thin sections were examined with a transmitting microscope at 2X (primarily), 4X, 10X, and 20X magnifications in both plane polarized (PPL) and cross polarized (XPL) light. Photos were taken through the microscope with a Nikon® digital camera. After characterization of the YMF in thin section, a microscopic search was undertaken to find YMF clods in the thin sections of Ap horizons on the mound's center and in Ap horizons from cores in the west, east, north, and south transects going away from the mound's center. The YMF clods found in these slides were marked on enlarged color prints of the computer-scanned slides so that their outlines could be later drawn in the ESRI ArcView GIS 3.3® computer program. The actual areas and the relative percentage of the clod area versus the soil outline in each slide were then determined in ArcView GIS 3.3®.

Particle size distribution (PSD) was determined on all soil horizons in the profile of excavation unit N332E428E1/2 and also on some possible YMF sources. The chosen PSD method was a modified version of the traditional pipette method whereby 300-mL fleakers were used in place of beakers (Indurante et al., 1990). The PSD was determined on the samples after removal of organic matter with H_2O_2 (on only the organic-rich horizons) and dispersion with sodium metaphosphate solution. Sand grains were separated into standard size fractions in whole phi intervals (1-2, 0.5-1, 0.25-0.5, 0.1-0.25, 0.05-0.1 mm) by dry sieving.

Descriptive statistics were used to characterize the sediment samples that were analyzed. Inferential statistics could not be used to determine whether significant differences exist between independent pairs of PSD samples, because there were only one or two of each PSD sample and that is not enough to satisfy the statistical tests (McGrew and Monroe, 2000).

Profiles and maps of the transects were prepared using Microsoft Excel® and Adobe Illustrator® computer programs. In addition, characteristics were noted that might have made the Belmont Neck site’s location or environment attractive to Mississippian people.

RESULTS

In this subsection, the results will be presented, including the geomorphological data, the study area’s stratigraphy, the redistributed mound layer (RML) and micromorphology data, the mound fill sourcing, and the site disturbance and destruction processes.

Geomorphological Data

The sources of utilized geomorphological data were the following: a geomorphic map of the river valley, aerial photos of the study area, various flood records, and the river's lateral migration rate.

Wateree Valley Geomorphic Map

A geomorphic map indicates that the Belmont Neck site is part of the geomorphic floodplain (Figure 5). In the portion of the Wateree Valley that is situated on the Upper Coastal Plain, the western edge of the valley has a steep slope and no terraces. The river channel is situated in the eastern half of its broad floodplain. A small T1 terrace borders the floodplain on the eastern side in the southern half of the map area. An extensive T2 terrace, equivalent to roughly 30% of the valley's area, stretches along the entire eastern edge of the valley in the map area. According to the map, the Belmont Neck site is situated in the geomorphic floodplain, although the eastern end of the neck is mapped as the local westernmost extent of the large T2 terrace.

Aerial Photos

Several good aerial photos of the study area were available (Figures 2 and 6A-D). In the 1994 CIR DOQQ photo (Figure 2), because the site is planted with pine trees, the ground surface is not visible at the site. However, there are places without pine trees in the village area east of the mound. Presumably, some characteristic of the soil there is not good for pine trees. The landowners have said that the original pine trees and the replanted ones there died for no obvious reason. In the field across the river and due east of the Belmont Neck site, we can see a curving U-shaped pattern of pale, sandy scroll bars. The swales are parallel to the nearby meander bend of the river, and they represent the previous positions of the river. Two other sets of scroll bars can be seen in the field across the river from and southwest of Mound A at the Mulberry site (Figure 2). The set farther east crosscuts an older set of scroll bars to the west. Therefore, two separate geomorphic surfaces exist in that area. North of the Belmont Neck site, the modern natural levee is located parallel and adjacent to the river bank.

In the 1937, 1949, and 1975 photos (Figure 6A-C) the site is treeless in a plowed field; this allows us to see a series of pale, curved scroll bars trending northwest-southeast in the western half of the field. These scroll bars in the field at Belmont Neck indicate that the site is situated on a laterally migrating alluvial surface, either a terrace or a floodplain. However, these scroll bars are not in the same orientation as the modern natural levee and the swale in the floodplain north of the site. This indicates that the Belmont Neck site is on a geomorphic surface that is separate from and older than the floodplain. In essence, the site is on a low alluvial terrace.

Stream Gage and Other Flooding Records

Records from USGS stream gage #02148000 upriver from the Belmont Neck site show peak annual streamflow from 1905 to 2004 (Figure 7; USGS, 2006). The reduction of very large floods by the Wateree Dam after 1920 is apparent because two of the five largest floods on record occurred prior to the construction of the dam (Whitley and Leigh, 2005). Whitley and Leigh (2005) calculated the bankfull discharge upriver at the Mulberry site (Figures 2 and 5) to be 31,161 ft^3/s. Since no major tributaries occur between the two places and because the river at Belmont Neck and the river at Mulberry have similar cross-sections, the river at Belmont Neck should have about the same bankfull discharge as at the Mulberry site. Therefore, the Wateree River at the Belmont Neck site experiences a bankfull flood or larger in 48 of the 82 years on record (59%). In other words, the bankfull flood has an annual recurrence frequency of about 59 percent (a 1.7-year recurrence interval flood). The mean annual flood (43,831 ft^3/s) has an annual recurrence interval of about 37 percent (2.7 year flood; Whitley and Leigh, 2005).

According to a plantation employee, during floods, water crosses the Belmont Neck, the neck of land where the meander cutoff will eventually occur (Truesdale, 2004). People stopped planting row crops in the Belmont field because of periodic flooding of about once every five years (Williams, 2004). In the 1980s and early 1990s, flooding became more common, at two to three floods per year (Williams, 2004). The "High House" (the house in Figure 3) at Belmont Neck was placed on tall piers because of flooding (Daniels, 2004). According to a letter to a landowner in November 1929, the barn northeast of the mound had a flood water mark about two feet above the ground (Williams, 1929a). A landowner stated in November 1929, "The dam [artificial levee] across the lot at Belmont barn is high enough and big enough to hold them [the cows] dry in case of high water. Water usually recedes in less than a day and rarely over two days…" (Williams 1929b).

Other Geomorphological Data

Assuming that the average lateral migration rate of the Wateree River as measured in the field across from the Mulberry site (0.1 to 0.2 m/yr; Whitley and Leigh, 2005) is the same as at the Belmont Neck site, then at A.D. 1100 (the time when the site was inhabited), the meander bend would have been approximately 135 m south of its modern location. Thus, the southern bank of the Wateree River was located within the modern large swale north of the site. In essence, the northern site boundaries (Figures 2 and 4) would have been adjacent to the river bank during the site's Mississippian occupation.

Stratigraphy

The stratigraphy of the mound profile, the control sections, and the transects will be presented in this subsection.

The Mound Profile

In Summer 2004, Test Unit N332E428E1/2 was excavated to 108 cm bgs, revealing the entire profile of mound material (Figures 4, 8, and 9; Table 2). It was located at the mound's center, which was also the tallest remaining part of the mound. This test unit was the same as that excavated in 2001 by Wagner (2001); the backfilled unit was re-excavated and deepened. The following is the general soil profile in the test unit. A 15-cm-thick Ap horizon (plow zone), composed of dark brown silty clay loam, contained dark yellowish brown clods, identical to soil in the layer below. The uppermost remaining mound layer (Stage 2), at 15-60 cm bgs, is a three-colored mound fill that was clearly deposited in individual basket loads. This second stage mound fill layer is composed of dark yellowish brown silty clay loam (YMF), very dark gray silty clay loam (GMF), and black silty clay mound fill without artifacts (BMF). Next, the first mound stage lies at 60-80 cm bgs. It is a very dark brown loam with common artifacts, including pottery sherds, charcoal, and animal bones. Its upper boundary is very level, straight, and abrupt (Figures 8 and 9). This first mound stage is actually soil from a midden, an organic-rich anthropogenic soil that formed from human refuse, which would have originated in the village area of the Mississippian site. This first mound stage has a much higher sand content than any of the other layers. The layer below, at 80-90 cm bgs, is a buried A horizon (Ab) of black silty clay loam with artifacts (common sherds and many charcoal pieces). This Ab horizon is also a midden, according to archaeological terminology. At 90-160 cm bgs is a Bw1 horizon of dark yellowish brown silty clay loam without artifacts. Below that, according to a hand auger sample, the soil grades into sandy loam and then loamy sand, with a coarse loamy sand at 380-400 cm bgs. In all of the mound layers, the fine and very fine sand fractions together make up at least 77% of the total sand (Table 2). The sand in the mound layers was predominantly composed of quartz and mica.

Also in Summer 2004, two other units were excavated on the mound south of the first test unit (Figure 4). During excavation of a looter's pit, a Mississippian-period human burial was found and left in place in Test Unit 2 (TU2), 6 m south of the previous unit; the burial pit had been dug into the Stage 2 mound fill. A historic feature, dug through Stage 2 of the mound fill and into the first mound stage *in situ* below it, was found in Test Unit 3 (TU3), three meters south of TU2. The historic feature in TU3 and historic brick fragments in the Ap on the mound give evidence for the historic house that once stood there. On the west face of TU3, the mound fill has a very straight, abrupt upper boundary beneath the Ap (Figure 10).

Control Sections

The soil profile in the mound was substantially different from the two soil profiles that served as controls. Control #1, core S353m, was located 353 m south of the mound's center on a scroll bar ridge, a landform topographically similar to the mound (Figures 4, 11, and 12). This core had the same vegetation as at the mound (planted pine trees). Like the mound, it had undergone plowing, but, unlike the mound, it had neither been a place of habitation nor had experienced any other anthropogenic disturbance. This control core exhibited the following profile: an Ap (0-16 cm bgs) of dark yellowish brown (10YR 4/4) loam, a Bw (16-31.5 cm bgs) of dark yellowish brown (10YR 4/6) loamy sand, a C1 (31.5-52.5 cm bgs) of brownish yellow (10YR 6/8) loamy sand, and a C2 (52.5-65+ cm bgs) of light yellowish brown (10YR 6/4) loamy sand. See Appendix A for more details. Unlike the mound profile, the mound layers and the organic-rich Ab/midden were absent, and the upper horizons were much sandier than the Bw1 at the mound.

The other control soil profile, Control #2, was in backhoe Pit #1 just five meters south of the artificial levee (Figures 4, 11, and 12). Control #2's ground surface was at the same elevation as the old natural levee at the southern edge of the large swale nearby (Figure 11) but about 0.3 m below the elevation of the base of the mound layers. Unlike at the mound, the area was not forested with planted pines and had neither been a habitation site nor had experienced any anthropogenic change, except for plowing. Instead, the area was grassy with some hardwood trees growing on the nearby artificial levee. Control #2 had the following soil profile: an Ap horizon (0-18 cm) of dark yellowish brown (10YR 3/4) silt loam, an A2 horizon (18-26 cm) of dark brown (10YR 3/3) silt loam, an Ab1 (26-37 cm) of dark brown (10YR 3/3) loam, an Ab2 (37-54 cm) of dark brown (10YR 3/3) loam, a C horizon (54-69 cm) of dark yellowish brown (10YR 4/6) fine sandy loam, an A'b horizon (69-73 cm) of dark brown (10YR 3/3) sandy loam, a C' (73-105 cm) of light yellowish brown (10YR 6/4) loamy sand, an A''b (105-109cm) very dark gray (10YR 3/1) loam, and a C'' horizon (109-157+ cm) of yellowish brown (10YR 5/6) fine sandy loam. See Appendix A for more details.

Profiles of the Transects

There were 66 total core hole locations, comprised of 18 North holes, 13 South holes, 18 East holes, and 17 West holes (Figure 4). There were also four backhoe pits and five hand auger holes (Figure 4). The east-west transect was 234 m long. The total surveyed north-south transect was 830 m long, but the portion that included soil samples was 657 m long. See Appendix A for soil descriptions of all profiles.

Stage 2, the three-colored mound fill, extended 16 m north-south (from core N6m to Test Unit 3) and 24 m west-east (from W18m to E6m; Figure 4). The first mound stage, beneath the Stage 2 mound fill, extended 39 m north-south (from N22m to S17m) and 48 m east-west (from W30m to E18m; Figure 4).

A profile of the south-north transect (Figure 11) depicts the extent of the *in situ* mound fill stages, the scroll bar ridge upon which the mound sits, the artificial historic levee, the large swale, the top of the modern river bank, and the edge of the low water in the channel. The west-to-east transect crosses the north-south transect at S8.65m. On the west transect (Figure 13), the Ap, Stage 2 mound fill, the first mound stage, and the buried A horizon can be seen. Silty and sandy subsoils are distributed along the west transect. An interesting area at cores W92m and W100m has two organic-rich Ab horizons. On the east transect (Figure 13), the mound layers can be seen on the left. An area with historically disturbed soil (archaeological historic features) stretches from cores E30m to E54m. Another interesting area with organic-rich soil like on the west transect extends from E96m to E126m. On the south transect (Figure 12); the first mound stage extends out only to core S17m. In the rest of the south transect, no evidence of Ab horizons or human disturbance was recovered. Shallow Ap horizons overlay silty to sandy subsoils. Next, the southern half of the north transect (Figure 12) extends from the mound to the artificial historic levee. Another organic-rich area is interestingly not situated at the lowest part of the topography on this transect. It stretches from N102m to N126m. Charcoal was found in some Bw horizons in the four transects, indicating that forest fires have occurred on the site in the past.

Next, the northern half of the north transect (Figure 14) extends from the historic levee to the modern river bank. On the southern slope of the big swale, in backhoe Pit #4, a buried A horizon slopes steeply downward (Figure 14). In Pit #4, the multitude of horizons and strata caused the layers to be named with letter and number combinations that do not correspond with proper pedological terminology (Soil Survey Staff, 1993). The Ab horizon in Pit #4 has formed in sedimentary Stratum X4 (one of the non-Soil Survey layers), so they are the same layer. Stratum X4 is bounded to the south (and beneath) by an erosional surface. All of the sloping strata to the south terminate at this erosional surface. Stratum X4 (Figures 11 and 14) slopes down more steeply than today's ground surface, and it disappears into the floor of Pit 4. There was a Mississippian sherd just below Stratum X4 and a historic iron artifact just above it. Therefore, all central swale soil stratigraphically above the Stratum X4 (to the north of the layer) is historic. In other words, over 1.5 m of historic sediment fills the central part of the swale. Therefore, the sedimentation in the central swale over the last 300 years has been at least 0.5 cm/yr. Because of its low elevation and the thickness of this historic sediment, the swale is definitely part of the geomorphic floodplain. The natural levee next to the modern river bank is approximately 2.5 m higher than the ground surface at the bottom of the swale. According to two auger holes (auger holes #5 and #3), the area north of the swale contains the same sort of soil parent material as that in the swale bottom (silty B horizons with a thinner, sandy B horizon beneath; Figure 14 and Appendix A). The soil in the swale bottom is more developed (it has a Bwv rather than a C or Bw horizon) only because it is at a lower elevation and is saturated by water much more often than the higher ground north of it. The more frequent seasonal saturation allowed for the development of plinthite (iron nodules, referred to as "v" in the horizon designation). Because these two areas have the same sort of sediment, they are part of the same allostratigraphic unit and landform, the geomorphic floodplain (allostratigraphic unit #1 in Figure 11).

The mound is situated on a scroll bar ridge about 1 m higher than the surrounding ground to the north and to the south, 0.5 m higher than to the west, and 0.7 m higher than to the east. The site itself is not situated in the geomorphic floodplain, because the erosional surface beneath Ab horizon (i.e., Stratum X4) acts as an allostratigraphic boundary. Instead, the site is on a different geomorphic landform, a first terrace (allostratigraphic unit #2 in Figure 11). A T1 terrace would have very little historic sediment deposited by the river. The *in situ* mound layers are a separate allostratigraphic unit (allostratigraphic unit #3 in Figure 11) because there is a bounding discontinuity beneath the first mound stage.

The only evidence of historic sedimentation in the vicinity of the mound (in the area planted with pine trees) is found in the interesting organic-rich areas on the north and east transects. Artifactual evidence reveals that the Mississippian ground surface at N110m was at least 52 cm lower than the modern one, and it was at least 33.5 cm lower at N102m (based on the presence of Mississippian ceramic sherds at those depths; Figure 12). This organic-rich area on the north transect actually was a past depression that received at least 52 cm of sediment since around A.D. 1000, which is equivalent to only 0.052 cm/year. Mississippian people did throw some refuse in this low spot (i.e., their sherds), so some of the sediment volume is their trash. The organic-rich area on the east transect is also a past depression that received Mississippian refuse and historic sediment (Figure 13). A sherd was found at 88 cm bgs in core E102m, which means that the Mississippian (around A.D. 1000) land surface at E102m was at least 88 cm lower than today. This is equivalent to an average sedimentation rate of 0.088 cm/year in the east transect depression. The organic-rich area in the west transect (W92m-W100m) was probably also a past depression that received sedimentation (Figure 13), but no Mississippian artifacts were found in the cores there. Besides these past depressions, everywhere else in the mound's vicinity had no evidence of historic sedimentation. Any Mississippian features (besides those in or under the *in situ* mound material) were just beneath the plow zone or just beneath historic features. Just north of the edge of the pine trees, Control #2 (Figures 4, 11, and 12) has also received probable historic sedimentation, as evidenced by the series of Ab horizons, but no artifacts were found to date these horizons. Control #2 is close to the large swale in the floodplain.

Redistributed Mound Layer and Micromorphology

In this section, the YMF in thin section will be described, the locations where *ex situ* YMF clods were found will be presented, and finally, calculations of mound volumes and of the redistributed mound layer will be presented.

Description of Yellow Mound Fill (YMF) in Thin Section

The dark yellowish brown clods in the Ap horizon of the deepest test unit (Figure 8) were identical in both color and texture to the soil of the YMF layer in the unit. In thin section, under 2X magnification, the YMF possesses certain characteristics. In plane polarized light (PPL), the predominant feature is the bright yellow matrix of clays and silt grains (Figure 15A). Occasional quartz sand grains appear as clear to yellow subangular crystals. In cross polarized light (XPL), the matrix is a bright gold color with occasional patches of yellow, light brown, and orange (Figure 15B). Quartz appears as white or black grains, and there are occasional multicolored muscovite crystals. In thin section, the color, the size of the sand grains, and the structure all combine to make the YMF distinct and different from the other mound layers and from all other components of Ap horizons. The YMF has a unique fabric (Stoops, 2003) that can be recognized. However, GMF and BMF cannot be distinguished from typical Ap material because their high organic content causes them to be a color that blends in with the fairly organic-rich Ap material. *In situ* YMF often has very sharp boundaries with the BMF and GMF, and small bodies of YMF are sometimes surrounded by the other types of mound fill (Figure 15B and C).

Ex Situ YMF Clod Data

Ex situ YMF clods that originated from the Stage 2 mound fill were found in the Ap horizon of 75% of the sampled cores (n = 8) within 14 m of the mound's center (Table 3 and Figure 16). In sampled Ap horizons from 17 m to 78 m from the mound's center, possible YMF clods occurred in only 8% of these thin sections (n = 1). In the samples farther than 14 m from the mound's center, possible YMF clods occurred in the Ap horizon of only core S49m.

Mound Volume Calculations

Hypothetical mound volumes were calculated for frustum-shaped, non-eroded mounds of varying heights and of a range of different base angles (25° to 38°), but all having the same basal dimensions: the extent of the first mound stage, 48 m by 39 m (Table 4). The actual angles used were the endpoints of the range and the mean: 25°, 32°, and 38°. Mounds with this basal extent with a base angle of 25° or less could not exist because they would have no summit. Possible volumes for mounds of this basal extent and a base angle of 32° range from 1,743 m^3 (for a height of 1 m) to 6,448 m^3 (for a height of 5 m). Possible volumes for mounds of the given basal extent and a base angle of 38° range from 1,353 m^3 (for a height of 1 m) to 4,044 m^3 (for a height of 5 m).

The volume of the *in situ* mound layers were calculated using actual soil profile information and the Surfer® computer program (in Table 5). The volume of the *in situ* mound layers is 494.44 m^3. According to manual comparisons performed in the field, the *in situ* mound layers have a higher bulk density than that of the Ap and the rest of the RML. No actual calculations of bulk density were performed.

