Spring 2018

Documentation of cultural landscape alteration at the Heritage Mounds site, Georgia

Shannon Sullivan
James Madison University

Documentation of Cultural Landscape Alteration at the Heritage Mounds Site, Georgia

---

An Honors College Project Presented to

the Faculty of the Undergraduate

College of Arts and Letters

James Madison University

---

by Shannon Sullivan

Accepted by the faculty of the Department of Sociology and Anthropology, James Madison University, in partial fulfillment of the requirements for the Honors College.

FACULTY COMMITTEE:

Project Advisor: Dennis Blanton, Ph.D.,
Assistant Professor of Anthropology, Department of Sociology and Anthropology

Reader: Julie Solometo, Ph.D.
Associate Professor of Anthropology, Department of Sociology and Anthropology

Reader: Louis S. Eaton, Ph.D.,
Professor of Geology, Department of Geology and Environmental Sciences

HONORS COLLEGE APPROVAL:

Bradley R. Newcomer, Ph.D.,
Dean, Honors College

PUBLIC PRESENTATION

This work is accepted for presentation, in part or in full, at the Sociology and Anthropology Undergraduate Research Symposium on April 16th, 2018

Table of Contents

List of Figures..3

List of Tables 4

Acknowledgments...5

Abstract 6

Introduction...7

Description of Heritage Mounds Site 11

Methods...13

Results...17

Conclusions and Recommendations 32

Appendix...35

References Cited 39

List of Figures

Figure 1. Lidar site map of 9DU2, the Heritage Mounds site. 13

Figure 2. Excavation at the plaza unit....................14

Figure 3. Beckman Coulter LS 13 320 Laser Diffraction Particle Size Analyzer....................16

Figure 4. Mound A Wetland Core profile....................18

Figure 5. Mound A Borrow Pit Core profile....................20

Figure 6. Unit 37 Expansion profile: SW Corner, West Profile, Control....................22

Figure 7. Mound A Plaza Unit profile: East Profile....................23

Figure 8. Unit 37 Extension artifact count....................24

Figure 9. Mound A Plaza Unit artifact count....................24

Figure 10. Mound A Wetland Core particle size percentages....................25

Figure 11. Mound A Borrow Pit particle size percentages....................25

Figure 12. Mound A Wetland Core ternary diagram....................26

Figure 13. Mound A Borrow Pit ternary diagram....................26

Figure 14. Unit 37 Extension particle size percentages....................27

Figure 15. Mound A Plaza Unit particle size percentages....................27

Figure 16. Unit 37 Extension ternary diagram....................27

Figure 17. Mound A Plaza Unit ternary diagram....................28

List of Tables

Table 1a. Mound A Wetland Core Chemical Analysis data - Elements................................28

Table 1b. Mound A Wetland Core Chemical Analysis data..29

Table 2a. Mound A Borrow Pit Core Chemical Analysis data - Elements............................29

Table 2b. Mound A Borrow Pit Core Chemical Analysis data..29

Table 3a. Unit 37 Extension Chemical Analysis data - Elements 30

Table 3b. Unit 37 Extension Chemical Analysis data 30

Table 4a. Mound A Plaza Unit Chemical Analysis data – Elements.....................................31

Table 4b. Mound A Plaza Unit Chemical Analysis data 31

Acknowledgments

I would like to express my deep gratitude to Dr. Blanton, my advisor, for his valuable guidance and advice throughout the research of this project. I would also like to thank my two readers, Dr. Eaton and Dr. Solometo, for their help throughout the writing of my capstone. My thanks also go to Ron Phillips, the JMU geology lab supervisor, for helping me understand the particle analyzer. I would also like to express my thanks to all of the field school students and archaeology volunteers who helped with collecting data for this project. I would also like to thank Mr. and Mrs. Ivester, for allowing me to do research on their property. Finally, I would like to thank the Department of Sociology and Anthropology for the money from the foundation award, and Kay Veith for the money from the Kay Veith archaeological field scholarship, that helped me pay for the field school and the chemical analysis from the University of Georgia.

Abstract

This project used geoarchaeological techniques to examine how humans impacted the landscape at the middle Mississippian archaeological site Heritage Mounds (9DU2), in Dougherty County, Georgia, specifically looking at a borrow pit and a plaza. The site was the civic and ceremonial capital of the Capachequi territory, occupied at two separate times between AD 1250 – 1700. At the site soil samples were collected from two excavation units and two wetland cores. The units were for analysis of the plaza, and the cores were for analysis of the Mound A borrow pit. The samples were used for particle size and chemical analysis, and were examined for anomalies. These anomalies in the data allowed me to identify the process of earthmoving for the plaza creation, as well as documenting the incidental effects of their farming and earthmoving in the borrow pit.

Introduction

This thesis uses geoarchaeology through doing chemical analysis, and particle size analysis of soil samples to identify land use and human alteration of the landscape at the Heritage Mounds site, a large late prehistoric civic-ceremonial center in Dougherty County, Georgia. Geoarchaeology is the use of earth-science techniques, concepts, or knowledge to study the archaeological record (Rapp and Hill 2006:2). When doing geoarchaeology, archaeologists "investigate the relations between the geological environment and culture" (Rapp and Gifford [Hassan] 1985:87). For many people, it is mainly dealing in soils, sediment, and stratigraphy.

An example of this would be archaeologists using sediment samples in order to recreate ancient floods, or droughts through analysis of soil cores. Geoarchaeologists have also looked at sediments to determine sea level during the Middle Stone Age (Shackley 1981:22). The geological work done is a way to help "advise" the archaeological interpretation (Rapp and Hill 2006:1), although some believe that it should be the "heart of archaeological endeavor" (Barham and Macphail 1989:96).

The chemical analysis is intended to identify nutrients and minerals in the soil, that indicate that agriculture was practiced in the vicinity of the site. Particle size analysis may help identify sites of human alteration of the local landscape. In this case, I looked for anomalies in the particle analysis, such as a spike in the amount of clay, or a sudden drop in the amount of silt. I looked to compare each unit and each core, to see if the spikes correlated, or if it was isolated to the individual stratigraphy.

This research is important because this type of analysis has not been done in this area yet. Conducting this analysis and interpretation of archaeological soils provides valuable information about how Mississippian era Native Americans used and altered their natural landscape. This research also contributes to an understanding of human impacts on the environment. By physically documenting how humans have changed their environment in the past, this research can be used to discuss how humans today are altering their environment.