Redistributed Mound Layer Calculations

Volumes of the redistributed mound layer (RML) were calculated using actual soil profile information and the Surfer® computer program (Table 5). The RML included all Ap horizons and all possible post-Mississippian layers, including the historic features and some upper horizons in the three depressions on the west, east, and north transects. The kriging method was used for interpolation, and the grid line spacing in Surfer® was 5 cm to 10 cm. Two volumes were calculated for cases in which the RML had a square-shaped map view of the following extents: 14 m (resulting in a volume of 185 m^3) and 49 m (a volume of 1,767 m^3) in all four directions from the mound's center. These are the two possible extents in which redistributed YMF clods might exist, according to the thin section data (Table 3). An ellipsoid-shaped RML in map view would have been more appropriate, but this was impossible to calculate in Surfer®. The volumes of the epipedon were calculated in the same way for the same two extents (Table 5). The epipedon with a radius of 14 m would have a volume of 549 m^3, and the epipedon with a radius of 49 m would have a volume of 2,557 m^3. The epipedon is composed of all soil horizons above the subsoil (B or C horizons), including the Ap, the mound layers, middens, Ab horizons, and historic features.

The thicknesses of the Ap horizon in the area covered by the RML were compared to those away from the RML in order to determine whether an appreciable amount of mound material was added to the Ap horizon near the mound. The average Ap thickness zero to 14 m from the mound's center is 19.5 cm. From zero to 49 m from the mound's center, the average Ap thickness is 19.6 cm. Away from the RML, in the cores 62 m and farther from the mound's center, the Ap thickness was 21.6 cm. Since the Ap away from the RML is not thinner than the

Ap close to the mound, then this evidence suggests that a significant amount of mound material was not added to the RML.

The combined volume of the *in situ* mound layers (ISML) with the RML with a 14-m-radius is 679 m^3, and the combined volume of the ISML with the RML of a 49 m radius is 2,262m^3 (Table 6). These two numbers are equivalent to the maximum possible volume of *in situ* and redistributed mound material. Volume totals were also calculated for the total ISML added to fifty percent of the volume of the 14-m and 49-m RML (834 m^3 and 1378 m^3, respectively; Table 6). These numbers represent a more accurate estimate for the maximum possible volume of *in situ* and redistributed mound material because part of the RML must be composed of soil that was never part of the mound. All of these total mound material volumes were then compared to volumes of a range of possible original mound sizes, with 25°, 32°, or 38° base angles and heights ranging from two to six meters but all having the same basal dimensions (39 x 48 m; Table 6). This comparison was done in order to find a likely original height for the Belmont Neck mound. No frustum shaped mounds are possible with the given basal dimensions and a 25° base angle for any height or for a mound with a base angle of 38° and a height of 6 m or more. A 2-m-high mound with a 32° angle has a volume of 3,242 m^3, and a 6-m-high mound with that angle is 7,147 m^3. Volumes for a mound with a 38° basal angle range from 2,732 m^3 (for a height of 2 m) to 4,044 m^3 (for a height of 5 m; Table 6).

Mound Fill Sourcing

The black mound fill (BMF) of Mound Stage 2 is composed of black (10YR 2/1) silty clay with only 3-4% sand and no artifacts (Table 6). About 16% of the BMF's sand is medium-sized, about 15% is fine, and 60% is very fine. This soil is very organic-rich, as evidenced by the color and by the large amount of both hydrogen peroxide and time needed to remove the organic matter before particle size analysis. The yellow mound fill (YMF) is composed of dark yellowish brown (10YR 4/6) silty clay loam with only 3.5-4.3% sand and no artifacts. About 3% of the YMF's sand is medium-sized, about 13% is fine, and 75% is very fine. The GMF is intermediate in color and very close to the YMF and BMF in texture and sand content. About 2% of the GMF's sand is medium-sized, about 17% is fine, and about 69% is very fine. No horizons sufficiently similar to the BMF and GMF were found in the transects. Several horizons were found that were similar to the YMF, based on color and texture (Table 7). Of these, only N142m's Bw2 horizon had a sand content low enough and clay and silts contents close enough to approach that of the YMF.

The first mound stage mound fill is much sandier (at least 20% sandier) than the Ap, the second stage mound fills, the Ab/midden, and the Bw in Test Unit N332E428E1/2 (Table 2). Where did this sand come from? The Ap horizon in some other parts of the site is just as sandy or sandier than the first mound stage, based on manual texture estimates from the cores. Examples are at W22m to W78m, W00m to W126 m, E10m to E62m, S21m to S97m, and N10m to N110m. Since some modern Ap horizons within the site boundaries can be as sandy or sandier than the first mound fill stage, then some Mississippian-era A horizons at the site would have been just as sandy.

Site Disturbance and Destruction Processes

While excavating the three test units in Summer 2004, the following animals disturbed the soil underground: earthworms, black beetles, ants, field mice, and mole crickets. Tree roots, looters' pits, plowing, and excavation activities by historic human occupants were also seen to disturb the archaeological material. These historic excavation activities include the digging of holes for historic house foundations and for a refuse pit or root cellar (the historic feature in Test Unit 3).

Because of the slope of the mound, slope wash and soil creep have definitely occurred during the mound's existence. Soil creep is the slow downslope movement of superficial soil, usually imperceptible except to observations of long duration (Easterbrook, 1993). Any soil creep that has occurred on the Belmont Neck mound due to expansion and contraction of the soil has mainly been caused by wetting and drying rather than freezing and thawing. Hard freezes occur in the area no more than a few times per year, whereas rain occurs much more frequently. Besides causing soil creep, rain causes slope wash, the transportation of individual particles downslope by water.

The landowners were certain that no bulldozing occurred after 1945 at Belmont Neck (Daniels, 2004). However, bulldozing, or the unmechanized equivalent, might have occurred in connection with the two historic houses on the site. A house was probably demolished on top of the mound between 1790 and 1820 (Wagner, 2005b; Wagner 2005c), and bulldozing might have occurred at that time. In 1820, a wooden farmhouse was moved to the Belmont Neck field to be the overseer's house; the structure was then called High House because it was placed on tall piers on top of the mound (Figure 3; Daniels, 2004). The house was taken down between 1939 and 1942, and there may have been bulldozing to clean up the area after its demolition (Daniels, 2004). In 1929, a landowner did write that he wanted to acquire either a "tractor and shovel or dragline and truck" the next year, so the necessary equipment was probably readily available at the time of the demolition (Williams, 1929a).

DISCUSSION

In this section, the results will be discussed. These include results pertaining to the following: the geomorphological data, the stratigraphy, the RML and micromorphology, mound fill sourcing, site formation processes, and Mississippian site location.

Geomorphological Data

According to the Wateree Valley geomorphic map (Figure 5), the Belmont Neck site is categorized as floodplain because there are no sharp escarpments around it, because it is surrounded by wetlands, and because it is not as high in elevation as the T2 terrace to the east. However, a very low terrace could escape detection by this map.

The portion of the river north of the site was once closer to the mound, probably up to the southern edge of the hardwood forest where the large swale is located today. Given Whitley and Leigh's (2005) calculation of 0.15-0.2 m/yr for lateral migration rates, then in A.D. 1100 the southern edge of the river channel would have been located within the modern large swale near the river, and Stratum X2 would have been the slope down to the river bank. In addition, the portions of the river at the neck of the meander bend used to be farther apart. Eventually, the meander will get cut off. Also, it is noteworthy that these lateral migration rates for the Wateree River are slow when compared to other rivers around the world of similar size (Hooke, 1980; Whitley and Leigh, 2005).

Historical records, living people's accounts of flooding at the Belmont Neck site, stream gage records, and the Wateree Valley geomorphic map all indicate that this archaeological site, including the mound, is currently situated within the hydrographic floodplain with a flooding recurrence interval of 5 years or less. However, allostratigraphic evidence from the soil profiles reveals that an absence or near absence of historic sedimentation indicate that the vicinity of the mound (1) does not experience floods often enough or of sufficient magnitude to have much sedimentation and (2) the mound is not located on the geomorphic floodplain, which by definition is the surface which periodically receives sedimentation during flooding. The mound is instead located on a slightly older and separate geomorphic surface, a first (T1) terrace, which predates the geomorphic floodplain. This conclusion is also supported by the aerial photos (Figures 2 and 6B-C), in which the scroll bars in the Belmont Field are in a different orientation than the floodplain swale and modern natural levee north of the site. The mound itself sits upon a scroll bar ridge landform on the T1 terrace.

Stratigraphy

Control #2 definitely has experienced significant historic or prehistoric sedimentation because of the series of Ab and C horizons. The C horizons represent sedimentation from one or more floods close together temporally, and the Ab horizons represent breaks between floods long enough that plants could grow and accumulate organic matter in the soil. Control #2 is closer to the river and about 0.3 m lower in elevation than the mound. The mound itself has experienced erosion rather than historic sedimentation, and the area around it has not experienced significant historic or late prehistoric sedimentation like that of Control #2. This indicates that floods on the mound were of insufficient magnitude or frequency to deposit sediment there.

In the mound profile, the dark yellowish brown clods in the Ap horizon of Test Unit N332E428E1/2 definitely originated from the YMF of Mound Stage 2 below. Their presence indicates that historic plowing cut into Mound Stage 2. By implication, any stratigraphically higher (and temporally later) mound stages, if they existed, were either incorporated into the Ap on and around the mound due to plowing and/or moved elsewhere by bulldozing.

The coarse sandy loam at 380-400 cm bgs is probable fluvial bedload material, and the horizons beneath the mound material are a typical fining upward fluvial sedimentary sequence. Together, these two stratigraphic observations indicate that at some time in the past, certainly predating Mississippian time (circa A.D. 900-1500), the river flowed at that location. However, the level of soil profile development indicates that it is probably Holocene in age.

The first two (and the only remaining) mound stages covered a rectangular area 48 m by 39 m, whose basal area was not extended when the second stage was added (Figure 4). The first stage of construction used artifact-rich midden soil from the village area. Midden material has been found in the construction stages of platform mounds in Kentucky, Cahokia, and elsewhere in the Southeast (Demel and Hall, 1998; Stout and Lewis, 1998). However, for the second mound stage, soil of different colors was probably acquired away from the occupation areas because of the absence of artifacts in the mound fill. If the second stage mound fill had been acquired from below the village area, then the BMF must have been an A or Ab horizon without artifacts, which is unlikely. The first mound stage looks as if it had been intentionally leveled before the mound fill was added (Figures 8 and 9). At least one human burial was placed in a burial pit intruding into the second mound fill construction stage.

Possibly other mound layers, perhaps of colors and textures different from the remaining mound layers, have been lost from above. This is likely if the mound had actually been 3.4 m or higher originally, as Squier and Davis (1998) reported. If so, then the missing layers could have had different compositions than the remaining mound layers, and these other lost mound layers might be impossible to identify micromorphologically. If these possible later mound stages draped of the sides of the mound, which often occurs in Mississippian mounds (Hally, 1978;

Polhemus, 1987), then some of this mound stage might be found preserved at the edge of the mound.

The interesting area at cores W92m and W100m has two organic-rich Ab horizons (Figure 13); it is interpreted to be a prehistoric depression that has since partially filled with sediment. On the east transect, another natural depression extends from E96m to E126m (Figure 13). Still another depression is interestingly not situated at the lowest part of the topography on the north transect; it stretches from N102m to N126m (Figure 11). The organic-rich areas on the north and the east transects were the only places in the vicinity of the mound that showed conclusive evidence of historic sediment deposition. The organic-rich area in the west transect probably also experienced historic deposition, but the absence of datable artifacts in its horizons precludes evidence of historic deposition. All three are interpreted to be small, shallow swales that were moister that the surrounding land and so accumulated organic material. Since these areas were lower than the rest of the topography nearby, floodwater collected in them, and they received sediment in this way.

The historic sediment in the large swale and on the modern natural levee north of the site (allostratigraphic unit #2 in Figure 11) can be correlated to the 1.0 to 1.5-m-thick "historical silty and fine sandy sediment" found in the floodplain across the river from the Mulberry site (Whitley and Leigh, 2005, p.31). Historical sedimentation has definitely occurred in this portion of the Wateree Valley north of the Belmont Neck site.

Redistributed Mound Layer and Micromorphology

The Ap horizon (plow zone) in the excavation unit possesses common, prominent clods of dark yellowish brown (10YR 4/6) silty clay loam. These clearly originated from the *in situ* mound fill, and so these YMF clods in the Ap are *ex situ* redistributed mound material. It was hypothesized that farther from the mound's center, the presence of these yellowish brown clods would indicate the presence and extent of a redistributed mound layer (RML). In effect, the YMF clods would act as tracers for the RML. This hypothesis was proven correct because YMF clods were found in micromorphological samples in the RML from zero to 49 m from the mound's center. In addition, the confirmation of an RML proves that the main erosive force at work on the mound is tillage erosion, with possibly bulldozing as well.

The fairly constant distribution of YMF clods in the Ap horizon within a radius of 14 m from the mound's center provides strong evidence of a redistributed mound layer (RML) at least in that area. Of course, the *in situ* Stage 2 mound fill extends, on average, 10 m from the mound's center, so an RML of a 14 m radius is not too surprising. The YMF clods have definitely migrated an average of four meters beyond the *in situ* Stage 2 mound fill in four directions from the mound's center. In spite of the distance from the other samples containing YMF clods, the three apparent YMF clods in the S49mAp sample do look like real YMF. These clods from S49mAp are interpreted to be real YMF, and so the RML extends at least 49 m from the mound's center.

A regression (R^2=0.27 for the trend line $y = 0.2112e^{-0.0538x}$) was made for the clod dataset, which consists of the percent YMF clod area of all of the micromorphological samples (Figure 16). The regression and also the visual display of the graph (Figure 16) illustrate a definite distance decay pattern in the data.

Stoops (2003) reports that, statistically, the actual size of grains (or clods) is 1.274 times their area measured in thin section. Even when multiplying by Stoops' number, the redistributed YMF clods only account for 2.1% of the volume of an RML with a radius of 49 m (Tables 3 and

5). However, since the *in situ* second stage mound fill has a slightly higher bulk density than that of the RML, volume comparisons between the two must consider this fact.

The presence of YMF clods and the trend of decreasing volumes away from the mound's center are more important than the percentage of the possible RML that is actually composed of redistributed YMF clods. Perhaps there used to be more YMF clods in the RML, but mechanical and chemical weathering, aided by plowing, caused them to disintegrate. The decreasing percent clod area away from the mound supports this hypothesis (Table 3 and Figure 16). Only at the mound's center, where the supply of YMF clods can be replenished with every plowing, do larger clods exist. Larger clods may exist at the mound's center because the mound itself was plowed less than the surrounding area because of the presence of the two houses between 1760 and 1940. Therefore, the YMF clods in the Ap on the mound itself have undergone less mechanical weathering from plowing than clods in the Ap further away.

The mound at Town Creek in central North Carolina was 4.3 m high, similar to the reported eighteenth century height of the Belmont Neck mound. A town house on this small mound had dimensions of about 7.6x7.6 m (Coe et al., 1995, p.287). Since people would need to walk around the building on the mound summit, the summit would have to be somewhat larger than the building. The small mound at the Dyar site had summit dimensions of 7.6x8.8 m (Smith, 1994). Therefore, Mississippian mound summits should have minimum dimensions of about 7.5x7.5 m (Table 4). Using this logic, one set of mound dimensions (5 m high, 38° base angle, and summit dimensions 15.8x6.8 m) might be too small to be the original mound volume, especially if the mound summit contained a building. To compare to a larger mound in the area, the 10-m high Adamson mound has summit dimensions of 26x18 m. Original mound dimensions of one to five meters high with a base angle of 25° were also ruled out because a mound with those dimensions would have no summit; it would be a pyramid, instead. The hypothetical mound volume calculations (Table 4) support original mound dimensions of up to 5 m high with a base angle of 32° to 38°. An excavation of a profile at the mound edge probably would solve this mound angle problem because deposition of eroded mound material on the footslope, as in Olsen et al. (2002), would have protected the base of the mound stage, preserving the base angle.

Was the mound at Belmont Neck actually as much as 3.4 m high originally, as estimated by Blanding (Squier and Davis, 1998)? Blanding has exaggerated his physical description of at least one other site. He describes Mound A at the nearby Mulberry site (Figures 2 and 5) as being "almost washed away" in 1848, while recent investigations have shown that Mound A was 50% intact over one hundred years later than Blanding's report (Squier and Davis, 1998, p.105-108; Whitley and Leigh, 2005). Was Blanding therefore exaggerating the height of the mound at Belmont Neck?

According a photo (Figure 3), the height of the mound in the 1930s was between 1.4 m and 1.9 m. A house ("High House") had been on top of the mound since 1820 (Daniels, 2004). In the photo (Figure 3), bare earth and possible plowing extended even up to the edge of the house's foundations. Therefore, this house protected from plowing only the part of the mound directly beneath it. Another important point is that High House was likely not the first historic structure built upon the mound. In the early nineteenth century, Blanding wrote that the mound had "been for many years the site of an overseer's house" (Squier and Davis, 1998). He was probably partially referring to the earlier slave overseer's house that was probably built upon the mound in the late eighteenth century due to the commercial indigo production practiced there until 1796 (Wagner, 2005b; Wagner 2005c). Therefore, the mound could have received damage during the demolition of one house and the subsequent construction of foundations for High house in 1820. In addition, plowing could have occurred even on the central part of the mound during the interim when no house stood there.

The mound must have been at least 2 m high originally, because it probably underwent some erosion between circa A.D. 1300 (when the Mississippian people abandoned the site) and 1820, when High House started to protect it. An original height of 4 to 5 meters is not out of the question simply based on mound volume calculations. One important fact is that Blanding saw the mound when one of the houses was already on top of it. If he saw High House (the second house) on top of the mound, then the mound likely could not have eroded 2 m in height while the house was above it. However, if Blanding had made his report when the first house was on top of the mound, then the mound could have been higher than two meters due to the probable erosion on the mound later between house occupations.

When calculated volumes of mounds with heights between 2 m and 6 m were compared to the total accountable mound material volume (*in situ* mound layers [ISML] plus the volume of the RML), the actual original height of the mound was made clearer (Table 6). The only size option that is similar to the combined volume of the ISML added to that of the RML with a 49-m radius (2,262 m^3) is a two-meter-high mound with a base angle of 38° (volume of 2,732 m^3). Of course, this calculation of the total accountable volume of mound material is an overstatement because not all of the RML is composed of mound material. Increasing mound heights for mounds with base angles of 32° and 38° are increasingly unlikely because they are increasingly larger than the combined ISML and RML volume. In other words, a 32° mound 2 m high has a volume 1.4 times that of the combined ISML and RML, while such a mound with a 5-m height has a volume 3.2 times that of the combined ISML and RML. Therefore, a height of two meters is the maximum possible original height of the Belmont Neck mound.

In conclusion, the original height of the Belmont Neck mound two meters high or less, based on the evidence. According to the data, the mound could not have been more than two meters high originally, and it was still at least 1.4 m high in the 1930s. Blanding certainly did overestimate his reported height of 3.4 to 5.8 m in the early nineteenth century (Squier and Davis, 1998).

Several ways in which the mound could have lost height were diagrammed, and then the data from the study were compared to the scenarios. These scenarios were (1) tillage erosion and a subsequent redistributed mound layer, (2) bulldozing, (3) movement of mound material into adjacent borrow pits, and (4) tillage erosion at work on a mound built on a natural ridge. The closest scenario to the actual mound area stratigraphy (Figures 12 and 13) is the fourth scenario. The mound was built on a natural ridge, and the presence of an RML containing YMF clods fits the stratigraphy that would be caused by tillage erosion. Bulldozing might have occurred at the site before 1940 in connection with the demolition of the two historic houses on the mound, but there is no evidence to support this.

Mound Fill Sourcing

The absence of artifacts in the second mound stage's BMF in the test units and the cores rules out an origin as a midden or as the Ab (Mississippian period A horizon) under the mound layers. The BMF probably came from a low-lying, damp, organic-rich surface horizon, possibly in a wetland. The closest areas like this are in the floodplain, and there are many floodplain areas within one kilometer of the mound. None of the ancient depressions found in the north, west, and east transects have dark-colored horizons of fine enough texture to be a possible source location, but the small sampling size in the transects might have caused a finer textured portion of these horizons to be overlooked. The origin of the BMF could have been a low-lying area on the T1 terrace or in the Mississippian-era floodplain.