Particle analysis is important in archaeological research. Particle analysis research has been done at other Mississippian sites, such as Cahokia, in Illinois. For example, in 2012 scientists were looking for evidence of flood events around the time that Cahokia was a major center. They collected sediment cores to determine particle size, which they then graphed. These graphs helped show the patterns of particle size, and revealed a large time range where there were not any large flood events from AD 600 to AD 1200. By looking at the particle sizes from the cores, they were able to determine that one major flood event happened. They were able to do this because they saw a spike in the amount of larger particles in the cores. Because of the massive flood, the velocity of the water was much higher than either of these lakes had experienced for about 600 years (Munoz et al. 2015). This higher velocity had the strength to carry heavier, coarser particles than it had had before (Brown 1997:67). They determined that this was one of many floods that added pressure to Cahokia, and may have been a factor in their decline by AD 1350 (Munoz et al. 2015).

Doing chemical analysis of soil can help archaeologists in many ways. First, it can help identify archaeological sites. If specific chemicals are identified, they could mean that specific activities were happening in that area. Phosphates are a popular nutrient to look for when trying to identify if there was human activity at a site. Looking at soil chemistry sometimes helps identify a buried O horizon, because it would will contain remnants of "decomposing organic matter" (Redman 1999:83). When identifying particular nutrients or chemicals found in the soil, it may also help us identify what plants were grown at a site. One major indicator that there was human activity in this area, mainly agriculture, would be the absence of specific elements in the soil; nitrogen, phosphorous, potassium, calcium, magnesium, and sulphur (Rapp and Hill 2006:122). An example of this is corn. If we were to find a lack of nitrogen in the soil, it may indicate that core was grown there, as corn depletes the nitrogen from the soil. pH is also an important indicator because if there is a high pH it could indicate human activity, such as fire (Rapp and Hill 2006:122). When doing the chemical analysis, I also looked for charcoal, which is an obvious indicator that there was human alteration.

In the Caddon Huntsville site in Arkansas, archaeologists used geochemistry to identify human activity areas. The site had been abandoned in 1400 AD. The archaeologists used geochemistry by looking for inorganic phosphates. They measured the phosphate levels, and because of their low levels in certain areas, were able to determine that the areas were most likely ceremonial (Rapp and Hill 2006:122). They were able to do this because phosphates are one of the stronger indicators of human activity.

Mississippian Cultural Patterns:

The Heritage Mounds site is thought to be the first capital of the Capachequi territory, and one of the stops Hernando De Soto made on his expedition in the mid-16th century (Blanton 2017). The Capachequi territory was occupied during the Mississippian time period. Most Mississippian populations were very large (Bowne 2013:27). In order to feed their growing populations, most Mississippians practiced a mixed economy, meaning they used agriculture, as well as hunting and gathering, to feed the growing population (Bowne 2013:15). The Mississippian chiefdoms were dependent on trade and agriculture. They farmed corn, beans, squash, pumpkins, gourds, and sunflowers (Ethridge and Meyers 2006:142). To maintain their crops, the Mississippian people mainly looked for "bottomlands" where they would receive increased rainfall and little frost (Bowne 2013:2).

In order to plant their crops, the Mississippian people had to clear some of the old growth trees. To do this, they had to be "ringed," which is when bark is removed before the crops are planted; killing the trees. This kills the canopy that was keeping sunlight out, and eventually the trees would rot away (Bowne 2013:15,16).

The Mississippians would practice agriculture in the bottomlands, near the wetlands and rivers, and would live on the higher grounds (Bowne 2013:2). As mentioned above, corn was a major crop of the Mississippian peoples. Corn was easy to store and very productive (Bowne 2013:3). One problem with the cultivation of corn was its depletion of nitrogen from the soil. This meant that nitrogen-rich soil was needed to provide enough food to the large population. To prevent the depletion of soil nutrients, the Mississippian people also planted beans, which are nitrogen fixers (Bowne 2013:16). Other ways the Mississippians took care of their crops were to build "hillocks" to plant the corn. This kept the seeds from drowning from the heavy rainfall. They also planted squash to help hold the moisture in the soil, and used their large leaves to help prevent weeks from growing in between the hillocks (Bowne 2013:16). Because of how nutrient extracting corn is on the soil, the fields would need to be left fallow for some period of time. While this was happening, some edible wild plants, or plants that attracted wild animals, may have grown, allowing these fields to still be useful to the people (Bowne 2013:17). The Mississippian people also had personal gardens, where they grew plants like yaupon holly, pumpkins, and sunflowers (Bowne 2013:17). These gardens were sheltered by the buildings, and gained organic matter as fertilizer from the human's waste, such as food (Courchesn et. al. 2015).

One indication that the Heritage Mounds site is a capital is the presence of three large mounds. The typical Mississippian centers had large towns, several mounds, and flat plazas (Ethridge and Meyers 2006:142). As stated above, Mississippian societies were larger than the societies that came before. To account for this, Mississippian societies were ruled by chiefs. These chiefs could raise armies and extract taxes (Bowne 2013:1). These chiefdoms were hereditary, with the elite population sometimes living on the large mounds, getting buried in burial mounds, or controlling the temples on top of the mounds (Bowne 2013:1,2,4). Mounds were a staple at Mississippian sites, ranging from one to 29 mounds at a site. At the base of these mounds was usually a plaza that could have been artificially leveled through the addition or subtraction of soil from the surface. They could have also been occasionally swept clean, or even paved with river rocks (Hally and Mainfort 2003:280).

Houses in the Mississippian period consisted to two types: winter and summer houses. The winter houses were more closed in than the summer houses, sometimes being partially underground (Hally and Mainfort 2003:276). The structures that we excavated during the field school were both, one was partially subterranean, and one was fully above ground.

Large Mississippian mound sites are considered "local centers," where the elite may have lived, but there was not a large permanent population. These acted as a capital, which could be used to hold and protect the entire population if need (Pluckhahn and McKivergan 2002:150). These major centers were planned towns where the plaza and mounds were the major social and trade hearts of the community (Lewis 1996:127).