The source of the YMF is definitely a Bw or Bt horizon because it is similar in color and general texture to many Bw horizons and some organic-poor Ap horizons in the area. The YMF had less sand than the Bw1 horizon directly below (8.8-11.8% sand). The closest place with similar color and particle size was at core location N142's Bw2 horizon, which was a dark yellowish brown (10YR 4/4) silty clay loam with 3.23% sand (Table 6). However, the presence of the (very dark) gray mound fill (GMF) mixed with the YMF and BMF indicates that the YMF probably came from a horizon directly below the BMF source. The GMF is intermediate in color and very close to the YMF and BMF in texture and sand content. Therefore, the GMF is probably from a horizon that was situated between the *in situ* BMF and YMF sources. It is possible that the GMF originated from mixing of the BMF and YMF sources during transportation by people toward the mound. However, this is unlikely because boundaries less than one centimeter thick are common between the GMF and the other two second stage mound fills in the mound profile.

The first mound stage material definitely is a mound stage and is distinct from the Ab below it because of (1) its 22% higher sand content than the Ab (Table 2), (2) its clear smooth lower boundary, and (3) its continuous nature in the mound area in four directions (Figures 12 and 13). Its origin is definitely midden from somewhere on the site. The Ab horizon below the first mound stage does not extend beneath the entire first mound stage (Figures 12 & 13). This could be because the texture or color of the first mound stage or of the Ab changed and became so similar that they are indistinguishable in cores E2m to E18m, at W22m to W30m, and at

N10m to N22m. Another possibility is that the Ab horizon is an *in situ* midden with a limited extent that was created by anthropogenic enrichment of the soil there prior to mound building. The natural soil in this area should not have an A horizon thicker than 10 inches or darker than very dark grayish brown (10YR 3/2), according to the description for the Congaree soil series (Soil Survey Staff, 2006). This black (10YR 2/1) Ab under the first mound stage is anthropogenically colored and thickened, and it is natural to not see another A horizon like this away from the mound or in Control #1.

Are there borrow pits in the area from which the first and second stages originated? If there were borrow pits that had been filled in, they might not have been detected because of the sampling strategy. Large borrow pits are not necessary. At the Etowah site in Georgia, small saucer-shaped possible borrow pits were filled in with midden (King, 1996). Small borrow pits like this could have easily escaped detection. Another possibility is that the Mississippian people scraped soil from a large nearby area for the mound stages. The YMF may have been the silty clay loam Bw horizon on another scroll bar ridge on the terrace. Similarly, the first mound stage may have resulted from scraping of an Ab/midden with a prehistorically wider extent (the Ab under the mound stages) and piling this material on top of the *in situ* Ab for the first mound stage. This Ab-scraping question cannot be answered with the data from this research, especially because of the discontinuous nature of the mound stratigraphy revealed by the Giddings cores. A future trench extending from the outer edge of the mound to the center would more likely be able to answer mound fill source questions such as this scraping hypothesis.

Site Disturbance and Destruction Processes

There is no conclusive evidence that the mound was bulldozed when the indigo house was demolished between 1796 and 1820 (Wagner, 2005b; Wagner, 2005c) or when High House was demolished circa 1940 (Daniels, 2004). Any extremely straight upper boundaries of the Stage 2 mound fill, as in Test Unit 3 (Figure 10), could have been caused by a plow because plows shear the soil as they move. However, the historic pit in Test Unit 3 is filled with *ex situ* second stage mound fill. Perhaps a bulldozer pushed this *ex situ* mound fill into the open pit.

Evidence of modern bioturbation of the soil by various plants and animals indicate that bioturbation has probably been occurring throughout the past seven centuries on the mound. The mound profile has been fairly well preserved in spite of this. Bioturbation also increases soil creep down slopes (Waters, 1992; Easterbrook, 1993), so soil creep could also be an important erosive process at the site. Another type of pedoturbation by animals (Johnson, 1990) could have occurred on the mound. Any dogs belonging to the historic people at Belmont Neck would have dug shallow holes into the mound under the two houses.

Logically, tillage erosion (and subsequent slope wash and soil creep) would have been the major destructive process during the few centuries when the Belmont Neck site underwent agriculture. At times when the two houses stood on the central part of the mound, tillage erosion would have been nonexistent directly under their foundations. However, the bare earth around the house in the 1930s (Figure 3) and possibly before that would have resulted in erosion on the parts of the mound that were not sheltered by the house.

Agriculture results in the ground being bare of plants during some parts of the year, and so the soil is exposed to the elements more so than when there is plant cover. The Adamson site in the same river valley has a nearly perfectly preserved platform mound ten meters high (Cable et al., 1999). Its preservation has in part been due to the herbaceous plants and large trees growing on the mound, reducing slope wash and soil creep. Archaeologists have encouraged growth of plants on mounds and other earthworks in order to reduce erosion (Andropogen, 1989; Thorne, 1990; Miller, 2000).

Mississippian Site Location/Environment

Hally (1996) theorizes that some places are optimal sites for chiefdoms because of fertile soils, shoals/riffles with aquatic resources, and ready access to two physiographic regions. The site definitely had fertile soils; in the 1930s-1940s, Belmont produced “one of the best corn crops in the county” (Williams, 2004). Riffles are shallow sections of a river channel that alternate with pools (Leopold et al., 1992). Riffles are available nearby, and the site is also situated in the Upper Coastal Plain very close to the Piedmont. The Belmont Neck site seems to fit all of the criteria for an optimal site of a chiefdom, but why was this location chosen for the capital of the first chiefdom of Cofitachequi and not a place a few miles up or down the river? Cable et al. (1999) state that the site is at a relatively high elevation, which offers protection from flooding and very near access to the river. This is true, but the Mulberry site at the next meander bend up the river also has these same two advantageous features, even though it not was chosen as a capital until later in the Mississippian period.

Since the 1960s, most Mississippian archaeologists have examined Hally’s (1996) previously mentioned three site selection factors, in addition to defensibility (Lewis and Stout, 1998). The research in the past forty years has indicated that, “at least in the East, every landscape contains far more good potential locations for a Mississippian town” than bad locations (Lewis and Stout, 1998; p.232-233). This implies that cultural choices affected site selection by Mississippian people more than geography and nature, and that the chosen location of any given town requires a unique, contextual explanation (Lewis and Stout, 1998). The Belmont Neck site definitely has features that would have been attractive to Mississippian people, but so do many other places along the Wateree River. Both physical and cultural reasons dictated the selection of any one site as a Mississippian chiefdom capital.

CONCLUSIONS

This research has shown that micromorphology can be quite successful for detecting redistributed material from a destroyed mound or other earthwork, and the resulting data are useful in placing a limit on the maximum original size of a mound. This type of study can be applied to other partially destroyed earthen structures if all or part of the structure's material can be differentiated from the soil of the surrounding epipedon. It is advantageous if the structure's material is a different color or texture than the epipedon and if the structure's material is cohesive enough to stay together as clods when transported/redistributed. The necessary time and cost of preparing the soil thin sections should be weighed against the need to locate the redistributed mound/earthwork layer.

Giddings probes are a very effective and minimally destructive method of retrieving substantial core samples at archaeological sites. At sites where there are trees or other obstacles preventing the use of full-sized truck-mounted Giddings probes, ATV-mounted probes are very effective. However, for a research endeavor of this sort, just Giddings cores and a few excavation units are not enough to see all stratigraphy and answer all of the research questions. Excavated trenches (either by archaeologists or by backhoes), stretching from the outer edge of the *in situ* mound material to the mound's center, are very necessary to see the important stratigraphy, especially to determine the mound's base angle and the mound fill sources.

The first objective of the research was to determine the subsurface and surface geomorphology in the vicinity of the site. The Belmont Neck site itself is situated on a scroll bar ridge landform. This ridge is located on a low geomorphic first terrace (T1) that is in the hydromorphic five-year (or less) floodplain, but it is allostratigraphically separated from the historic sedimentation in the large swale and on higher elevations closer to the river bank (Figure 11). To the north of the archaeological site, both the large swale and the modern natural levee are situated in the geomorphic and hydromorphic floodplains (Figure 11). Although the site has experienced flooding in the past, the only places in the mound vicinity where historic sedimentation has occurred are the partially filled depressions 106 m north of the site and 99 m east of the site. The Belmont Neck mound was built on a low scroll bar ridge landform is 1.0 m higher than the surrounding ground to the north and to the south, 0.5 m higher than to the west, and 0.7 m higher than to the east. The orientation of this ridge appears to be roughly east-west. This ridge is a scroll bar that has a typical fining upward fluvial sediment sequence.

The second objective of the research was to determine the source of the mound fill. The first two (and the only remaining) mound stages covered a rectangular area 48 m by 39 m, whose basal area was not extended when the second stage was added. The first stage of construction used soil from an artifact-rich area, probably from the village area, but soil of different colors for the second stage was probably acquired away from the occupation areas. The midden soil of the first mound stage is much sandier than the rest of the mound layers, so it was acquired from a sandy surface horizon. The first mound stage looks as if it had been intentionally leveled before the second stage mound fill was added (Figures 8 and 9). Possibly other mound layers, perhaps of colors and textures different from the remaining mound layers, have been lost from above. If so, then these other lost mound layers might be impossible to identify micromorphologically. No evidence of borrow pits was recovered, although the second stage mound fill must have originated from the Bw or Bt and A horizons of an organic-rich low spot in the low alluvial terrace (T1) or from the floodplain. Based on manual texture estimates from the cores compared to the mound fills' particle size, the three depressions about 100 m north, west, and east of the mound were probably not the source locations of the mound fill, although the sample size might be too small to say for sure.

The third and final objective was to determine the nature and extent of both natural and cultural processes (especially the destructive processes) that have altered or obscured the Mississippian component of the site. Blanding certainly did overestimate his reported height of 3.4 to 5.8 m in the early nineteenth century (Squier and Davis, 1998). The original height of the Belmont Neck mound was definitely not over two meters high, based on the evidence (Tables 4, 5 and 6). The mound was still about 1.7 m high in the 1930s, and it is 0.8 m high now. The existence of a thin (usually no thicker than the Ap horizon) redistributed mound layer (RML) was confirmed with micromorphology. *Ex situ* YMF clods were found consistently within a radius of 14 m from the mound's center, and three *ex situ* YMF clods were found in an Ap sample 49 m from the mound's center. Therefore, the RML is at least 49 m in diameter. It has been interpreted that few YMF clods were found more than 14 m from the mound's center because mechanical and chemical weathering (aided by plowing) has degraded the clods. The main cause of the decreased height of the mound over the past three centuries is interpreted to be tillage erosion. Bioturbation, slope wash, and soil creep were minor erosive factors. Other destructive factors include digging by looters and for construction of historic house foundations. There is no conclusive evidence of bulldozing at the site.

This research could have been improved in a few ways. First, more horizons and more sub-samples of each should have been analyzed for PSD. Unfortunately, time constraints did not permit this. More PSD analysis would have allowed more complete and more accurate soil descriptions, and more PSD sub-samples would have permitted inferential statistics to be performed on the mound fills and their possible sources. PSD analysis of the mound fill in the cores in addition to that in the test units would have allowed the textural variability of the mound fills to be known. Second, quantitative analysis or organic material content would have improved the descriptions of the mound fills and their comparisons to possible sources. Third, ideally, more thin sections should have been made and analyzed for redistributed YMF clods. However, time and financial constraints did not allow this. Fourth, bulk densities should have been measured for *in situ* second stage mound fill and for the RML. This would have made calculations of possible original mound size more exact. Also, future studies in the area should examine any stratigraphy revealed in the ditch east of the end of the east transect (Figure 4). Finally, a trench needs to be excavated stretching from the outer edge of the in situ mound fill to the mound's center in order to answer questions about the base angle and mound fill sources. Lack of time and money prohibited doing this during the research. Future investigators would have to pay the landowners for any pine trees destroyed during this trenching.

Table 1. Mound Base Angles Derived from Archaeological Profiles of Mississippian Mounds in the Southeast. All of them, except for the Adamson site's base angle, are derived from the angles of the outer sides of mound stages preserved in archaeological profiles. The Adamson site's base angle is derived from the dimensions of an intact mound.

Location and Site Number	**Reference**	**Base Angle**
Little Egypt site (9MU102), GA	(Hally, 1978, p. that follows 508)	20.5
Dyar site (9GE5), GA	(Smith, 1994, p.95)	22
Little Egypt site (9MU102), GA	(Hally, 1978, p. that follows 508)	26.5
Little Egypt site (9MU102), GA	(Hally, 1978, p. that follows 508)	26.5
Dyar site (9GE5), GA	(Smith, 1994, p.95)	28.5
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	29.5
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	30.5
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	32
Little Egypt site (9MU102), GA	(Hally, 1978, p. that follows 508)	32
Beaverdam Creek (9EB85), GA	(Rudolph and Hally, 1985, p.57)	32
Adamson site (38KE11), SC*	(Cable et al., 1999)	32
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	33
Etowah site (9BR1), GA	(King, 1996, p.97)	33
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	36
Toqua site (40MR6), TN	(Polhemus, 1987, p.103)	37
Etowah site (9BR1), GA	(King, 1996, p.95)	38
Little Egypt site (9MU102), GA	(Hally, 1978, p. that follows 508)	48
	mean	31.59
	standard deviation (s)	6.35
	mean - 1s	25
	mean + 1s	38

Table 2. Soil Description of the Mound Layers. Soil description and particle size information for the typical mound soil layers, as seen in the west face of Test Unit N332E428E1/2. The following are the abbreviations in the table: * = average of PSD from two samples, bgs = below ground surface, gr = granular, sbk = subangular blocky, dk = dark, yllish = yellowish, brn = brown, cmn = common; med = medium, v. = very, c. = coarse, and fn. = fine.

Horizon Name	Depth (cm bgs)	Munsell Color	Texture	% Sand*	% Silt*	% Clay*	% of Total Sand %V.C.	%C.	%Med.	%Fn.	%V.Fn.	Structure	Artifacts	Lower Boundary	Other
Ap (Plow Zone)	0-15	dk brn (10YR 3/3)	silty clay loam	16.8	54.6	28.6	1.4	4.5	11.9	30.7	46.5	weak fine gr & sbk	some historic & prehistoric	abrupt wavy	cmn prominent mottles of YMF; cmn distinct mottles of BMF
Yellow Mound Fill (YMF)	15-50	dk yllish brn (10YR 4/6)	silty clay loam	3.9	61.7	34.4	0.0	1.2	3.2	13.2	75.0	moderate, med to very coarse sbk	nearly absent	abrupt smooth	interlaced with the G & BMF; cmn BMF-filled root channels; abundant fine-med mica.
Black Mound Fill (BMF)	15-50	black (10YR 2/1)	silty clay	3.5	53.4	43.0	0.0	5.2	16.7	14.7	60.0	moderate, med to very coarse sbk	nearly absent	abrupt smooth	intergrades to the GMF; abundant fine-med mica
Gray Mound Fill (GMF)	15-50	very dk gray (10YR 3/1)	silty clay loam	3.4	58.6	38.0	0.0	0.5	2.3	16.7	68.8	moderate, med to very coarse sbk	nearly absent	abrupt smooth	intergrades to the BMF; cmn fine-med mica
1st Mound Stage	50-70	very dk brn (10YR 2/2)	loam	36.8	37.6	25.7	1.6	3.6	13.7	45.0	33.9	massive/none	cmn sherds, bone, charcoal	clear smooth	~0.5% 2-15mm quartzite river pebbles; common med-coarse mica
Ab	70-80	black (10YR 2/1)	silty clay loam	14.7	51.9	33.3	0.7	1.7	7.5	23.4	66.4	massive to single-grained	many charcoal, cmn sherds	gradual smooth	cmn fine-med mica
Bw1 (subsoil)	80-148	dk yllish brn (10YR 4/6)	silt loam to silty clay loam	10.3	63.1	26.6	0.0	0.1	2.7	12.0	85.2	massive/none	none		many fine-med mica; old root casts & few fine lumps/mottles of dk brn (7.5YR3/2)

Table 3. *Ex Situ* YMF Clod Data from the Thin Sections. "PZ1_horiz" and "PZ3_horiz" are samples taken from the Ap horizon of Test Unit N332E428E1/2 at the mound's center. The final column multiplies the %Area by the number needed to produce the true area of the clods (Stoops, 2003).

Slide Name	**Distance from Mound's Center (m)**	**Total Soil Area (mm^2)**	**# of Clods**	**Total Area of Clods (mm^2)**	**% Area of Clods in Slide**	**% Area*1.273… (Stoops, 2003)**
PZ1_horiz	0	1520.275	13	22.092	1.453	1.851
PZ3_horiz	0	1473.506	6	272.105	18.467	23.524
E2mAp	2		0	0	0	0
W2mAp	2	1456.663	6	96.449	6.621	8.435
E6mAp	6		0	0	0	0
N10mAp	10	1471.213	1	5.881	0.400	0.509
W10mAp	10	1595.019	6	9.916	0.622	0.792
E14mAp	14	1212.937	1	1.141	0.094	0.120
S17mAp	17		0	0	0	0
W18mAp	18		0	0	0	0
E22mAp	22		0	0	0	0
N22mAp	22		0	0	0	0
W30mTZ	30		0	0	0	0
N38mAp	38		0	0	0	0
W38mAp	38		0	0	0	0
E42mAp	42		0	0	0	0
S49mAp	49	1452.017	3	6.887	0.474	0.604
E54mAp	54		0	0	0	0
W62mAp	62		0	0	0	0
S65mAp	65		0	0	0	0
N78mAp	78		0	0	0	0
				Mean of %Area (0-78m):	1.655	2.108

Table 4. Calculations of Hypothetical Mound Volumes. Footnotes: * = A mound with these dimensions would be a pyramid, not a frustum. ** = By comparison to a building on the Town Creek mound (Coe et al., 1995), Mississippian mound summits probably have minimum dimensions of 7.5 m by 7.5 m, so this mound might be too small to be an actual mound size. *** = Height from the 1930s photo (Figure 3).

Height (m)	Height Comments	Base Angle	Volume of Mound (m^3)	Outcome Comments	Base Length (m)	Base Width (m)	Summit Length (m)	Summit Width (m)	Base Area (m^2)	Summit Area (m^2)
5	higher than Squier	25	none	no summit*	48	39	none	none	1872	none
4	lower than Squier	25	none	no summit*	48	39	none	none	1872	none
3	lower than Squier	25	none	no summit*	48	39	none	none	1872	none
2	lower than Squier	25	none	no summit*	48	39	none	none	1872	none
1.65	1930's height***	25	none	no summit*	48	39	none	none	1872	none
1	<1930's height***	25	none	no summit*	48	39	none	none	1872	none
5	higher than Squier	32	6,448	possible	48	39	32.9	23.9	1872	785
4	lower than Squier	32	5,576	possible	48	39	35.9	26.9	1872	966
3	lower than Squier	32	4,513	possible	48	39	38.9	29.9	1872	1,165
2	lower than Squier	32	3,242	possible	48	39	41.9	32.9	1872	1,382
1.65	1930's height***	32	2,744	possible	48	39	43.0	34.0	1872	1,463
1	<1930's height***	32	1,743	possible	48	39	45.0	36.0	1872	1,618
5	higher than Squier	38	4,044	possible**	48	39	15.8	6.8	1872	107
4	lower than Squier	38	3,876	possible	48	39	22.2	13.2	1872	294
3	lower than Squier	38	3,463	possible	48	39	28.7	19.7	1872	564
2	lower than Squier	38	2,732	possible	48	39	35.1	26.1	1872	917
1.65	1930's height***	38	2,387	possible	48	39	37.4	28.4	1872	1,060
1	<1930's height***	38	1,605	possible	48	39	41.6	32.6	1872	1,353

Table 5. Volume Calculations of the *In Situ* Mound Layers, the RML, and the Epipedon. Calculations are shown of volumes of the *in situ* mound layers (first and second mound stages), the redistributed mound layer (RML), and the epipedon. All calculations were derived using data from cores, test units, and auger holes. This data were then put into the Surfer® program and interpolated using the kriging method at the resolution of the line spacing in the table.

Layer Name	**Area Range (m)**	**Volume (m^3)**	**Line Spacing (cm)**
In situ mound layers	48mX39m basal extent	494.44	5.00
RML	0-14	184.79	5.00
Epipedon	0-14	548.88	5.00
RML	0-49	1,767.38	10.00
Epipedon	0-49	2,557.26	10.00

Table 6. Comparisons of Combined RML with *In Situ* Mound Volumes to Hypothetical Mound Volumes. The first four rows lines of the table are data calculated from Surfer®. The rest of the rows are volume calculations for mounds of different heights but all with the same basal dimensions of 39 x 48 m. All mound volume calculations are for a mound with a base width of 39 m and a base length of 48 m. All numbers are rounded to the nearest whole number. Notes: ISML = *in situ* mound layers; vol = volume. * = A mound with these dimensions would have no summit.