The reason Mississippians are interesting to study in regards to landscape alteration is because the Mississippian period brought massive population growth, settlement expansion, and warfare (Chamblee 2006:45). Because of this population growth and expansion, the social structure changed, and resulted in the massive earthmoving for the mounds. These mounds were not popular in the early and middle Woodland period, and were only commonly produced in the Mississippian period. The transition from the Woodland period was marked by agriculture and massive platform mounds, and was fairly abrupt (Schroedl et.al. 1990:189)

Description of Heritage Mounds Site

The Heritage Mounds site (9DU2) is in the southwest of Georgia, in Dougherty County, near Albany. The site is at least 62 acres and is located north of the convergence of the Chickasawhatchee Creek and an unnamed stream. The area around the site is currently used mainly for quail hunting and consists of widely spaced pines and oaks. It is longest from north to south at about 760 meters long. Field work commenced in 2014 with a James Madison University archaeological field school. The field school continued again into the summer of 2015. In 2016 a smaller team went to work there (Blanton 2017).

The site was occupied multiple times starting at about 8000 BC. Up until the Middle Mississippian period there had only been “short term archaic habitation.” The first major occupation was from AD 1200 to 1400. During this period, the initial building of the mounds, Mounds A, B, and C, was started. During this time, the site wasn’t used for occupation; it was mainly a “vacant ceremonial center.” After this, there was an unexplained hiatus from AD 1350 to 1550. The second occupation period started around AD 1550 and went until 1700. This late Mississippian period saw further construction of the three main mounds, and possible contact with the conquistador Hernando de Soto. Two European artifacts were found near Mound A, the larger of the three; that date is near the time that de Soto was supposed to come through the area, around AD 1540. This site is thought to be the capital of the Capachequi province that was mentioned in the chronicles of de Soto's men. Not much is said about it in de Soto's men's writing, except that the houses were described as "caves below ground" (Blanton 2017).

The site is made up of three pyramid shaped mounds, one larger one in the north, and two smaller to the south. All around the site are borrow pits. The borrow pit is where the people collected the soil for the mounds. The largest borrow pit, and the one that was sampled from for this study, is located southwest of the larger mound (Blanton 2017).

Methods

Sampling Rationale:

I decided to use two units and two cores because I wanted to get different perspectives on how the Mississippians altered their landscape. The units were used on higher ground because there was less sediment and soil to cover the strata from the time period I was looking to study. The wetland cores, however, had been covered by the sediment through the flooding of the wetland.

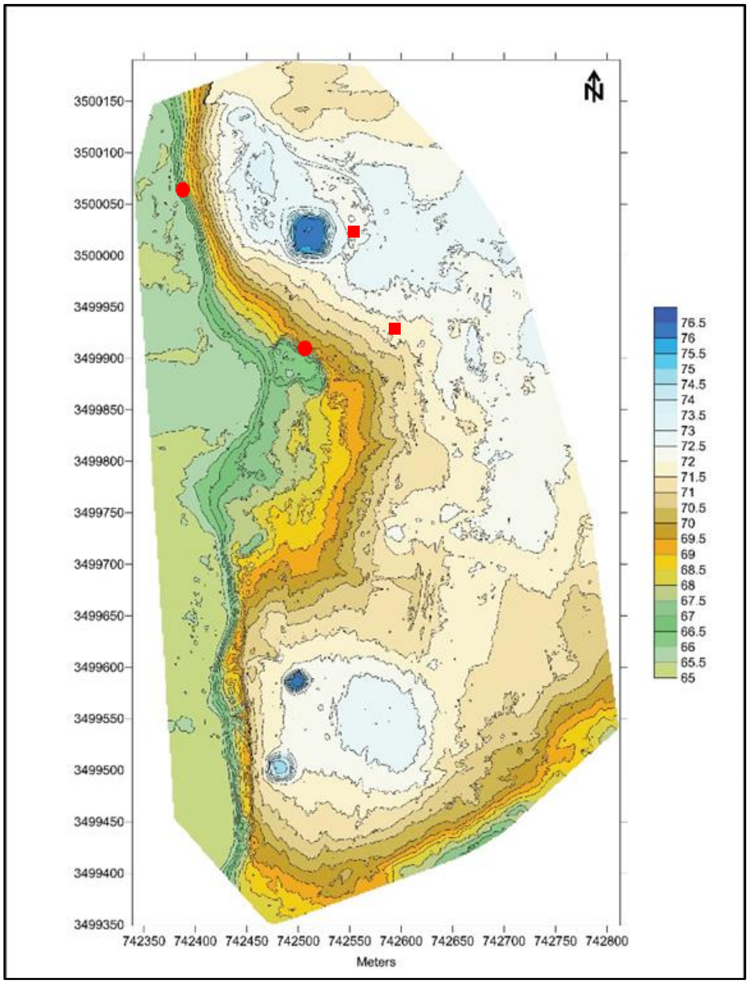


Figure 1. Lidar site map of 9DU2, the Heritage Mounds site. Red circles are the locations of the cores, and the red squares are the locations of the units.

I chose Unit 37 for the control because it was shown to be a unit that had no direct human alteration, but was still near an area that was known to have human occupation. I chose the area in front of Mound A because it looked flat to the naked eye, and was on the opposite side of the wetland. It faced the temple that was identified during the 2016 season. In most Mississippian communities, at the base of the mounds there are usually plazas that are flattened and kept clean, so using these assumptions, this area seemed to be the place to start looking for the plaza.

The locations of the cores were chosen because I was trying to test the Mound A borrow pit. The borrow pit location what chosen because it was a large pit, separated from the rest of the wetland. The wetland core was far enough from Mound A, but still close enough to be able to be used for comparison for the borrow pit core.

Field Methods:

Figure 2. Excavation at the plaza unit

The first unit was an extension to a unit dug by volunteers. This extension went down to 50 centimeters. At each 10 cm interval about 2 cups of soil was collected as well as all the artifacts from that level. This unit was physically undisturbed by human activity and was used as the control.

The second unit was in the middle of the plaza for Mound A and was therefore called Mound A Plaza Unit. This unit was dug down to 60 centimeters. For this unit, the soil samples were taken after the unit was completely dug, so each 10 cm level was measured on the south wall, and then the samples were taken from there. As we were digging artifacts from each level were also collected.

The third unit was at the south west apron of Mound A, and was called Mound A SW Apron Unit. This unit was dug until 90 cm. The excavation did not reach subsoil, but it was extremely difficult for any of us to reach farther to bring it down anymore. This unit did not provide many artifacts, which was unexpected.

Our first core was taken in the Chickasawhatchee wetland next to Mound A. This core was taken by cutting a point into a 10 foot, 2 inch PVC pipe, and hammering it into the ground with a sledge hammer. A lid was put on the top of the core using a primer and glue, to keep the soil where it was and to provide suction. For this core, we still had no way of pulling it out, so it stayed in the wetland for a few days. Eventually we used three galvanized pipes set up as a tripod and a come-along jack to pull it out. The bottom point was then cut off and a cap was glued to this end. For the next three cores the same procedure was followed.

Lab Methods:

Twenty-eight soil samples were sent to the University of Georgia Agriculture & Environmental Services Labs, where they were all tested for: LBC, pH, Equiv. Water pH, % base saturation, CEC, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, An, Organic Material, and carbon. The University of Georgia used the Mehlich 1 soil test.

Figure 3. Beckman Coulter LS 13 320 Laser Diffraction Particle Size Analyzer

Twenty-eight soil samples were analyzed using the Beckman Coulter LS 13 320 Laser Diffraction Particle Size Analyzer. The samples were prepared by being disaggregated by a mortar and pestle, so that there were no large clumps remaining for better analysis. The samples were poured through a splitter in order to get a representative sample of the soil. A sample of approximately 0.5g to 2.5 g was extracted for the grain size analysis. I started off with a lower weight, but as the analysis continued and the samples had a larger sand content, a larger amount of sample was needed to get the correct obscuration, which was anywhere from 8 to 12%, with 10% being ideal. The sample was then mixed with anywhere from 22.5 mL to 40 mL of 4% de-flocculant, or Calgon, to minimize clumping together of the clays. This is agitated for three to five minutes, and then poured into the machine. After 60 seconds, the data is presented as a graph and excel sheet.

Some of the samples needed to have the organics removed, so they were placed in a muffle furnace at 500° for 24 hours for carbon ignition. Some of the other samples were still damp, after having been left out for a few days, so they were put in the oven for 24 hours as well to dry them out. In between each sample, every piece of equipment was cleaned so that there was no contamination between the different samples.

All of the soil samples were more than 76% sand. Most of them were 80% sand, separated between fine, medium, coarse, and very coarse. While it was easy to tell that the soil was sandy, I overestimated the amount of clay in the soil when testing for the texture by myself.

Results

This section focuses on my observations of the core and unit profiles, the artifact counts, the particle size, and the chemical analysis. This section will first discuss each type of analysis first, starting with the cores, and then going on to the units.

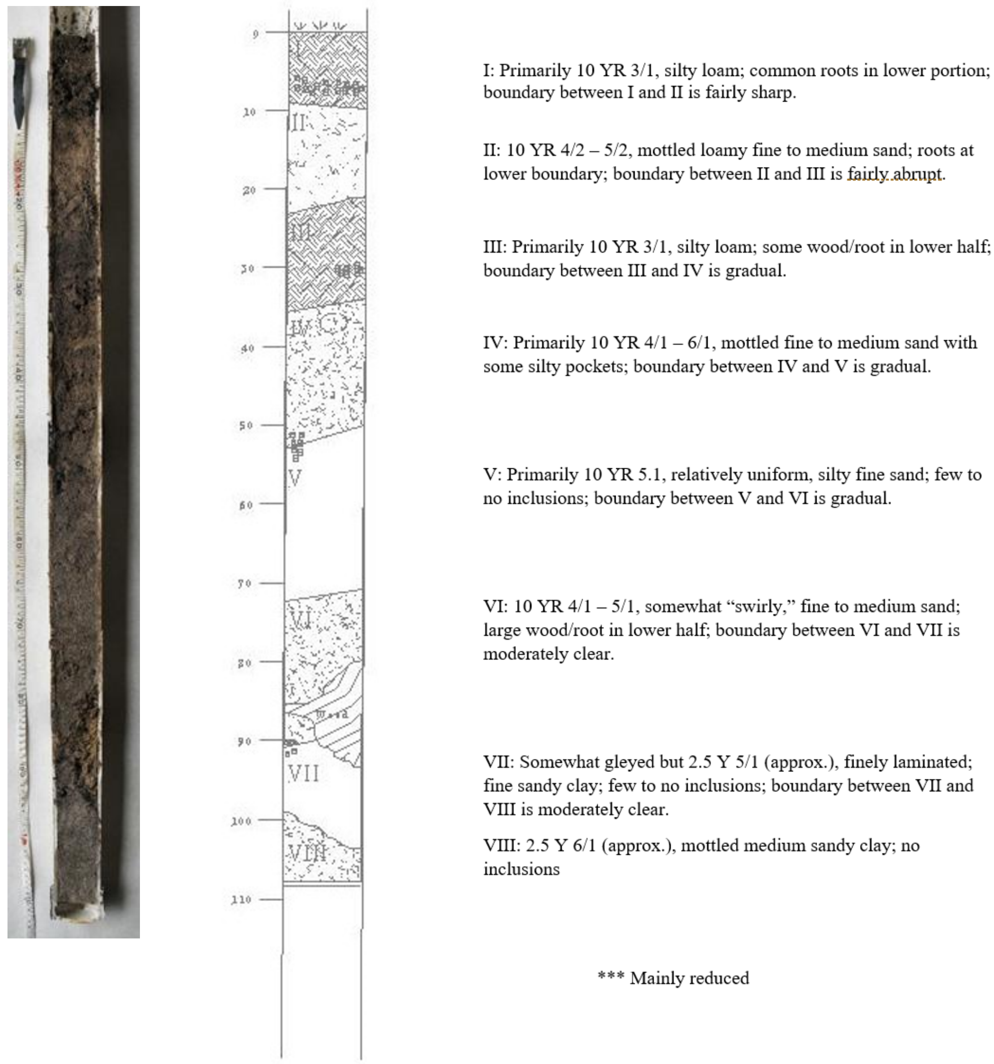


Figure 4. Mound A Wetland Core profile.