Calculation	**Mound Shape Comments**	**Comparison to RML Comments**	**Height (m)**	**Base Angle**	**Volume (m^3)**	**Summit Length (m)**	**Summit Width (m)**	**Area of Summit (m^2)**
ISML + 14 m RML					679			
ISML + 49 m RML					2,262			
ISML + 50%(14 m RML)					834			
ISML + 50%(49 m RML)					1,378			
-	-	-	-	-	-	-	-	-
hypothetical mound vol	no summit*	could not exist	2 to 7	25	none	none	none	none
-	-	-	-	-	-	-	-	-
hypothetical mound vol	frustum-shaped	vol is 3.2X the ISML+49 m RML vol	6	32	7,147	30	21	622
hypothetical mound vol	frustum-shaped	vol is 2.9X the ISML+49 m RML vol	5	32	6,448	33	24	785
hypothetical mound vol	frustum-shaped	vol is 2.7X the ISML+49 m RML vol	4.6	32	6,121	34	25	855
hypothetical mound vol	frustum-shaped	vol is 2.5X the ISML+49 m RML vol	4	32	5,576	36	27	966
hypothetical mound vol	frustum-shaped	vol is 2.0X the ISML+49 m RML vol	3	32	4,513	39	30	1,165
hypothetical mound vol	frustum-shaped	vol is 1.7X the ISML+49 m RML vol	2.5	32	3,905	40	31	1,271
hypothetical mound vol	frustum-shaped	vol is 1.4X the ISML+49 m RML vol	2	32	3,242	42	33	1,382
hypothetical mound vol	frustum-shaped	summit too small	6	38	3,902	9	0.3	3
hypothetical mound vol	frustum-shaped	vol is 1.8X the ISML+49 m RML vol	5	38	4,044	16	7	107
hypothetical mound vol	frustum-shaped	vol is 1.8X the ISML+49 m RML vol	4.6	38	4,003	18	9	172
hypothetical mound vol	frustum-shaped	vol is 1.7X the ISML+49 m RML vol	4	38	3,876	22	13	294
hypothetical mound vol	frustum-shaped	vol is 1.5X the ISML+49 m RML vol	3	38	3,463	29	20	564
hypothetical mound vol	frustum-shaped	vol is 1.4X the ISML+49 m RML vol	2.5	38	3,142	32	23	730
hypothetical mound vol	frustum-shaped	vol is 1.2X the ISML+49 m RML vol	2	38	2,732	35	26	917

Table 7. Particle Size Distribution for the YMF and Its Possible Sources. Particle size distribution is shown for the YMF from Test Unit N332E428E1/2 (at the mound's center) and for several possible sources, including various horizons from cores and from the Bw1 at that test unit.

					% of Total Sand				
Sample ID	**% Sand**	**% Clay**	**% Silt**	**Texture**	**%V.C.**	**%C.**	**%Med.**	**%Fn.**	**%V.Fn.**
YMF1	3.9	34.4	61.7	silty clay loam	0.0	1.2	3.2	13.2	75.0
Bw1 (at mound)	10.3	26.6	63.1	silty clay loam to silt loam	0.0	0.1	2.7	12.0	85.2
N142m, Bw2	3.2	33.0	63.8	silty clay loam	0.0	0.0	1.7	12.8	77.7
S13m, Bw	11.9	29.6	58.5	silty clay loam	0.4	1.0	6.0	29.4	60.8
S97m, Bw2	15.3	25.2	59.5	silt loam	0.0	0.0	0.7	4.6	90.3
W22m, Bw	13.9	27.8	58.3	silty clay loam	0.0	0.0	1.5	11.3	83.1
E18m, Bw	9.6	30.3	60.1	silty clay loam	0.0	0.2	1.4	12.3	80.1
E102m, Bw	19.5	23.1	57.5	silt loam	0.0	0.2	3.4	26.8	67.1
E110m, Ap	12.6	27.6	59.8	silty clay loam	0.6	0.4	5.8	30.8	58.9

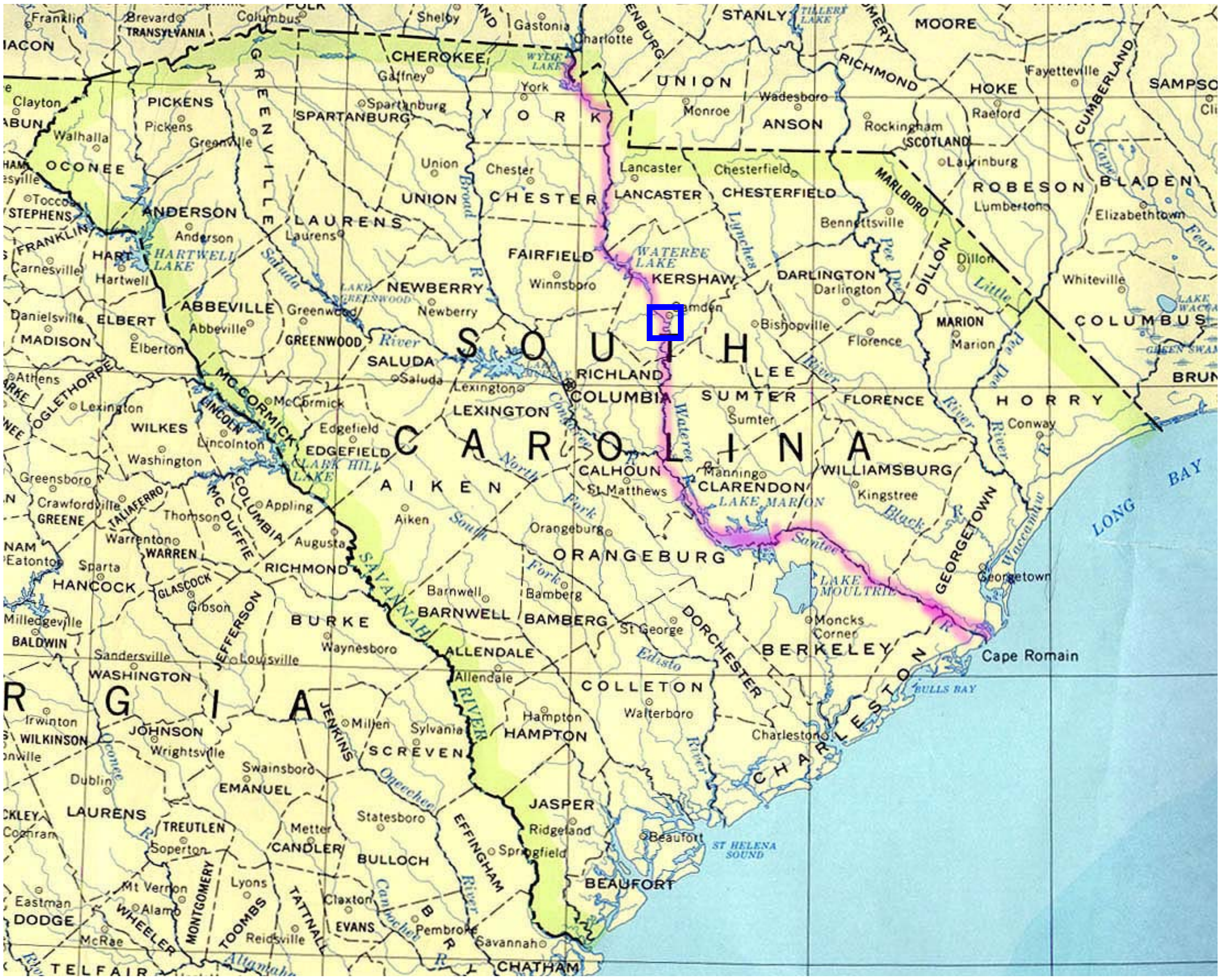


Figure 1. Map of South Carolina and the Study Area. The Wateree and Santee Rivers are highlighted in pink. A blue square marks the approximate location of the study area. (Modified from http://www.lib.utexas.edu/maps/united_states/south_carolina_90.jpg)

Figure 2. Aerial Photo Collage of the Belmont Neck Site and the Vicinity. The location of the south-north and west-east transects (yellow lines), the site boundaries (solid green line; Cable et al., 1999), and Mound A at the Mulberry site (blue triangle) are shown. The photos are 1994 USGS Color Infrared (CIR) digital orthophoto quarter quadrangles (DOQQs) with one-meter resolution. Source: SCDNR, 2004.

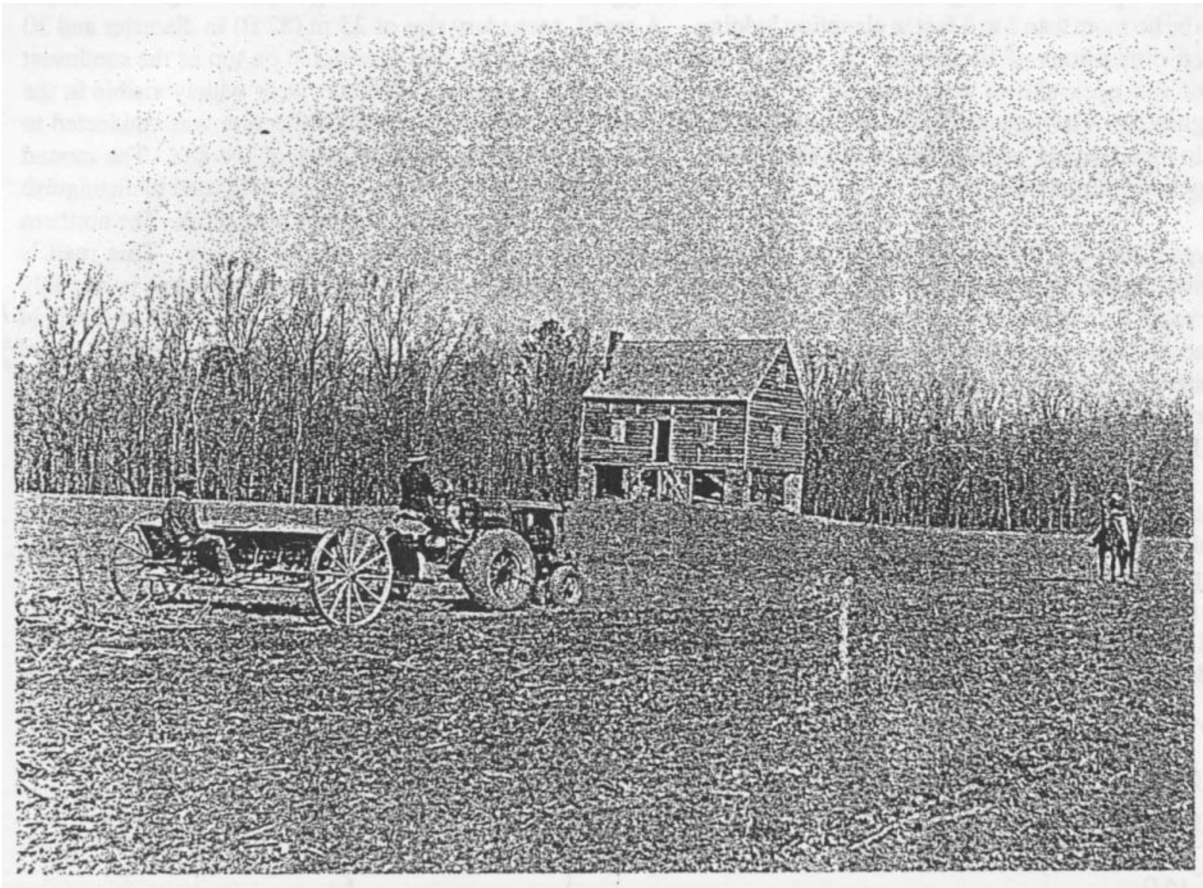


Figure 3. A Photograph of "High House" on the Belmont Mound. A Daniels' family photograph of Belmont Neck showing a building called "High House" situated on the low rise of the mound in the 1930s (Cable et al., 1999; Williams, 1929). Notice that the building was on tall foundation piers, probably due to flooding. Notice the bare earth and possible plowing all of the way up to the house's foundations.

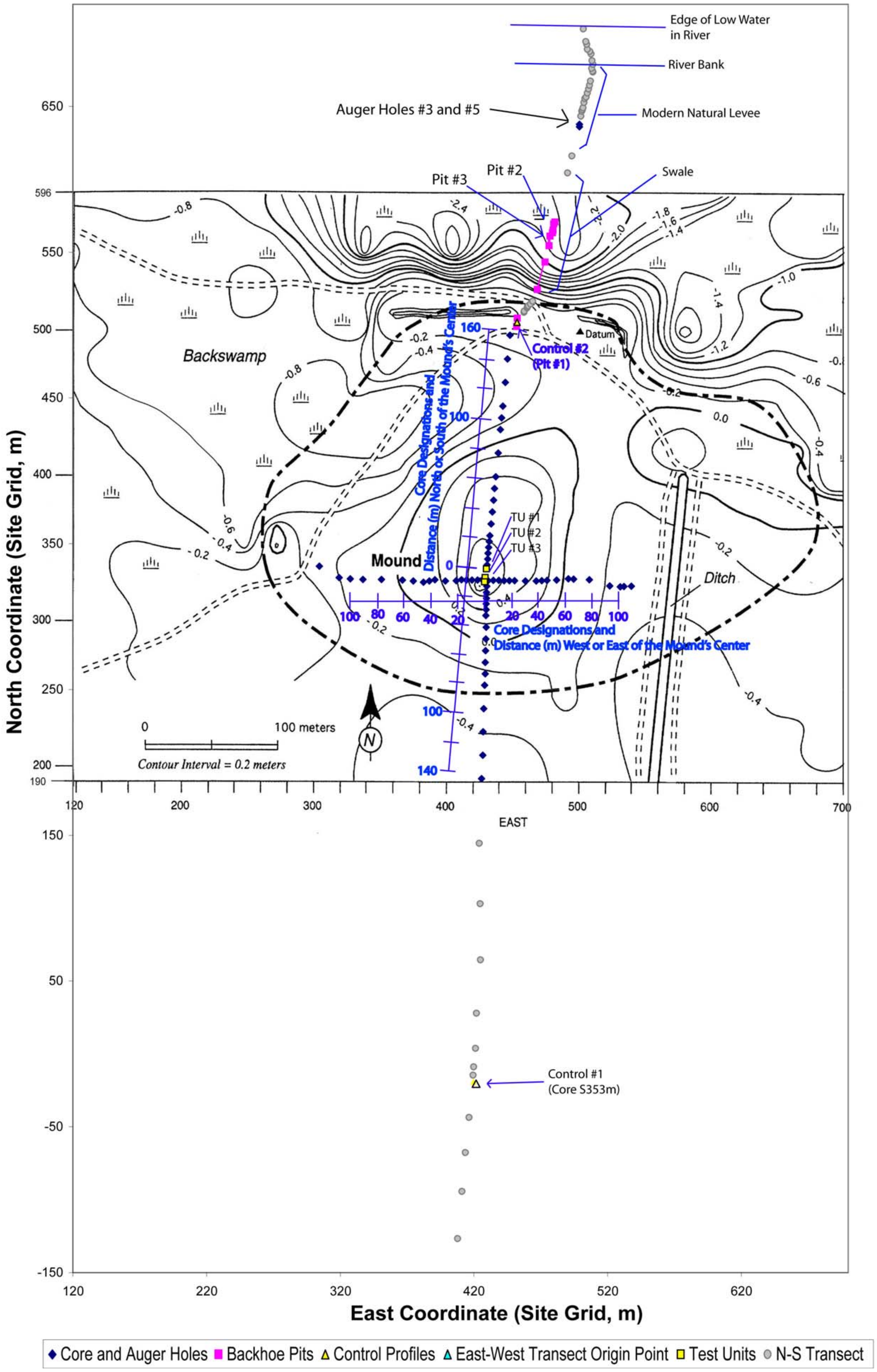


Figure 4. Map of the Belmont Neck Site. This map shows the topography, the transects, the core and auger holes, the two control profiles, the four backhoe pits, and the three test units. The locations of the river at low water level, the modern natural levee, and the swale are also shown. The relative elevation was mapped in 1998 on the site grid (modified from Cable et al., 1999). The dashed-and-dotted black line represents the site boundaries. Paired black dashed lines represent dirt roads.

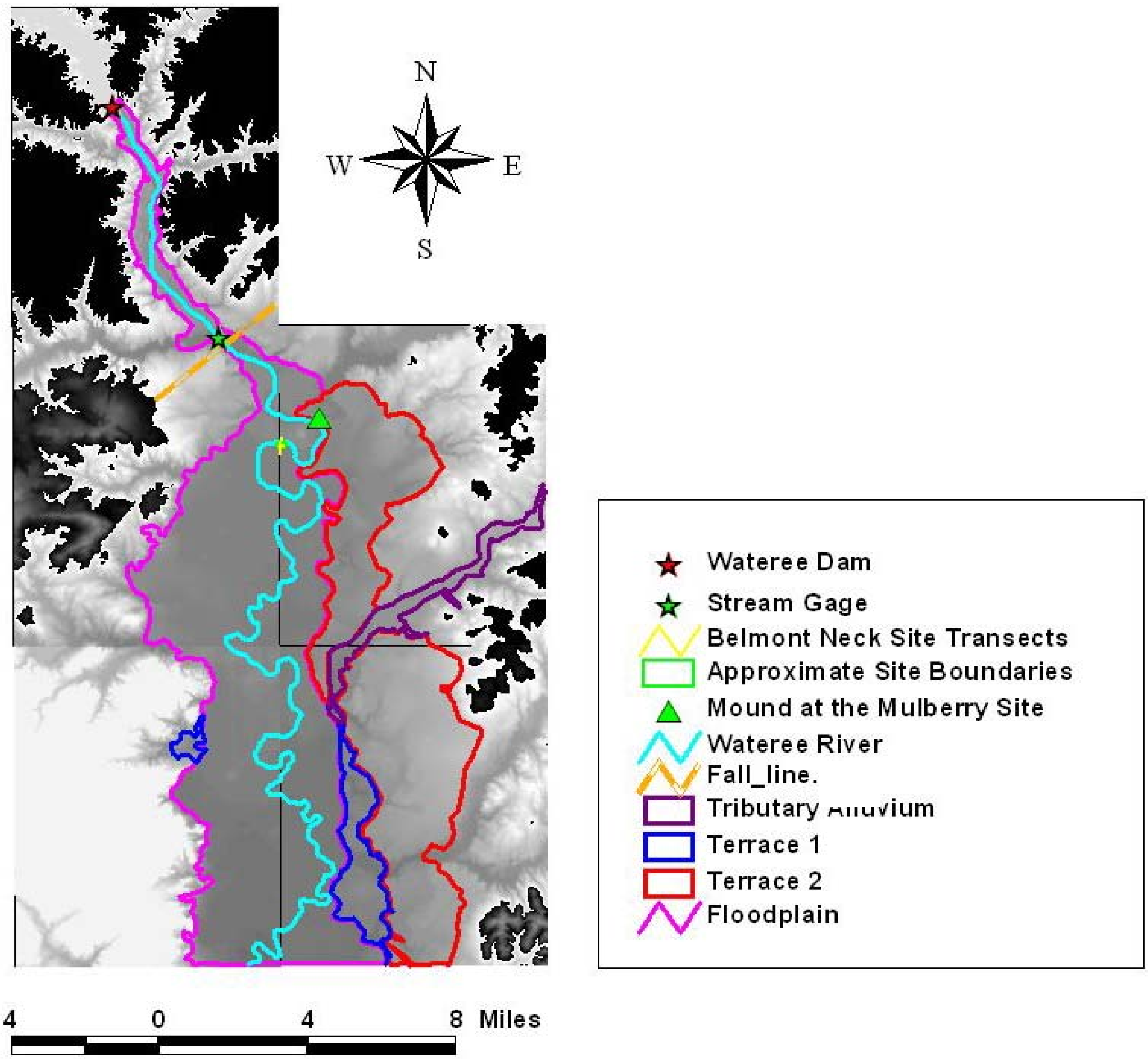


Figure 5. Geomorphic Map of the Wateree Valley in the Upper Coastal Plain. The various geomorphic units (floodplain, T1, T2, and tributary alluvium) are shown as outlines draped over the digital elevation models (DEMs) for the five USGS quadrangles on the map. The Wateree River is a turquoise-colored line overlayed on the geomorphic units. The locations of the Belmont Neck site, the Mulberry site, the stream gage, and the Wateree Dam are shown. An orange line marks the approximate location of the roughly west-east-trending Fall Line, the boundary between the Piedmont and the Upper Coastal Plain. The latitude and longitude coordinates for the corners of the map are the following: (1) northwest corner: 522,996.29 and 3,803,546.66; (2) northeast corner: 546,094.84 and 3,789,794.06; (3) southwest corner: 523,044.72 and 3,761,949.91; and (4) southeast corner: 546,094.84 and 3,762,046.78. The long black lines in the map are some of the boundaries between the 7.5-minute quadrangles.