A) Core photo B) Core drawing

The Mound A Wetland Core provided eight strata: I, II, III, IV, V, VI, VII, and VIII. Stratum I is primarily 10 YR 3/1, with silty loam, and common roots in the lower portion of the stratum. The boundary between stratum I and II is fairly sharp. Stratum II is 10 YR 4/2 to 5/2 and mottled, with loam and fine to medium sand. There are roots at the lower boundary, and the boundary between stratum II and III is fairly abrupt. Stratum III is primarily 10YR 3/1 with silty loam and some wood and root in the lower half. The boundary between stratum III and IV is gradual. Stratum IV is primarily 10YR 4/1 to 6/1, and mottled. It is fine to medium sand with some silty pockets. The boundary between IV and V is gradual. Stratum V is primarily 10 YR 5/1 and is relatively uniform, with silty fine sand. There are few to no inclusion. The boundary between V and VI is gradual. Stratum VI is 10 YR 4/1 to 5/1, with somewhat “swirly” fine to medium sand. It has a large wood root in the lower half of the stratum. The boundary between VI and VII is moderately clear. Stratum VII is somewhat gleied, but is 2.5 YR 5/1, and approximately finely laminated with fine sandy clay. There are few to no inclusions. The boundary between VII and VIII is moderately clear. Stratum VIII is 2.5 Y 6/1 approximately, and is mottled, with medium sandy clay. There are no inclusions. This core is mainly reduced.

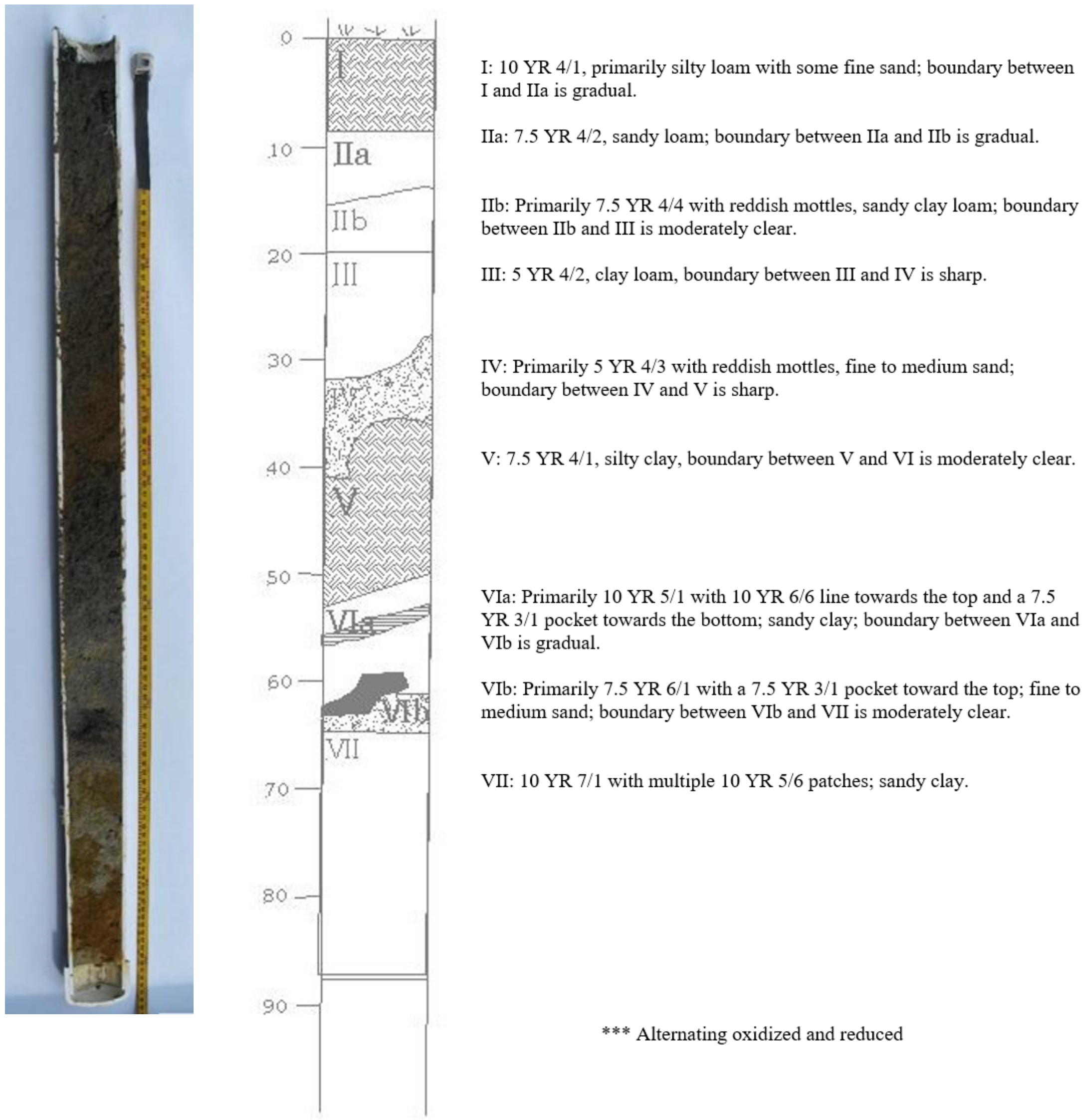
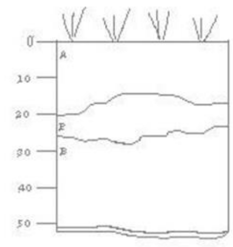


Figure 5. Mound A Borrow Pit Core profile

A) Core photo B) Core drawing

The Borrow Pit Core has nine strata: I, IIa, IIb, III, IV, V, VIa, VIb, and VII. Stratum I is 10 YR 4/1 and primarily silty loam with some fine sand. The boundary between stratum I and IIa is gradual. Stratum IIa is 7.5 YR 4/2, with sandy loam. The boundary between IIa and IIb is gradual. Stratum IIb is primarily 7.5 YR 4/4 with reddish mottles and sandy clay loam. The boundary between IIb and III is moderately clear. Stratum III is 5 YR 4/2 and clay loam. The boundary between III and IV is sharp. Stratum IV is primarily 5 YR 4/8 with reddish mottles and fine to medium sand. The boundary between IV and V is sharp. Stratum V is 7.5 YR 4/1 and silty clay. The boundary between V and VIa is moderately clear. Stratum Viz is primarily 10 YR 5/1 with a 10 YR 6/6 line towards the top and a 7.5 YR 3/1 pocket towards the bottom. It is sandy clay, and the boundary between VIa and VIb is gradual. Stratum VIb is 7.5 YR 6/1 with a 7.5 YR 3/1 pocket towards the top, and is fine to medium sand. The boundary between VIb and VII is moderately clear. Stratum VII is 10 YR 7/1 with multiple 10 YR 5/6 patches throughout, and is sandy clay. This core is alternating oxidized and reduced.