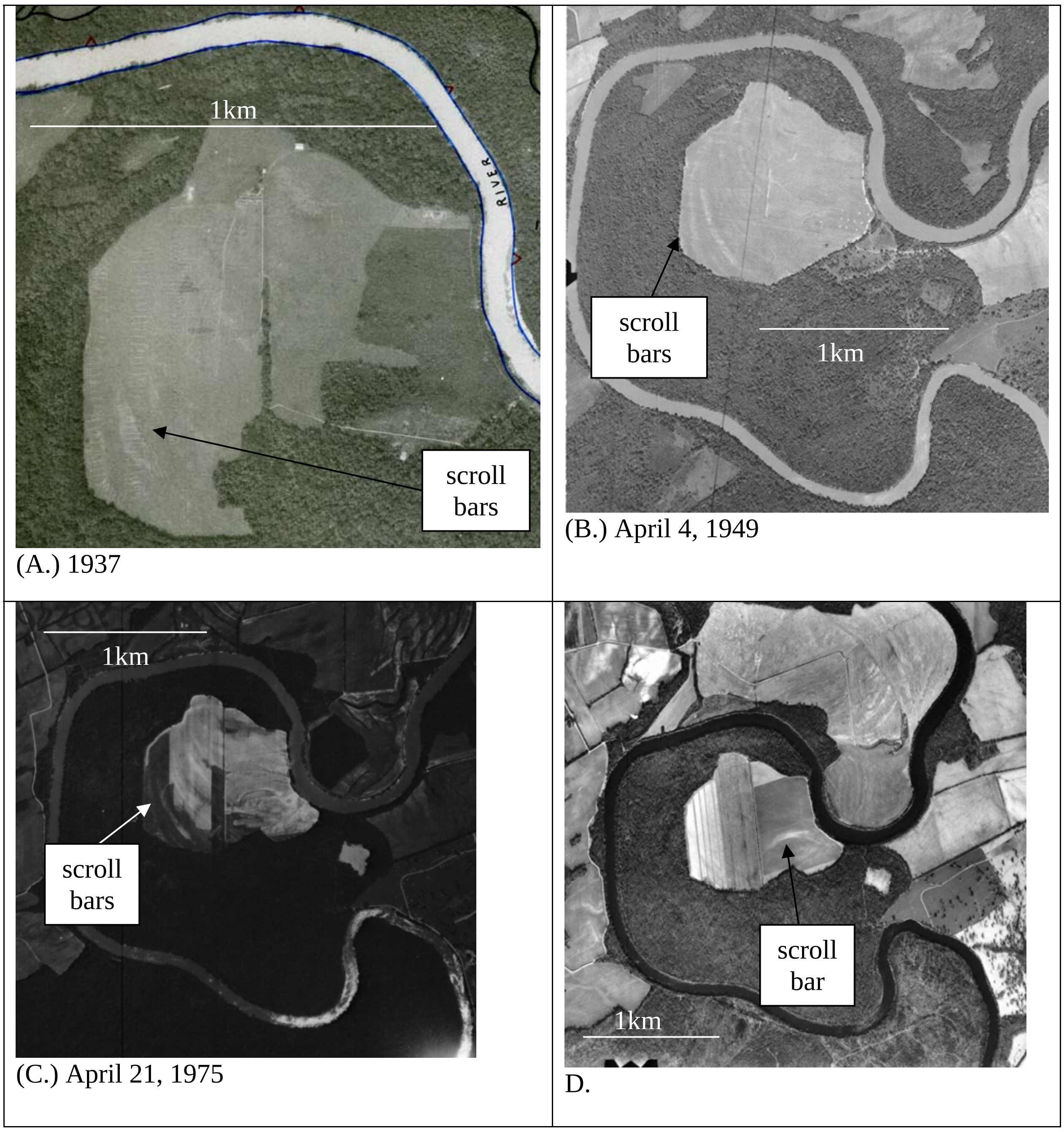


Figure 6A-E. Aerial photos of the study area: (A) 1937 black and white photo; (B) April 4, 1949, black and white photo # PE-1949-5F-110; (C) April 21, 1975, black and white photo #45055-1975-175-97; and (D) January 31, 1981, black and white USDA photo #45055-1981-181-70. (Sources: USGS and USDA)

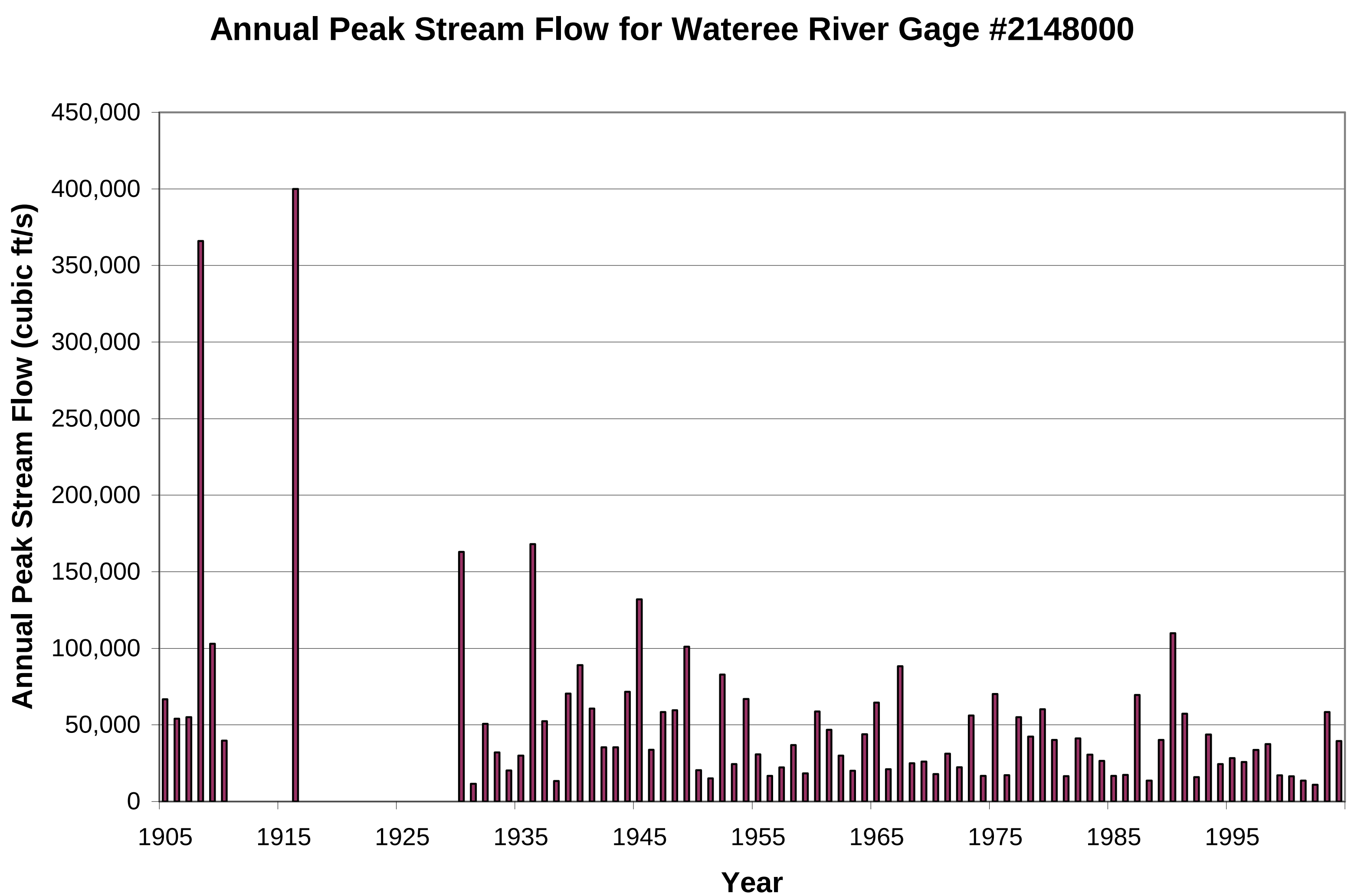


Figure 7. Peak Annual Streamflow, 1905-2004, from USGS Stream Gage #02148000. This gage is on the Wateree River 10.7 km upriver from the Belmont Neck site 11.9 km downriver from the Wateree Dam (Figure 13; USGS, 2006).

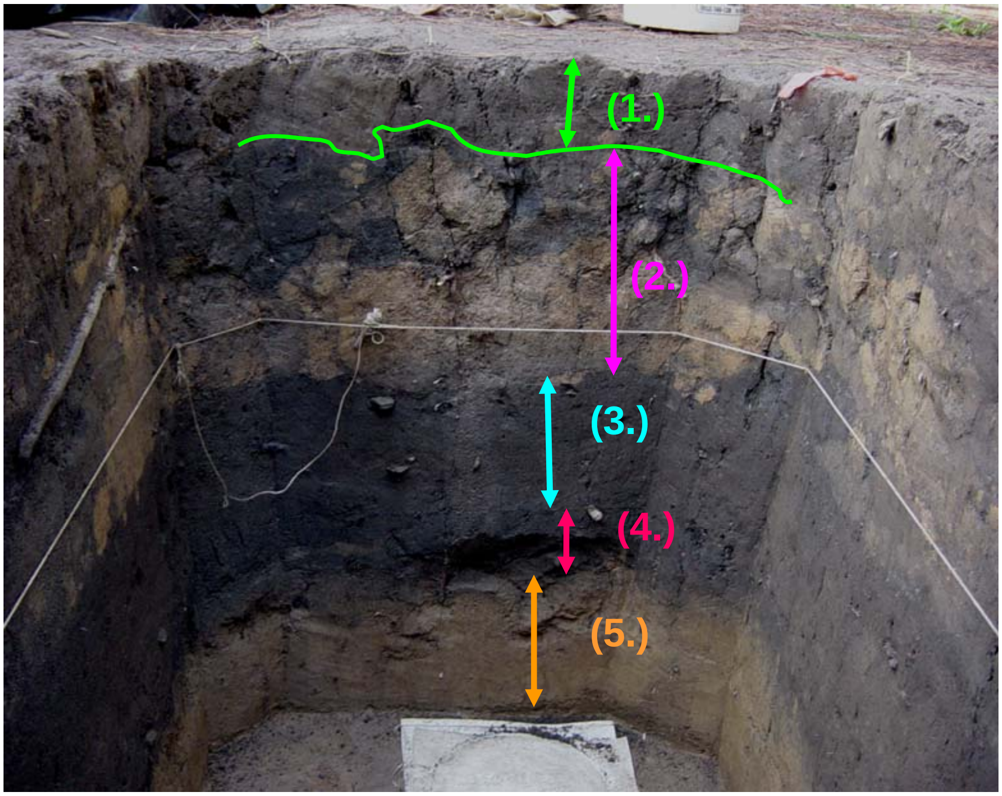


Figure 8. The Mound Profile at Test Unit N332E428E1/2, South Face. The mound profile on the south face of the deepest extent of the unit. Layers: (1.) Ap, (2.) mound fill, (3.) first mound stage, (4.) Ab, and (5.) Bw. The wavy green line is the abrupt, wavy lower boundary of the Ap horizon. For scale, the string marks 40 cm below the ground surface, and the distance between the side walls is one meter.

Figure 9. The Mound Profile at Test Unit N332E428E1/2, East Face. Note the straight, abrupt upper boundary of the first mound stage. For scale, the distance between the short side walls is 2 m. Photo by Gail Wagner, July 2004.

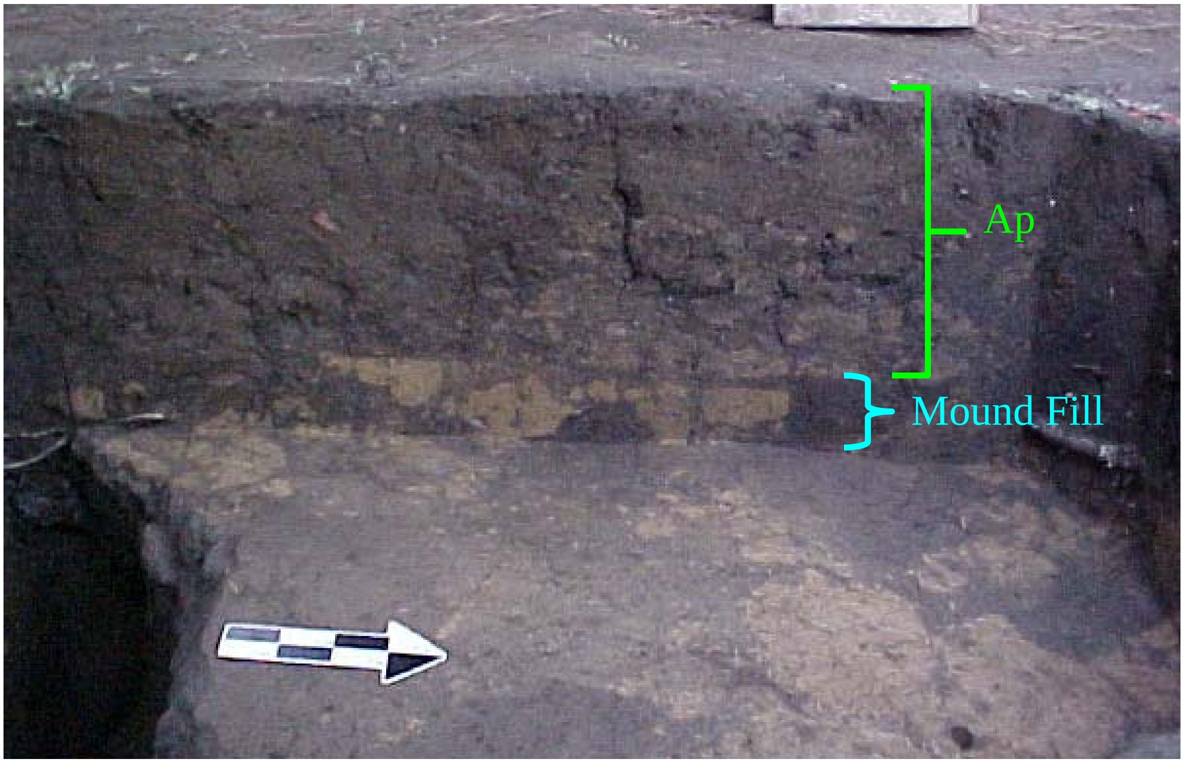


Figure 10. The Mound Profile at Test Unit 3, West Face. Note the very straight, abrupt boundary between the mound fill and the Ap horizon above, probably caused by plowing. For scale, the arrow is 20 cm long, and each rectangle on it is 5 cm long. Photo by Gail Wagner, July 2004.

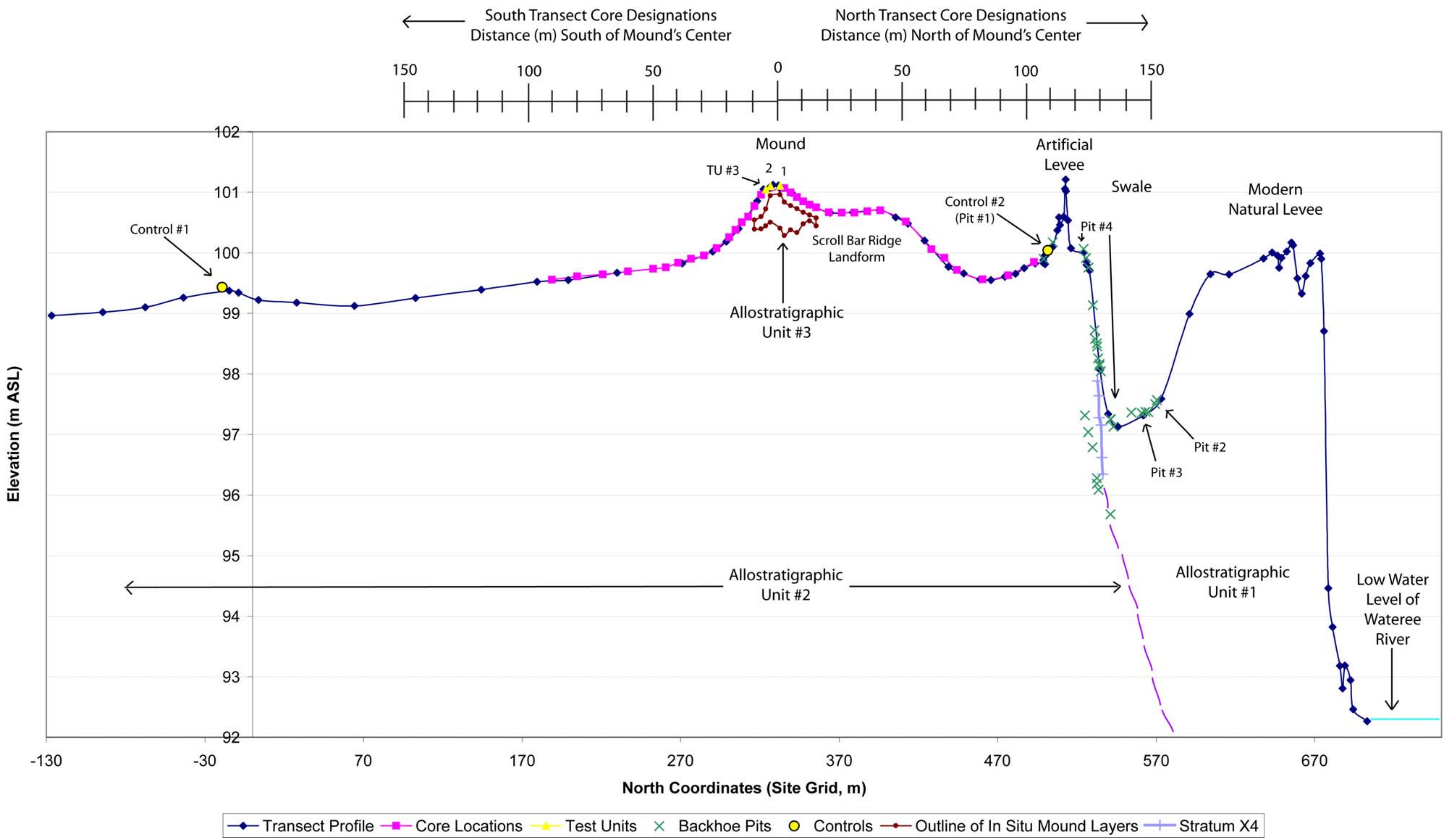


Figure 11. Overall Profile of the South to North Transect. The figure has 25 times vertical exaggeration. The following are located on the transect at the labeled locations: the mound, an artificial levee built in the nineteenth century, the large swale in the floodplain, the modern natural levee, and the edge of the Wateree River at low water level (the turquoise line). Stratum X4 is shown as a lavender line, and the bright purple dashed line extending down from it is the interpreted estimated location of Stratum X4 below the level of the backhoe pits. Allostratigraphic Unit (AU) #1 is sediment in the floodplain. AU #2 is the low terrace (T1). AU #3 is the in situ mound layers (outlined in burgundy). The mound sits upon a scroll bar ridge landform (the portion of the profile above 100 m elevation, excluding the mound layers. The four backhoe pits, the two control profiles, and the three test units (TUs) are labeled.