For the two cores, there are few similarities. Stratum I on both are similar, both being 10 YR and silty loam, the biggest difference being that the wetland core is 10 YR 3/1 and the borrow pit core is 10 YR 4/1. The next close similarity is on stratum V for the wetland core and stratum VIa for the borrow pit core. They are both 10 YR 5/1, although while the wetland core is silty fine sand, and the borrow pit core is sandy clay. These being the only similarities may indicate that stratum VIa is where the borrow pit started, and stratum I was the modern layer.



A: 7.5 YR 3/2 (Dark Brown); loamy sand.

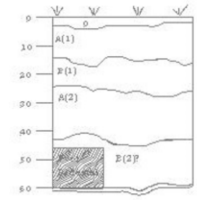
E: 5 YR ¾ (Dark Reddish Brown); sandy clay loam; the boundary between E and B is gradual.

B: 2.5 YR ¾ (Dark Reddish Brown); fine sandy clay loam.

Figure 6. Unit 37 Expansion profile: SW corner, West Profile, Control

A) Unit photo B) Unit drawing

The first unit, the Unit 37 expansion, went down to 50 centimeters, at each 10-centimeter interval, about two cups of soil was collected, as well as all the artifacts from that level. This unit was physically undisturbed by human activity and was used as the control. Stratum A is 7.5 YR 3/2 (dark brown) and a loamy sand. The E stratum is 5 YR ¾ (dark reddish brown) and a sandy clay loam. Stratum B is 2.5 YR ¾ (dark reddish brown) and a fine sandy clay loam. The boundary between stratum E and B is gradual. Stratum E is much thinner than both stratum A and B.



O: 7.5 YR 2.5/3 (Very Dark Brown); sandy loam.

A(1): 5 YR 3/3 (Dark Reddish Brown); sandy loam.

E(1): 5 YR 4.3 (Reddish Brown); sandy clay loam.

A(2): Buried A? Mottled 5 YR ¾ (Dark Reddish Brown); sandy clay loam (fine).

E(2): 2.5 YR 2.5/4 (Dark Reddish Brown); very fine sandy clay loam (possibly clay loam); root pedestal in bottom corner.

Figure 7. Mound A Plaza Unit profile: East Profile

A) Unit photo B) Unit drawing

The second unit was in the middle of the plaza for Mound A, referred to here as Mound A Plaza Unit. This unit was dug down to 60 centimeters. For this unit, the soil samples were taken after the unit was completely excavated, so each 10-centimeter level was measured on the south wall, and then the samples were taken from there. As we were excavating, artifacts from each level were also collected. Stratum O was 7.5 YR 2.5/3 (very dark brown) and sandy loam. Stratum A(1) was 5 YR 3/3 (dark reddish brown) and sandy loam. Stratum E(1) was 5 YR 4/3 (reddish brown) and sandy clay loam. Stratum A(2) is possibly a buried A layer, and is 5 YR ¾ (dark reddish brown) and a fine sandy clay loam. Stratum E(2) is 2.5 YR 2.5/4 (dark reddish brown) and a very fine sandy clay loam, or a clay loam. There is a root pedestal in the lower left hand corner of the E(2) layer.

When comparing these two small units, there are a lot of similarities. The A horizon of the plaza unit is very similar to the O horizon of unit 37. The O horizon is very dark brown sandy loam, while the A horizon is dark brown loamy sand. The plaza unit A(2) horizon also matches very closely with the unit 37 E horizon. They are both 5 YR ¾, and sandy clay loam. The plaza unit E(2) horizon is also very similar to the stratum B in unit 37. The only difference between the two, is that stratum E(2) is 2.5 YR 2.5/4 and stratum B is 2/5 YR ¾, which is almost nothing. Mound A Plaza Unit's stratum A(1) and E(1) do not match up as well with the strata from the Unit 37 extension. This may indicate that they are the plaza.

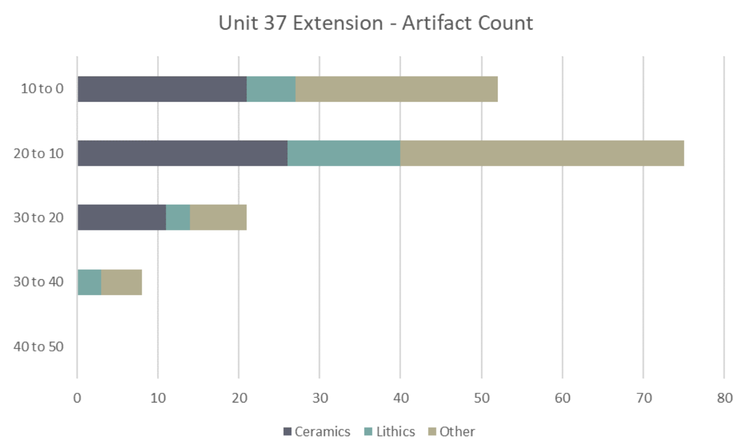


Figure 8. Unit 37 Extension artifact count – Total artifact count = 156

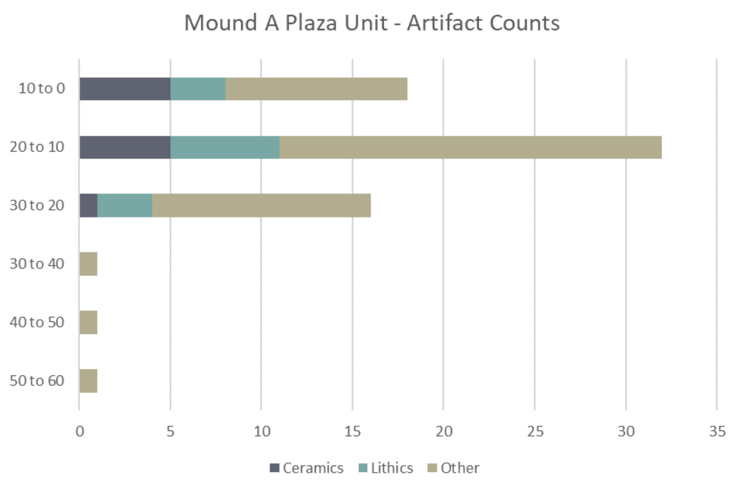


Figure 9. Mound A Plaza Unit artifact count – Total artifact count = 69

There were only 29 artifacts and 40 concretions collect from the plaza unit. This is a lot less than the number of artifacts found in unit 37. This would help support the idea that the plaza was kept clean from debris.