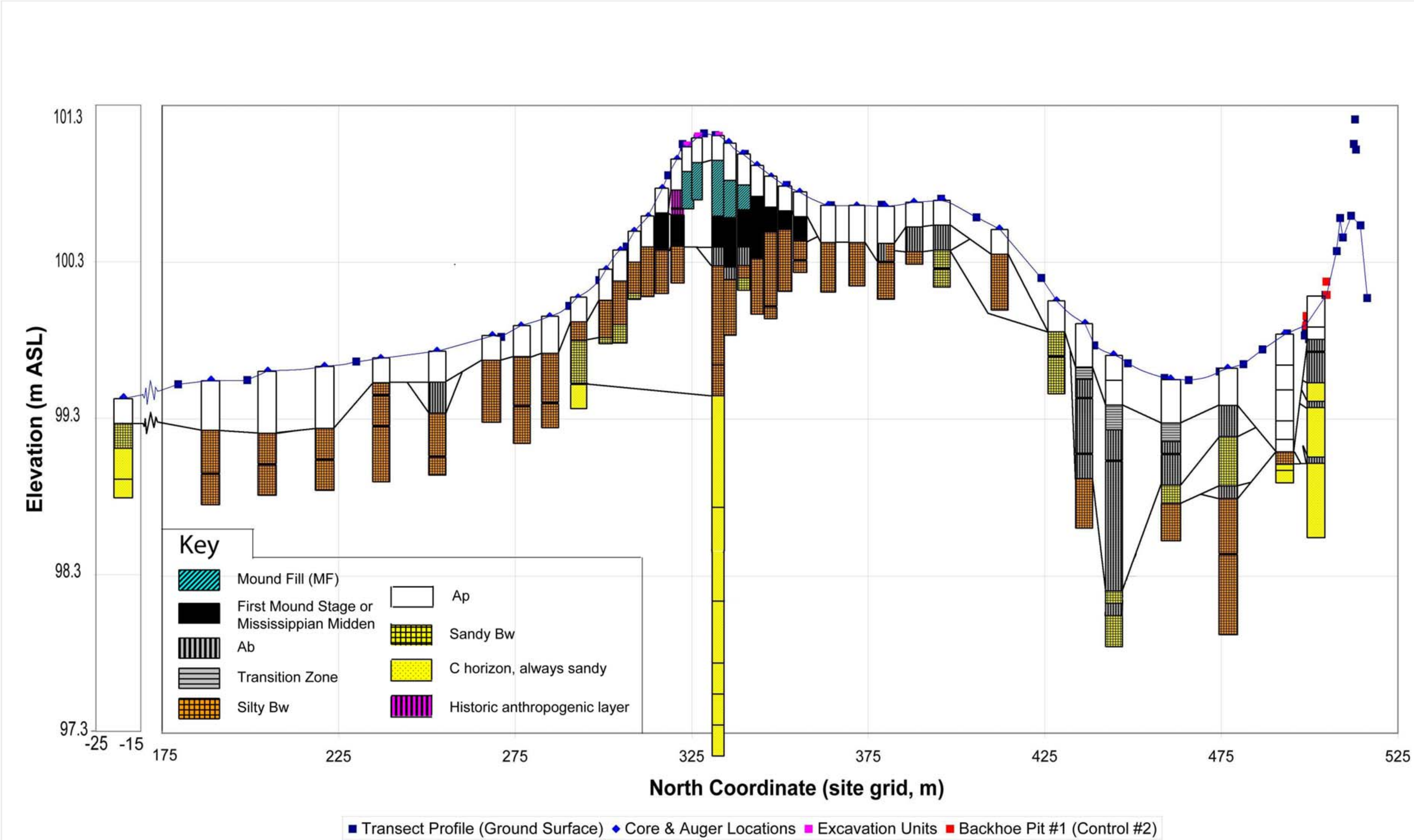


Figure 12. The Stratigraphy on the South-North Transect (Except for the Northernmost Portion near the River), Facing West. Southward is to the left, and northward is to the right. The mound is in the center. Control #1 (Core S353m) is shown on a separate graph (at the same scale) on the left side. The blue line is the ground surface, and the black lines are stratigraphic boundaries. Note that the width of the cores is not to scale; the actual cores are only about 4 cm wide.

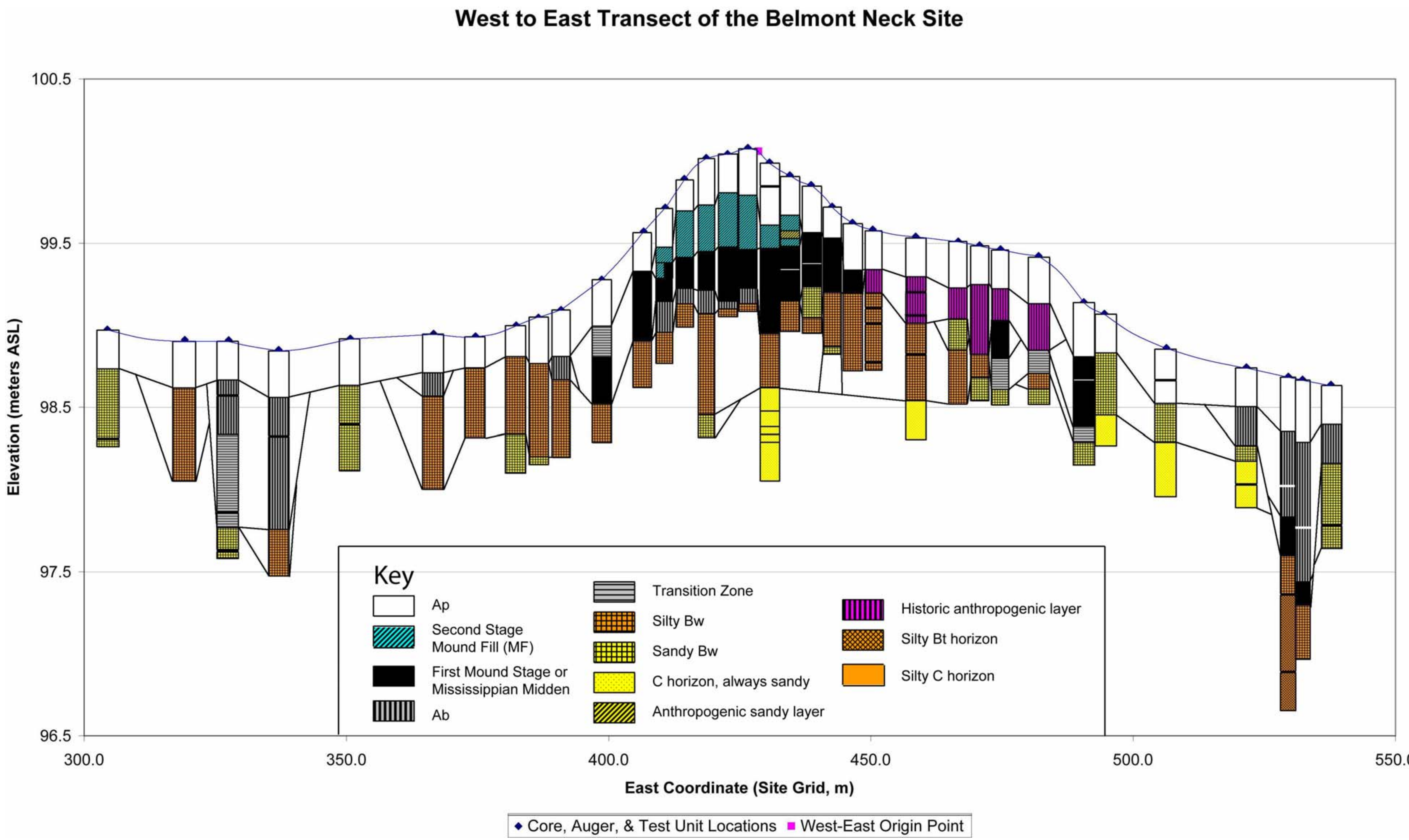
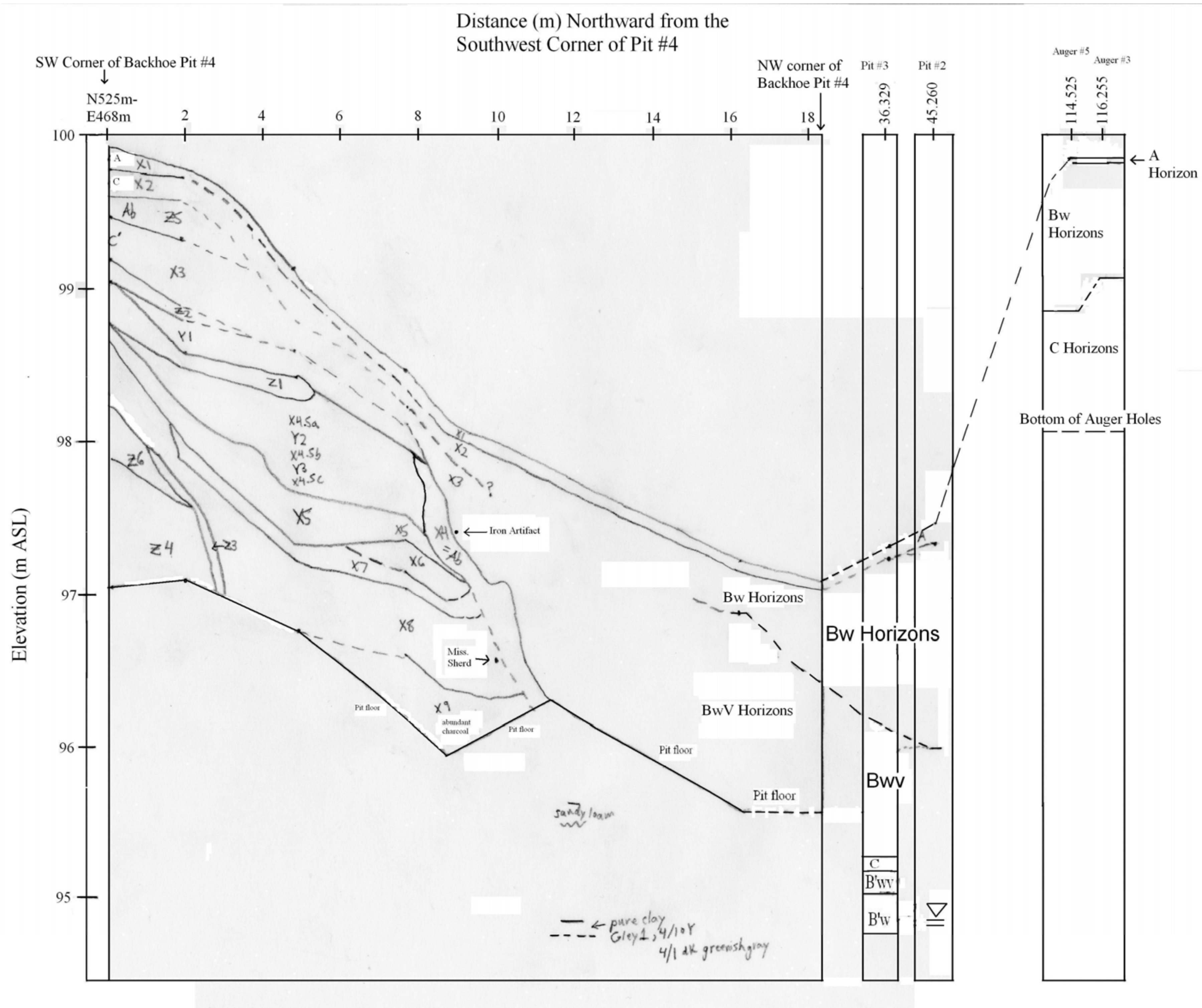


Figure 13. The Stratigraphy of the West-East Transect, Facing North. Westward is to the left, and eastward is to the right. The mound is on the right. The blue line is the ground surface, and the black lines are stratigraphic and/or pedological boundaries. Note that the width of the cores is not to scale; the actual cores are only about 4 cm wide.



Key for Figure 14:

X1 = A horizon, dark gray (7.5YR 4/1) silty clay loam
X2 = C1 horizon, brown (7.5YR 4/4) silty clay loam
Z5 = Ab horizon
X3 = C2 horizon, brown (7.5YR 4/4) silty clay loam
Z2 = C horizon, dark yellowish brown (10YR 4/4) sandy loam
Y1 = Ab horizon, brown (7.5YR 4/3)
Z1 = C horizon, dark yellowish brown (10YR 4/4) sandy loam
X4.5a, b, & c = dark yellowish brown (7.5YR4/6) loamy sand lenses
Y2 = C horizon, dark yellowish brown (7.5YR4/6) sandy loam
Y3 = Bw horizon; common charcoal
X5 = C horizon, dark yellowish brown (10YR 4/4) silty clay loam
X6 = C horizon, brown (7.5YR 4/4) sandy loam
X7 = C horizon, brown (7.5YR 4/3) silty clay loam
X8 = Bw horizon, dark yellowish brown (10YR 4/6) loamy sand
X9 = Bw horizon, yellowish brown (10YR 5/6) sandy loam; abundant charcoal
Z6 = C horizon, brown (10YR 4/3) silty clay loam
Z3 = Bw horizon, dark yellowish brown (10YR 4/4) loamy sand to sandy loam
Z4 = Bw horizon, yellowish brown (10YR 5/4) silty clay loam
X9 = Bw horizon, loamy sand
X4 = Ab horizon, dark brown (7.5YR 3/2)

Figure 14. The Stratigraphy of the Northernmost Portion of the South-North Transect, Facing West. It is the part of the north transect nearest to the river. Southward is to the left, and northward is to the right. The profile consists of Backhoe Pits #4, 3, and 2; and Auger holes #5 and #3. The soil description is not detailed because time constraints caused a focus on the stratigraphy and soil colors. Most important layer on the diagram is Stratum X4, an Ab horizon that marks the boundary between Allostratigraphic Unit (AU) #1 (historic alluvial sediment) to the north and AU #2 (older alluvial terrace) to the south. The locations of the Mississippian sherd found below Stratum X4 and the iron artifact found above it are marked on the diagram.

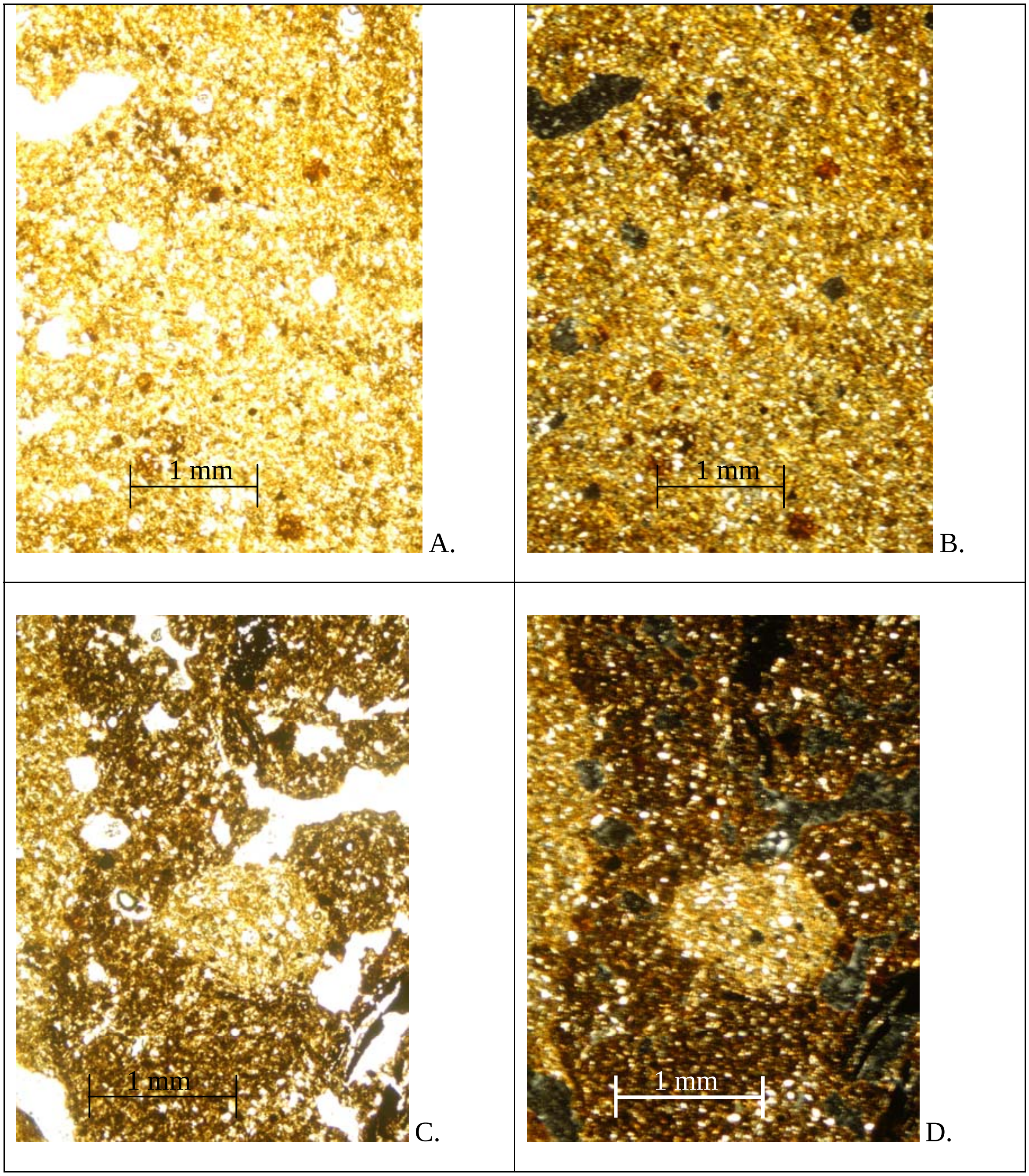


Figure 15A-D. Microscopic Views of *In Situ* YMF in Thin Section at 2X Magnification. These thin section samples are from the west wall of Test Unit N332E428E1/2: (A) a typical view of YMF in PPL; (B) a typical view of YMF in XPL; (C) a YMF clod (center) surrounded by BMF with more YMF on the left, in PPL; and (D) the same as "C" but in XPL. All pictures are of YMF thin section sample #3. In (A) and (B), the whole view is YMF.

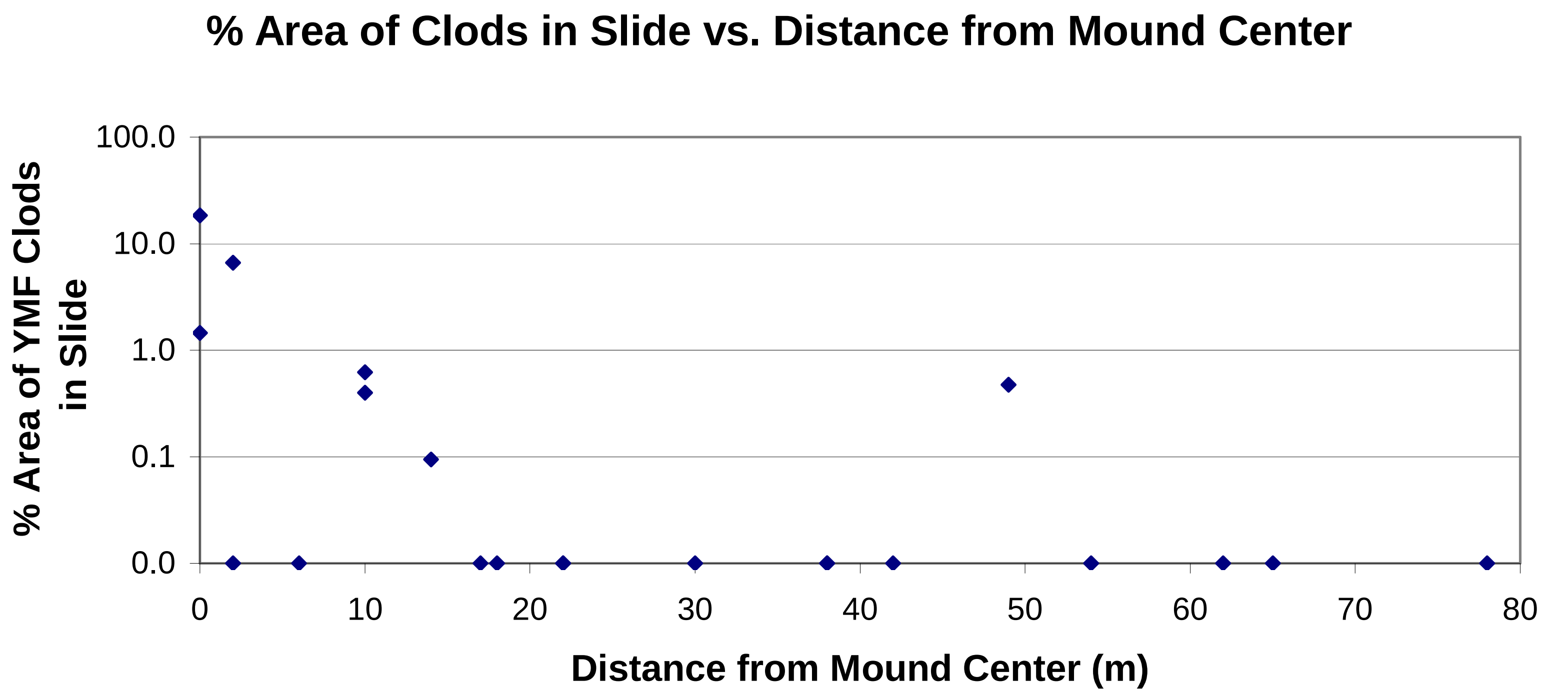


Figure 16. Graph of Percent Area of *Ex Situ* YMF Clods per Thin Section Slide versus Distance from the Mound's Center. It is the same data as in Table 3.