Particle Analysis:

This section will first examine particle size results for the two wetland cores. The first wetland core is the Mound A Wetland Core. This core will be considered the control, as it is from a natural setting. The second is the Mound A Borrow Pit Core, which is from an artificial setting.

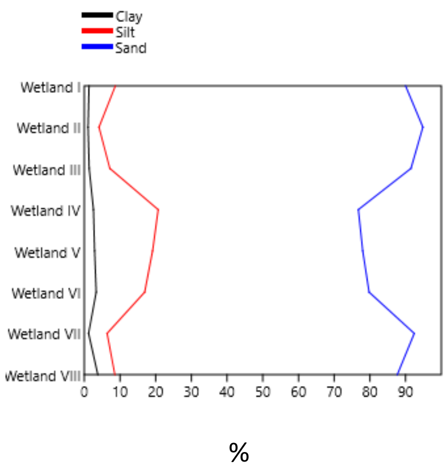


Figure 10. Mound A Wetland Core particle size percentages

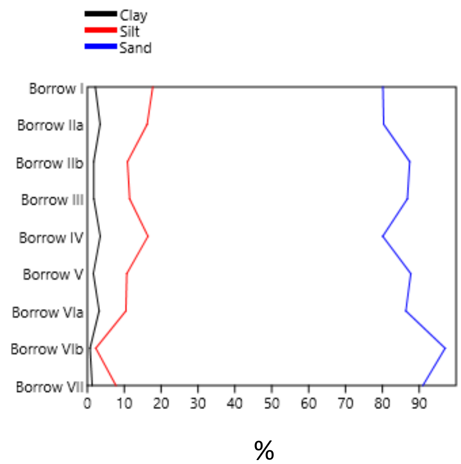


Figure 11. Mound A Borrow Pit particle size percentages

The Wetland Core has more silt towards the bottom, decreasing from stratum II to IV, and then increasing from stratum VII to IV. There is also a higher amount of clay after stratum IV. There is also a high amount of silt at stratum IV, V, and VI. In this core, there are two instances of fining upward. The first is from Stratum III and up, as the sand percentage decreases slightly from the 90's to 84%. The second is from the bottom, Stratum VII, to Stratum IV. Here the sand percentage decreases from 91% to 74%. The silt and clay percentages also increase, with clay going from 1.7% to 5.9% and silt going from 6.3% to 19.9%.

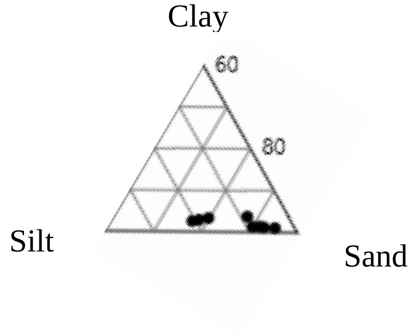


Figure 12. Mound A Wetland Core ternary diagram – particle size distributions / percentages

The Borrow Pit core has a high amount of silt at the top and it decreases towards the bottom. The sand also increases as it gets towards the bottom. There is also more clay as it gets closer to the top. These all indicate that the core is fining upward. Stratum VIb has an oddly low amount of silt, jumping from 8.66% in stratum VIa, to 2.22% in stratum VIb, and the back up to 8.29% in stratum VII. Stratum VIb also has the highest amount of sand, 96.67%. It jumps from 85.76% to 96%, and then back down to 89.61%. Stratum VIb also has the lowest amount of clay in the borrow pit core, at 1.10%, which is also a jump down from 5.58% in stratum VIa.

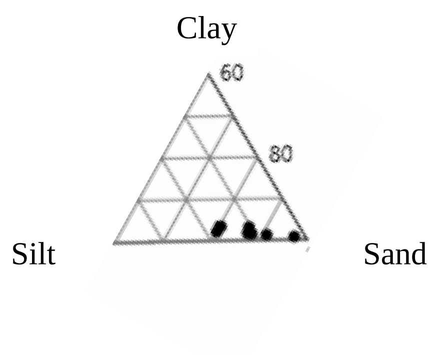


Figure 13. Mound A Borrow Pit ternary diagram – particle size distributions/percentages

Here I will be examining the two small units that were excavated. The first, the Unit 37 Extension, will be considered the control, as it was not noticeably altered by human activity. The second is the Mound A Plaza Unit, which was hypothesized that some alteration could be identified.

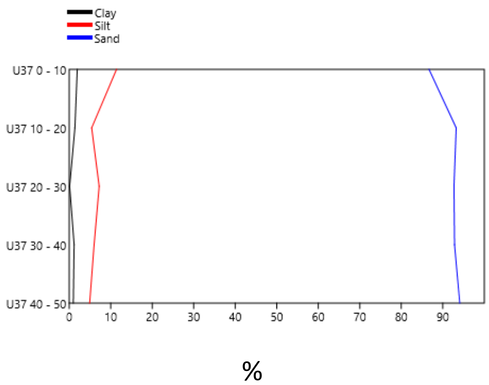


Figure 14. Unit 37 Extension particle size percentages

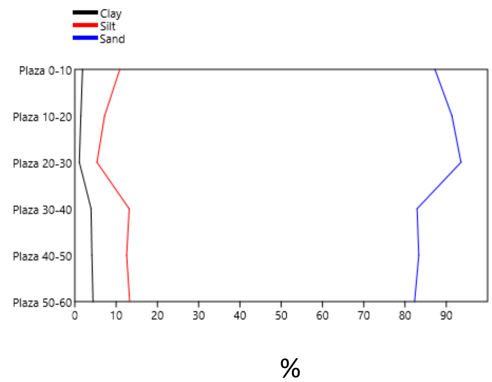


Figure 15. Mound A Plaza Unit particle size percentages

The Unit 37 Extension has the lowest amount of clay overall, from 20 to 30 cm its at 0.7%. This unit is pretty stable, with the sand slightly varying between 91% and 92%. The silt ranges from 5% to 7% and the clay ranges from 0.7% to 2%. This is all disregarding 0 to 10 cm, because it is out of the ordinary with every class; clay, silt, and sand.