CHAPTER 4

CONCLUSIONS

This research has shown that micromorphology can be quite successful for detecting redistributed material from a destroyed mound or other earthwork, and the resulting data are useful in placing a limit on the maximum original size of a mound. This type of study can be applied to other partially destroyed earthen structures if all or part of the structure's material can be differentiated from the soil of the surrounding epipedon. It is advantageous if the structure's material is a different color or texture than the epipedon and if the structure's material is cohesive enough to stay together as clods when transported/redistributed. The necessary time and cost of preparing the soil thin sections should be weighed against the need to locate the redistributed mound/earthwork layer.

Giddings probes are a very effective and minimally destructive method of retrieving substantial core samples at archaeological sites. At sites where there are trees or other obstacles preventing the use of full-sized truck-mounted Giddings probes, ATV-mounted probes are very effective. However, for a research endeavor of this sort, just a Giddings cores and a few excavation units are not enough to see all stratigraphy and answer all of the research questions. Excavated trenches (either by archaeologists or by backhoes), stretching from the outer edge of the *in situ* mound material to the mound's center, are very necessary to see the important stratigraphy, especially to determine the mound's base angle and the mound fill sources.

The first objective of the research was to determine the subsurface and surface geomorphology in the vicinity of the site. The Belmont Neck site itself is situated on a scroll bar ridge landform. This ridge is located on a low geomorphic first terrace (T1) that is in the hydromorphic five-year (or less) floodplain, but it is allostratigraphically separated from the historic sedimentation in the large swale and on higher elevations closer to the river bank (Figure 11). To the north of the archaeological site, both the large swale and the modern natural levee are situated in the geomorphic and hydromorphic floodplains (Figure 11). Although the site has experienced flooding in the past, the only places in the mound vicinity where historic sedimentation has occurred are the partially filled depressions 106 m north of the site and 99 m east of the site. The Belmont Neck mound was built on a low scroll bar ridge landform is 1.0 m higher than the surrounding ground to the north and to the south, 0.5 m higher than to the west, and 0.7 m higher than to the east. The orientation of this ridge appears to be roughly east-west. This ridge is a scroll bar that has a typical fining upward fluvial sediment sequence.

The second objective of the research was to determine the source of the mound fill. The first two (and the only remaining) mound stages covered a rectangular area 48 m by 39 m, whose basal area was not extended when the second stage was added. The first stage of construction used soil from an artifact-rich area, probably from the village area, but soil of different colors for the second stage was probably acquired away from the occupation areas. The midden soil of the first mound stage is much sandier than the rest of the mound layers, so it was acquired from a sandy surface horizon. The first mound stage looks as if it had been intentionally leveled before the second stage mound fill was added (Figures 8 and 9). Possibly other mound layers, perhaps of colors and textures different from the remaining mound layers, have been lost from above. If so, then these other lost mound layers might be impossible to identify micromorphologically. No evidence of borrow pits was recovered, although the second stage mound fill must have originated from the Bw or Bt and A horizons of an organic-rich low spot in the low alluvial terrace (T1) or from the floodplain. Based on manual texture estimates from the cores compared to the mound fills' particle size, the three depressions about 100 m north, west, and east of the mound were probably not the source locations of the mound fill, although the sample size might be too small to say for sure.

The third and final objective was to determine the nature and extent of both natural and cultural processes (especially the destructive processes) that have altered or obscured the Mississippian component of the site. Blanding certainly did overestimate his reported height of 3.4 to 5.8 m in the early nineteenth century (Squier and Davis, 1998). The original height of the Belmont Neck mound was definitely not over two meters high, based on the evidence (Tables 4, 5 and 6). The mound was still about 1.7 m high in the 1930s, and it is 0.8 m high now. The existence of a thin (usually no thicker than the Ap horizon) redistributed mound layer (RML) was confirmed with micromorphology. *Ex situ* YMF clods were found consistently within a radius of 14 m from the mound's center, and three *ex situ* YMF clods were found in an Ap sample 49 m from the mound's center. Therefore, the RML is at least 49 m in diameter. It has been interpreted that few YMF clods were found more than 14 m from the mound's center because mechanical and chemical weathering (aided by plowing) has degraded the clods. The main cause of the decreased height of the mound over the past three centuries is interpreted to be tillage erosion. Bioturbation, slope wash, and soil creep were minor erosive factors. Other destructive factors include digging by looters and for construction of historic house foundations. There is no conclusive evidence of bulldozing at the site.

This research could have been improved in a few ways. First, more horizons and more sub-samples of each should have been analyzed for PSD. Unfortunately, time constraints did not permit this. More PSD analysis would have allowed more complete and more accurate soil descriptions, and more PSD sub-samples would have permitted inferential statistics to be performed on the mound fills and their possible sources. PSD analysis of the mound fill in the cores in addition to that in the test units would have allowed the textural variability of the mound fills to be known. Second, quantitative analysis or organic material content would have improved the descriptions of the mound fills and their comparisons to possible sources. Third, ideally, more thin sections should have been made and analyzed for redistributed YMF clods. However, time and financial constraints did not allow this. Fourth, bulk densities should have been measured for *in situ* second stage mound fill and for the RML. This would have made calculations of possible original mound size more exact. Also, future studies in the area should examine any stratigraphy revealed in the ditch east of the end of the east transect (Figure 4). Finally, a trench needs to be excavated stretching from the outer edge of the in situ mound fill to the mound's center in order to answer questions about the base angle and mound fill sources. Lack of time and money prohibited doing this during the research. Future investigators would have to pay the landowners for any pine trees destroyed during this trenching.

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APPENDIX A

SOIL DESCRIPTIONS FROM CORES, AUGER HOLES, TEST UNITS, AND BACKHOE PITS

All soil colors were recorded after the soil was moistened and compared to the Munsell book. The only exact textures are those for Test Unit N332E428E1/2. The rest of the soil texture information, due to time constraints, comes from manual estimates made in the lab or in the field.

Moisture Index: 0 (no water) through 10 (saturated).

Abbreviations: ASL = above sea level, v = very, dk = dark, med = medium, sbk = subangular blocky, fr = friable; MS1 = Mound Stage 1, MS2 = Mound Stage 2, TZ = transition zone horizon, cl = clay, sm = smooth, gr = gradual, abr = abrupt, cmn = common, sa = sandy, si = silty, brn = brown, fn = fine, crs = coarse, hist = historic, Miss. = Mississippian-aged, approx. = approximately.

Part 1. Two examples of the Complete Set of Information That Was Gathered for Each Soil Profile.

1) Core W2m — Date Collected: 1/10/05

Site Grid Coordinates (m): N325.309, E426.514 — Elevation: 99.852 m ASL

Slope: 0% — Landuse: planted pine trees

Geomorphic Surface (Upland, etc.): low alluvial terrace (T1) — Landform: scroll bar ridge

Hillslope component (Summit, etc.): summit

Artifact depth range: 0-23 (Ap), 51-70 (1st mound stage).

Horizon #1: Ap – 0 to 23 cm; v dk grayish brown (10YR 3/2) silty clay loam; v weak med sbk structure; fr consistence; 5 moisture index; common v fine & few coarse roots; few common coarse prominent yellowish brown (10YR 5/6) mottles; common brick fragments; clear smooth 4-cm lower boundary.

Horizon #2: GMF (2nd mound stage) – 22 to 33.5 cm; v dk gray (10YR 3/1) silty clay loam; v weak med sbk structure; firm consistence; 5 moisture index; common v fine roots; no artifacts; clear smooth 3-cm lower boundary.

Horizon #3: YMF (2nd mound stage) – 33.5 to 40 cm; dk yellowish brown (10YR 3/4) silty clay loam; v weak med sbk structure; firm consistence; 5 moisture index; common v fine roots; no artifacts; abrupt wavy lower boundary.

Horizon #4: BMF (2nd mound stage) – 40 to 51 cm; v dk gray (10YR 3/1) silty clay; v weak med sbk structure; fr consistence; 5 moisture index; common v fine roots; abrupt smooth 2-cm lower boundary.

Horizon #5: 1st mound stage – 51 to 70 cm; v dk grayish brown (10YR 3/2) loam; v weak med sbk structure; fr consistence; 4 moisture index; common v fine roots; many v fine charcoal fragments; clear smooth 4-cm lower boundary.

Horizon #6: Ab – 70 to 79 cm; black (7.5YR 2.5/1) silty clay loam; v weak med sbk structure; fr consistence; 5 moisture index; few v fine roots; common coarse prominent dk yellowish brown (10YR 4/4) mottles; abrupt smooth 1.7-cm lower boundary.

Horizon #7: Ap – 70 to 84+ cm; dk yellowish brown (10YR 4/4) silty clay loam; massive structure; firm consistence; 2.5 moisture index; few v fine roots.

2) Test Unit N332E428E1/2 at the mound's center | Date Collected: 7/9/04

Site Grid Coordinates (m): N332.7575, E 429.4925 | Elevation: 101.1 m ASL

Slope: 0% | Landuse: planted pine trees

Geomorphic Surface (Upland, etc.): low alluvial terrace (T1) | Landform: scroll bar ridge

Hillslope component (Summit, etc.): summit, slightly convex

Artifact depth range: 0-15 (Ap), 50-80 (1st mound stage and Ab).

The information comes from the western profile of the unit (0-108.0cm bgs) and from Auger #1 (108.0-388.0cm bgs) which was 20cm south of the mapping nail in the north-central part of the unit. The auger was a hand-powered auger 8cm in diameter. Note that two PSD samples were collected from each horizon in the profile in Whirl-Pack™ bags. All samples in the profile were taken from the south profile, except for the GMF, which was taken from both the south and west profiles, with one bag from each profile. One to two samples were taken from the auger horizons.

Horizon #1: Ap – 0 to 15 cm; dk brown (10YR 3/3) silty clay; has some v fine sand; weak fine granular and sbk structure; fr consistence; common fine to coarse roots; common prominent mottles of dk yellowish brown (10YR 4/6) silty clay; common distinct mottles of black (10YR 2/1) silty clay; some historic and prehistoric artifacts; abrupt wavy boundary.

Horizon #2: 2nd mound stage (Anthropic Horizon) – 15 to 50 cm; 3 parts:

a) dk yellowish brown (10YR 4/6) silty clay loam (YMF); often interlaced with the gray or black; common black (10YR2/1) filled root channels; abundant fine to medium mica grains

b) black (10YR 2/1) silty clay; intergrades to the gray; abundant fine to medium mica grains

c) v dark gray (10YR 3/1) silty clay loam; intergrades to the black; common fine to medium mica grains

moderate med to v coarse sbk structure (peds 4-12 cm long); firm consistence; common fine to med roots; artifacts are nearly absent; abrupt smooth boundary.

Horizon #3: 1st Mound Stage (Anthropic Horizon) – 50 to 70 cm; v dk brown (10YR2/2) loam; has medium sand; massive structure/no structure; 0.5% 2-15mm rounded to subangular quartzite river pebbles; common fine to medium and one coarse root; common fine to medium charcoal pieces; common coarse artifacts – prehistoric sherds and bone; common med to coarse (up to 2 mm) mica grains; clear smooth boundary.

Horizon #4: Ab – 70 to 80 cm; black (10YR2/1) silty clay loam; some very fine sand; massive to single-grained structure (no structure); many fine roots; many fine to med charcoal pieces; common coarse artifacts – prehistoric sherds – but fewer than in the 1st mound stage; common fine to medium mica grains; gradual (6-9 cm) smooth boundary; the boundary looks leached.

Horizon #5: Bw1 – 80 to 148 cm; dk yellowish brown (10YR 4/6) silty clay; massive structure (no structure); few med roots; firm moist consistence; many fine to med mica grains; v faint mottling of slightly darker brown when dry, but when wet, it disappears into the general color; v dense; has old root casts and scattered fine lumps/mottles of darker soil: dk brown (7.5YR 3/2) silty clay loam.

Horizon #6: Bw2 – 148 to 168 cm; brown (10YR 4/3) silty clay loam; has v fine sand; no roots; abundant fine to med mica grains; very dense; has old root channels filled with darker soil.

Horizon #7: C1 – 168 to 228 cm; dk yellowish brown (10YR 4/4) v fine sandy loam; abundant fine to med mica grains.

Horizon #8: C2 – 228 to 288 cm; dk yellowish brown (10YR 4/4) fine sandy loam; sand is coarser than the horizon above; abundant fine to med mica grains.

Horizon #9: C3 – 288 to 328 cm; dk yellowish brown (10 YR 4/6) sandy loam; has more silt and clay than the above layer; 5% by volume of the sand grains are black; abundant fine to med and some coarse mica grains.

Horizon #10: C4 – 328 to 348 cm; dk yellowish brown (10YR 5/6) loamy sand; 7% by volume of the sand grains are black and 3% are reddish yellow; common fine to med and some coarse mica grains.

Horizon #11: C5 – 348 to 368 cm; brownish yellow (10YR 6/6) loamy sand; sand is slightly less coarse than the layer above; 7% of sand grains are black and 3% are reddish yellow; common fine to medium mica grains with few coarse mica grains.

Horizon #12: C6 – 368 to 388 cm; yellowish brown (10YR 5/4) coarse loamy sand; possible bed material; common med to coarse mica grains; one 15-mm rounded quartz river pebble.

Part 2. Table of the Most Important Information for Each Profile.

Profile Name	Horizon #	Depth (cm bgs)	Horizon Type	Munsell Color	Texture	Redox Concent-rations	Mottles	Lower Boundary	Artifacts
W2m	1	0-23	Ap	v dk grayish brn (10YR 3/2)	si cl loam		few YMF	cl sm	yes
	2	23-33.5	MS2 GMF	v dk gray (10YR 3/1)	si cl loam			cl sm	no
	3	33.5-40	MS2 YMF	dk yellowish brn (10YR 3/4)	si cl loam			abr wavy	no
	4	40-51	MS2 BMF	v dk gray (10YR 3/1)	si clay			abr sm	no
	5	51-70	MS1	v dk grayish brn (10YR 3/2)	loam			cl sm	yes
	6	70-79	Ab	black (7.5YR 2.5/1)	si cl loam		cmn Bw	abr sm	no
	7	79-84+	Bw	dk yellowish brn (10YR 4/4)	si cl loam				no
W6m	1	0-19	Ap	v dk grayish brn (10YR 3/2)	si cl loam			abr irr	yes
	2	19-29	MS2 BMF	v dk gray (10YR 3/1)	si clay			abr irr	no
	3	29-48.5	MS2 YMF	yellowish brown (10YR 5/6)	si cl loam		many BMF	abr irr	no
	4	48.5-74.5	MS1	v dk gray (10YR 3/1)	loam			cl sm	yes
	5	74.5-81.5	Ab	v dk gray (10YR 3/1)	si clay		cmn Bw	abr brkn	yes
	6	81.5-83+	Bw	yellowish brown (10YR 5/8)	si cl loam		few Ab		no
W10m	1	0-23.5	Ap	v dk grayish brn (10YR 3/2)	sa loam		cmn BMF	cl sm	yes

	2	23.5-41	MS2 BMF	v dk gray (10YR 3/1)	si clay		few YMF	abr sm	no
	3	41-46	MS2 YMF	yellowish brn (10YR 5/4)	si cl loam		cmn BMF	abr sm	no
	4	46-68.5	MS1	v dk gray (10YR 3/1)	loam			abr sm	yes
	5	68.5-78	Ab	v dk gray (10YR 3/1)	si cl loam		few Bw1	cl sm	no
	6	78-133	Bw1	yellowish brn (10YR 5/4)	si cl loam	few med distinct		gr sm	no
	7	133-144+	Bw2	dk yellowish brn (10YR 4/4)	fn sa loam				no
W14m	1	0-17	Ap	dk yellowish brn (10YR 4/4)	sa loam			cl sm	yes
	2	17-23	MS2 GMF	v dk grayish brn (10YR 3/2)	si cl loam		cmn YMF	abr sm	no
	3	23-32	MS2 YMF	yellowish brn (10YR 5/6)	si cl loam		cmn GMF	abr wavy	yes
	4	32-39.5	MS2 BMF	v dk gray (10YR 3/1)	si cl loam		cmn YMF	abr sm	yes
	5	39.5-57	MS1	v dk grayish brn (10YR 3/2)	si cl loam			abr sm	yes
	6	57-65	Ab	v dk gray (10YR 3/1)	si cl loam		cmn Bw	cl sm	no
	7	65-77.5+	Bw	dk yellowish brn (10YR 4/4)	si cl loam				no
W18m	1	0-20	Ap	dk brn (10YR 3/3)	loam			gr sm	yes
	2	20-29	MS2 GMF	v dk gray (10YR 3/1)	si cl loam		cmn YMF	abr sm	yes
	3	29-49	MS1	v dk gray (10YR 3/1)	si loam		many YMF	cl sm	yes
	4	49-64	Ab	v dk grayish brn (10YR 3/2)	loam		cmn Bw	gr sm	yes

	5	64-81+	Bw	yellowish brn (10YR 5/4)	si cl loam				no
W22m	1	0-18	Ap	dk yellowish brn (10YR 4/4)	loam			cl sm	yes
	2	18-55	midden/ Ab	v dk gray (10YR 3/1)	si loam			gr sm	yes
	3	55-80.5+	Bw	dk yellowish brn (10YR 4/4)	si cl loam				no
W30m	1	0-22.5	Ap	dk brn (10YR 3/3)	loam			gr sm	yes
	2	22-5-38.5	TZ	v dk grayish brn (10YR 3/2)	si loam		few 10 YR 4/3	cl wavy	yes
	3	38.5-64.5	Midden/ Ab	v dk gray (10YR 3/1)	si loam			gr sm	no
	4	64.5-85+	Bw	brn (10YR 4/3)	si cl loam				no
W38m	1	0-23	Ap	brn (10YR 4/3)	sa loam			cl sm	yes
	2	23-36	Ab	v dk grayish brn (10YR 3/2)	loam			gr sm	no
	3	36-74.1+	Bw	dk yellowish brn (10YR 4/4)	loam				charcoal
W42m	1	0-22	Ap	dk yellowish brn (10YR 4/4)	sa laom			gr sm	yes
	2	22-71	Bw1	dk yellowish brn (10YR 3/4)	si loam		yes	abr sm	charcoal
	3	71-74.5+	Bw2	dk yellowish brn (10YR 4/6)	loamy sand				no
W46m	1	0-15.5	Ap	dk yellowish brn (10YR 4/4)	loam			cl sm	no
	2	15.5-57	Bw1	dk yellowish brn (10YR 4/4)	loam			cl sm	yes
	3	57-75.5	Bw2	dk yellowish brn (10YR 4/4)	fn sa loam				no

W54m	1	0-14	Ap	dk brn (10YR 3/3)	loam		slightly darker	abr sm	yes
	2	14-53.5+	Bw	dk yellowish brn (10YR 4/4)	loam				charcoal
W62m	1	0-20	Ap	dk grayish brn (10YR 4/2)	loam		cmn Ab	abr irr	yes
	2	20-33.5	Ab	v dk gray (10YR 3/1)	loam			cl wavy	no
	3	33.5-80+	Bw	dk yellowish brn (10YR 4/4)	loam				no
W78m	1	0-24	Ap	dk yellowish brn (10YR 3/4)	sa loam			gr sm	yes
	2	24-42.5	Bw1	dk yellowish brn (10YR 4/4)	sa loam			diffuse sm	no
	3	42.5-66+	Bw2	dk yellowish brn (10YR 4/6)	loamy sand				no
W92m	1	0-25	Ap	brn (10YR 4/3)	si loam			cl sm	yes
	2	25-42	Ab1	v dk grayish brn (10YR 3/2)	loam		cmn 10YR 5/4	gr sm	yes
	3	42-90	Ab2	v dk gray (10YR 3/1)	loam		10YR4/4 sa loam	gr sm	no
	4	90-114+	Bw	yellowish brn (10YR 5/6)	si loam			si loam	no
W100m	1	0-20	Ap	dk yellowish brn (10YR 4/4)	fn sa loam			abr sm	no
	2	20-27	Ab1	brn (10YR 4/3)	fn loamy sand		few 10YR 3/2	gr sm	no
	3	27-49.5	Ab2	v dk gray (10YR 3/1)	sa loam			clear wavy	yes
	4	49.5-86	AB	brn (10YR 4/3)	loamy sand		cmn 10YR3/1	abr sm	no

	5	86-96.5	BA	dk yellowish brn (10YR 4/4)	fn sa loam		many 10YR 3/1	abr sm	no
	6	96.5-107	Bw1	dk yellowish brn (10YR 4/4)	fn sa loam			abr sm	no
	7	107-113+	Bw2	dk yellowish brn (10YR 4/4)	loamy sand				no
W110m	1	0-24	Ap	dk yellowish brn (10YR 4/4)	sa loam			abr sm	charcoal
	2	24-71+	Bw	dk yellowish brn (10YR 4/4)	loam				charcoal
W126m	1	0-19	Ap	dk yellowish brn (10YR 4/4)	sa loam			cl sm	charcoal
	2	19-54	Bw1	dk yellowish brn (10YR 4/4)	sa loam		many 10YR 4/3	cl sm	no
	3	54-60.5+	Bw2	dk yellowish brn (10YR 4/6)	loamy sand				no
E2m	1	0-12	Ap1	v dk grayish brn (10YR 3/2)	si cl loam		cmn YMF	cl wavy	yes
	2	12-30	Ap2	dk brn (10YR 3/3)	crs loamy sand		few YMF	abr irr	yes
	3	30-42.5	MS2 GMF	v dk grayish brn (10YR 3/2)	si clay loam		cmn YMF & BMF	abr irr	no
	4	42.4-89.5	MS1	v dk grayish brn (10YR 3/2)	sa loam			cl sm	yes
	5	89.5-115	Bw	dk yellowish brn (10YR 4/4)	loam			gr sm	no
	6	115-130	C1	yellowish brn (10YR 5/6)	loamy sand			abr sm	no
	7	130-134	C2	dk yellowish brn (10YR 4/6)	loamy sand			abr sm	no
	8	134-140	C3	yellowish brn (10YR 5/6)	loamy sand			abr sm	no

	9	140-143.5	C4	dk yellowish brn (10YR 4/6)	loamy sand			abr sm	no
	10	143.5-164+	C5	dk yellowish brn (10YR 4/6)	loamy sand				no
E6m	1	0-20	Ap	dk grayish brn (10YR 4/2)	loam			cl sm	yes
	2	20-27	MS2 GMF	v dk grayish brn (10YR 3/2)	si cl loam		cmn BMF & YMF	abr sm	no
	3	27-30	Anthro-pogenic	yellowish brn (10YR 5/4)	sa loam		many 10YR 3/2	abr wavy	yes
	4	30-35	GMF	v dk grayish brn (10YR 3/2)	si cl loam		cmn YMF	abr sm	no
	5	35-48	MS1	v dk grayish brn (10YR 3/2)	loam			abr sm	yes
	6	48-63.5	Midden/ Ab	dk grayish brn (10YR 4/2)	loam		cmn Bw	abr sm	yes
	7	63.5-78.5+	Bw	yellowish brn (10YR 5/6)	loam		few Midden		no
E10m	1	0-22	Ap	v dk grayish brn (10YR 3/2)	loam			cl sm	yes
	2	22-39.5	Midden	v dk grayish brn (10YR 3/2)	loam		sand lens	cl sm	yes
	3	39.5-52	Midden	v dk grayish brn (10YR 3/2)	loam			cl sm	no
	4	52-66	Bw1	yellowish brn (10YR 5/6)	fn sa loam			abr sm	no
	5	66-77+	Bw2	dk yellowish brn (10YR 4/4)	si cl loam		cmn 10YR 4/2		no
E14m	1	0-17	Ap	v dk grayish brn (10YR 3/2)	loam			abr sm	yes
	2	17-43	Midden	v dk gray (10YR 3/1)	loam		few Bw1	gr sm	yes

	3	43-73	Bw1	dk yellowish brn (10YR 4/4)	si cl loam		cmn 10YR 3/4	cl sm	no
	4	73-76+	Bw2	dk yellowish brn (10YR 4/4)	fn sa loam				no
E18m	1	0-23	Ap	v dk grayish brn (10YR 3/2)	loam			abr wavy	yes
	2	23-34.5	Midden	v dk gray (10YR 3/1)	loam		cmn Bw	cl sm	no
	3	34.5-74.5+	Bw	yellowish brn (10YR 5/6)	si clay loam		cmn 10YR 3/4		charcoal
E22m	1	0-21.5	Ap	v dk grayish brn (10YR 3/2)	loam			cl sm	yes
	2	21.4-31.5	Ab (historic)	v dk grayish brn (10YR 3/2)	sa loam		cmn Bw1	cl wavy	yes
	3	31.5-40	Bw1	dk yellowish brn (10YR 4/6)	loam		cmn 10YR 4/4	abr sm	no
	4	40-47.5	Bw2	dk grayish brn (10YR 4/2)	loam		cmn 10YR 4/6	cl wavy	no
	5	47.5-69	Bw3	dk yellowish brn (10YR 4/4)	si cl loam			cl sm	no
	6	69-70.5+	Bw4	yellowish brn (10YR 5/4)	loam				no
E30m	1	0-20	Ap	v dk grayish brn (10YR 3/2)	loam			abr sm	yes
	2	20-27	A/B1 (anth hist)	v dk grayish brn (10YR 3/2)	loam		many 10YR 4/4	abr sm	yes
	3	27-39	A/B2 (anth)	v dk grayish brn (10YR 3/2)	loam		many 10YR 5/4	abr sm	yes
	4	39-43.5	Anth Burnt	dk yellowish brn (10YR 4/6)	sa loam			abr sm	yes

	5	43.5-61	Bw1	brn (10YR 4/3)	si cl loam			cl sm	no
	6	61-85	Bw2	dk yellowish brn (10YR 4/4)	loam			diffuse sm	no
	7	85-102.5+	C	dk yellowish brn (10YR 4/6)	loamy sand				no
E38m	1	0-23	Ap	v dk grayish brn (10YR 3/2)	loam			gr sm	yes
	2	23-41.5	Midden (hist)	v dk grayish brn (10YR 3/2)	loam			gr sm	yes
	3	41.5-56	Bw1	dk yellowish brn (10YR 4/4)	fn sa loam			cl sm	no
	4	56-84+	Bw2	brn (10YR 4/3)	loam				no
E42m	1	0-21	Ap	v dk grayish brn (10YR 3/2)	loam		few 10YR 4/4	cl sm	yes
	2	21-56.5	Feature (hist)	v dk gray (10YR 3/1)	loam			gr sm	yes
	3	56.5-69.5	Bw1	yellowish brn (10YR 5/6)	loam			cl sm	no
	4	69.5-78+	Bw2	dk yellowish brn (10YR 4/4)	fn sa loam				no
E46m	1	0-18	Ap	v dk grayish brn (10YR 3/2)	loam			cl sm	yes
	2	18-37.5	Ab (hist)	v dk grayish brn (10YR 3/2)	loam		cmn 10YR 3/1	abr wavy	yes
	3	37.5-56.5	Midden (Miss.)	v dk gray (10YR 3/1)	loam			cl irr	yes
	4	56.5-70.5	Midden-Bw TZ	v dk grayish brn (10YR 3/2)	loam		few 10YR 5/4	cl sm	no
	5	70.5-81+	Bw	yellowish brn (10YR 5/4)	fn sa loam		few TZ		no

E54m	1	0-25	Ap	v dk grayish brn (10YR 3/2)	loam			cl sm	cl sm
	2	25-46	Midden (hist)	v dk gray (10YR 3/1)	loam			cl sm	cl sm
	3	46-58	Midden-Bw TZ	v dk grayish brn (10YR 3/2)	loam		cmn 10YR 5/4	cl irr	cl sm
	4	58-69.5	Bw1	brn (10YR 4/3)	si loam		cmn 10YR 3/2	cl sm	cl irr
	5	69.5-77.5+	Bw2	dk yellowish brn (10YR 4/4)	fn sa loam				cl sm
E62m	1	0-26.5	Ap	dk grayish brn (10YR 4/2)	loam			cl sm	yes
	2	26.5-41	Ab1	dk grayish brn (10YR 4/2)	loam		few 10YR 5/6	abr sm	yes
	3	41-62	Ab2	dk grayish brn (10YR 4/2)	loam		few 10YR 5/6	abr sm	yes
	4	62-71.5	Ab/C	dk grayish brn (10YR 4/2)	loam		cmn 10YR 5/6	abr wavy	no
	5	71.5-83+	Bw	light yellowish brn (10YR 6/4)	loamy sand		cmn 10YR 5/6		no
E66m	1	0-21	Ap	brn (10YR 4/3)	loam			gr sm	yes
	2	21-51	Bw	dk yellowish brn (10YR 4/6)	sa loam	redox depletions		diffuse sm	no
	3	51-68+	C	yellowish brn (10YR 5/6)	loamy sand				no
E78m	1	0-17	Ap	dk yellowish brn (10YR 4/4)	loam			abr sm	no
	2	17-27	A	dk yellowish brn (10YR 4/4)	loam		few 10YR 3/3	cl sm	no

	3	27-49	Bw	yellowish brn (10YR 5/6)	fn sa loam		cmn 10YR 4/4	gr sm	no
	4	49-74+	C	light yellowish brn (10YR 6/4)	loamy sand				no
E96m	1	0-21.5	Ap	brn (10YR 4/3)	si loam				no
	2	21.5-39	Ab	dk brn (10YR 3/3)	loam		cmn	abr sm	yes
	3	39-47.5	Bw	brn (10YR 4/3)	fn sa loam		cmn 10YR 3/3	cl wavy	no
	4	47.5-60	C1	dk yellowish brn (10YR 4/4)	loamy sand		many 10YR 3/4	cl sm	no
	5	60-71	C2	yellowish brn (10YR 5/6)	fn loamy sand			cl sm	no
E102m	1	0-26	Ap	brn (10YR 4/3)	si loam			gr sm	no
	2	26-55	Ab1	v dk grayish brn (10YR 3/2)	loam			cl sm	yes
	3	55-73	Ab2	v dk grayish brn (10YR 3/2)	si loam		sa loam lenses	gr sm	no
	4	73-91	Midden	v dk gray (10YR 3/1)	loam		sa loam lenses	gr sm	yes
	5	91-113.5	Bw	brn (10YR 4/3)	si loam	cmn 10YR 3/4		gr sm	yes
	6	113.5-150	Bt1	dk grayish brn (10YR 4/2)	loam	cmn 10YR 3/4		gr sm	no
	7	150-172+	Bt2	brn (10YR 5/3)	si cl loam	cmn 7.5YR 3/4			no
E110m	1	0-30.5	Ap	dk yellowish brn (10YR 4/4)	si cl loam		few 10YR 4/2	cl sm	no

	2	30.5-76	Ab1	v dk grayish brn (10YR 3/2)	loam		few 10YR 4/3	cl sm	yes
	3	76-104	Ab2	v dk grayish brn (10YR 3/2)	si loam		sand lens	cl sm	yes
	4	104-114	Midden	v dk gray (10YR 3/1)	loam		cmn 10YR 4/2	abr sm	yes
	5	114-143+	Bw	dk grayish brn (10YR 4/2)	si loam	cmn 10YR 4/4			no
E126m	1	0-21	Ap	dk yellowish brn (10YR 4/4)	loam			cl sm	no
	2	21-40	Ab	v dk grayish brn (10YR 3/2)	loam		sand lens	abr irr	no
	3	40-71	Bw1	dk yellowish brn (10YR 4/6)	sa loam		cmn 10YR 4/2	cl sm	no
	4	71-84+	Bw2	yellowish brn (10YR 5/6)	fn loamy sand				no
S13m	1	0-18	Ap	v dk grayish brn (10YR 3/2)	si loam			cl sm	yes
	2	18-34	Ab1 (hist feature)	dk grayish brn (10YR 4/2)	loam			abr sm	yes
	3	34-36.5	Ab2 (hist sand & gravel)	brn (10YR 4/3)	gravelly loamy sand			abr sm	yes
	4	36.5-56.5	MS1	v dk brn (10YR 2/2)	loam			gr sm	yes
	5	56.5-81.5+	Bw	dk yellowish brn (10YR 4/4)	si loam		few Bw		charcoal
S17m	1	0-16	Ap	v dk grayish brn (2.5Y 3/2)	si loam			cl sm	yes
	2	16-38.5	Ab (hist & Miss.)	dk grayish brn (10YR 4/2)	loam			gr sm	yes

	3	38.5-67.5+	Bw	dk yellowish brn (10YR 4/4)	si loam				no
S21m	1	0-18	Ap	v dk grayish brn (2.5Y 3/2)	loam		cmn Bw	gr sm	yes
	2	18-51.5+	Bw	yellowish brn (10YR 5/4)	si loam		cmn Ap		charcoal
S25m	1	0-18.5	Ap	v dk grayish brn (2.5Y 3/2)	loam			cl sm	yes
	2	18.5-39	Bw1	dk yellowish brn (10YR 4/6)	loam		many 10YR 4/2	gr sm	no
	3	39-45+	Bw2	yellowish brn (10YR 5/8)	fn sa loam		cmn 10YR 5/3		no
S29m	1	0-18	Ap	brn (10YR 4/3)	loam		sand lens	cl sm	no
	2	18-49	Bw1	yellowish brn (10YR 5/6)	loam		cmn 10YR 4/4	gr sm	no
	3	49-59+	Bw2	dk yellowish brn (10YR 4/6)	loamy sand				no
S33m	1	0-20	Ap	dk brn (10YR 3/3)	loam			cl sm	yes
	2	20-44	Bw1	dk yellowish brn (10YR 4/4)	loam			gr sm	no
	3	44-48+	Bw2	dk yellowish brn (10YR 4/6)	fn sa loam				no
S41m	1	0-16	Ap	dk yellowish brn (10YR 4/4)	loam				yes
	2	16-26.5	Bw1	dk yellowish brn (10YR 4/6)	si loam		cmn 10YR 3/4	cl sm	yes
	3	26.5-54	Bw2	dk yellowish brn (10YR 4/6)	fn sa loam		cmn 10YR 3/6	abr sm	no

	4	54-70+	C	yellowish brn (10YR 5/6)	loamy sand			gr sm	no
S49m	1	0-23	Ap	dk yellowish brn (10YR 4/4)	loam		few 5YR 4/4	cl sm	yes
	2	23-55	Bw1	yellowish brn (10YR 5/8)	si loam		cmn 10YR 4/3	gr sm	no
	3	55-72+	Bw2	yellowish brn (10YR 5/6)	loam		cmn 10YR 5/4		no
S57m	1	0-20	Ap	dk yellowish brn (10YR 4/4)	loam			gr sm	no
	2	20-51.5	Bw1	dk yellowish brn (10YR 4/4)	si loam		cmn 10YR 4/3	diffuse sm	no
	3	51.5-75+	Bw2	dk yellowish brn (10YR 4/4)	loam				no
S65m	1	0-16.5	Ap	dk yellowish brn (10YR 4/4)	loam				charcoal
	2	16.5-55+	Bw	dk yellowish brn (10YR 4/4)	si loam		cmn 10YR 3/4	cl sm	no
S81m	1	0-19.5	Ap	dk grayish brn (10YR 4/2)	loam		few Ab	gr sm	yes
	2	19.5-41	Ab	v dk gray (10YR 3/1)	si loam		loamy lens	cl sm	no
	3	41-67.5	Bw1	dk yellowish brn (10YR 4/4)	si loam		cmn 10YR 4/2	gr sm	no
	4	67.5-81+	Bw2	dk yellowish brn (10YR 4/4)	loam		cmn 10YR 4/3		no
S97m	1	0-17	Ap	dk yellowish brn (10YR 4/4)	loam			cl sm	no

	2	17-23	Bw1	yellowish brn (10YR 5/4)	loam		sandy loam laminae	abr sm	no
	3	23-42.5	Bw2	dk yellowish brn (10YR 4/4)	si loam		cmn 10YR 3/4	gr sm	no
	4	42.5-78.5+	Bw3	dk yellowish brn (10YR 4/6)	si loam		cmn 10YR 4/4		no
Auger S113m	1	approx. 0-40	Ap	dk yellowish brn (10YR 4/4)	si cl loam				no
	2	appox. 40-60	Bw1	dk yellowish brn (10YR 4/4)	si loam				no
	3	approx. 60-80+	Bw2	yellowish brn (10YR 5/4)	loam				no
Auger S129m	1	approx. 0-40	Ap	dk yellowish brn (10YR 4/4)	si cl loam				no
	2	appox. 40-60	Bw1	dk yellowish brn (10YR 4/4)	si loam				no
	3	approx. 60-80+	Bw2	yellowish brn (10YR 5/4)	loam				no
Auger S145m	1	approx. 0-30	Ap	brn (10YR 4/3)	si cl loam				no
	2	appox. 30-60	Bw1	dk yellowish brn (10YR 4/4)	si loam				no
	3	approx. 60-80+	Bw2	yellowish brn (10YR 5/6)	si clay loam				no
S353m (Control #1)	1	0-16	Ap	dk yellowish brn (10YR 4/4)	loam			gr sm	no
	2	16-31.5	Bw	dk yellowish brn (10YR 4/6)	loamy sand			cl sm	no
	3	31.5-52.5	C1	brownish yellow (10YR 6/8)	loamy sand			cl sm	no

	4	52.5-65+	C2	lt yellowish brn (10YR 6/4)	loamy sand				no
TU3	1	0-17	Ap						
	2	17-32	Disturbed MS2						
	3	32-40+	MS2		si clay to si cl loam				
TU2	1	0-16	Ap	dk brn (10YR 3/3)	si clay		few YMF & GMF	abr wavy	yes
	2	16-33	MS2, with burial pit cut into it	(10YR 4/6)	si clay to si cl loam				no
TU N332 E428E1/2	1	0-15	Ap	dk brn (10YR 3/3)	si clay		cmn YMF & BMF	abr wavy	yes
	2	15-50	MS2		si clay to si cl loam			abr sm	no
	2a	15-50	MS2 YMF	dk yellowish brn (10YR 4/6)	si cl loam		cmn GMF or BMF		no
	2b	15-50	MS2 BMF	black (10YR 2/1)	si clay		cmn YMF or GMF		no
	2c	15-50	MS2 GMF	v dk gray (10YR 3/1)	si cl loam		cmn YMF or BMF		no
	3	50-70	MS1	v dk brn (10YR 2/2)	loam			cl sm	yes
	4	70-80	Ab	black (10YR 2/1)	si cl loam			gr sm	yes
	5	80-148	Bw1	dk yellowish brn (10YR 4/6)	si cl loam			Auger, so unknown	no

	6	148-168	Bw2	brn (10YR 4/3)	si cl loam			Auger, so unknown	no
	7	168-228	C1	dk yellowish brn (10YR 4/4)	v fn sa loam			Auger, so unknown	no
	8	228-288	C2	dk yellowish brn (10YR 4/4)	fn sa loam			Auger, so unknown	no
	9	288-328	C3	dk yellowish brn (10YR 4/6)	sandy loam			Auger, so unknown	no
	10	328-348	C4	dk yellowish brn (10YR 5/6)	loamy sand			Auger, so unknown	no
	11	348-368	C5	brownish yellow (10YR 6/6)	loamy sand			Auger, so unknown	no
	12	368-388	C6	yellowish brn (10YR 5/4)	crs loamy sand			Auger, so unknown	no

The North Profile was not included due to time constraints. Email heatherbartley@hotmail.com to request a table containing the north transect information.