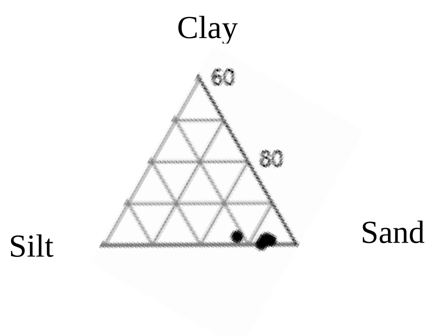


Figure 16. Unit 37 Extension ternary diagram – particle size distributions/percentages

The Plaza Unit is also fining upwards from 30 cm to the top. Despite this, there is a high amount of silt from 30 cm to the bottom. At 30 cm there seems to be a boundary, where is jumps from higher than 90% sand from 0 to 30 cm, to around 80% from 30 to 60 cm.

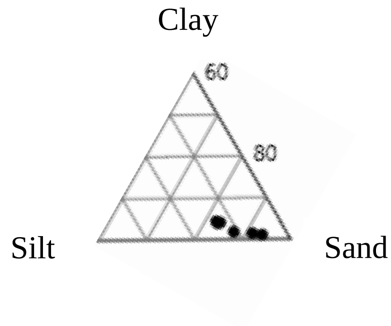


Figure 17. Mound A Plaza Unit ternary diagram – particle size distributions/percentages

Overall there is a significant amount more sand in all of the strata samples, ranging from as high as 74.18% to 96.67%. This means that each stratum would be considered either sand or loamy sand. The lowest percentage of sand, 74.18%, also has the highest amount of silt, at 19.93%. This stratum, Mound A Wetland Core Strat IV, however, does not have the highest amount of clay, at only 5.88%. The Plaza Unit from 50 cm to 60 cm, has the highest percentage of clay, 6.96%.

Chemical Analysis:

		mg/kg (ppm)											
Samp	**Ca**	**Cd**	**Cu**	**Fe**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**P**	**Pb**	**Zn**
I	1188	0.26	0.59	123.3	38.24	36.04	14.03	<0.05	13.14	0.27	7.48	1.07	2.42
II	572	0.14	0.23	38.2	11.00	12.17	4.66	<0.04	6.31	0.10	2.47	0.76	0.69
III	1017	0.16	<0.23	20.8	11.99	14.84	3.10	<0.05	7.36	0.17	1.79	0.96	0.67
IV	782	0.14	<0.20	12.2	9.82	12.63	1.07	<0.04	6.95	0.14	1.67	0.92	0.42
V	749	0.16	0.23	11.6	5.45	10.90	0.93	<0.04	6.80	0.12	2.08	1.23	<0.21
VI	659	0.13	0.24	11.3	3.97	9.31	0.57	<0.04	5.23	0.10	2.63	1.12	0.24
VII	668	0.07	0.24	12.8	5.74	7.87	<0.20	<0.04	4.93	0.05	2.48	1.39	<0.20
VIII	594	0.05	0.32	9.8	5.83	8.25	<0.20	<0.04	4.95	<0.04	2.54	1.15	<0.20

Table 1a. Mound A Wetland Core Chemical Analysis data – Elements

						%	
Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH $_{CaCl2}$ [2]	Equiv. water pH	Base Satur-ation %	CEC meq/100g	OM [3]	C
I	461	5.00	5.60	63.07	10.14	4.79	3.16
II	182	5.19	5.79	72.22	4.18	1.94	1.67
III	260	5.36	5.96	77.07	6.84	2.95	1.85
IV	191	5.51	6.11	81.68	4.98	2.01	1.23
V	164	5.64	6.24	86.05	4.51	1.79	0.96
VI	176	5.67	6.27	83.60	4.08	1.57	0.79
VII	153	6.10	6.70	93.89	3.67	1.02	0.44
VIII	165	6.25	6.85	96.09	3.20	0.79	0.24

Table 1b. Mound A Wetland Core Chemical Analysis data

In the Wetland Core, the pH decreases more and more with each stratum. This happens with most of the chemicals that were tested for as well. The only chemicals that didn't decrease were Cr, Cu, Mo, and Pb as they were fairly immobile. At stratum III there seem to be a lot of anomalies, some are higher than those around it, and some are lower. The CEC, Ca, Mg, Na, Zn and Om3 are all high, and the Cu, P, and Pb are all low. In the Fe there is a jump from 20.8 ppm to 12.2 ppm from stratum III to IV.

		mg/kg (ppm)											
Samp	Ca	Cd	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn
I	257	0.06	1.33	119.5	61.63	30.32	12.17	0.16	14.31	0.16	7.44	1.79	1.92
II-a	65	<0.04	0.81	117.8	12.61	10.23	2.08	0.08	5.39	0.05	7.65	0.67	0.47
II-b	60	0.05	1.23	254.1	9.53	12.22	2.49	0.16	6.25	0.10	6.08	1.37	0.78
III	55	0.04	1.42	237.5	7.00	10.64	1.08	0.15	6.69	0.09	8.35	0.72	0.65
IV	27	<0.04	0.52	97.1	2.69	5.11	0.27	0.04	3.08	<0.04	5.93	0.27	0.21
V	60	0.07	1.88	184.0	5.78	19.29	0.82	0.10	8.08	0.16	11.50	0.42	0.61
VI-a	40	<0.04	0.72	144.7	3.70	13.16	0.45	<0.04	5.61	0.04	5.37	0.27	0.21
VI-b	45	<0.04	0.79	155.5	3.83	14.89	0.48	<0.04	6.00	0.05	5.47	0.38	0.22
VII	55	<0.04	0.72	173.0	7.41	17.57	1.33	<0.04	6.26	0.08	4.26	1.15	0.37

Table 2a. Mound A Borrow Pit Core Chemical Analysis data – Elements

						%	
Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH $_{CaCl2}$ [2]	Equiv. water pH	Base Satur-ation %	CEC meq/100g	OM [3]	C
I	477	4.50	5.10	25.04	7.01	4.24	2.45
II-a	197	4.33	4.93	17.42	2.68	1.18	0.52
II-b	452	4.23	4.83	7.37	6.14	2.09	1.00
III	427	4.14	4.74	6.84	6.01	2.08	0.81
IV	168	4.24	4.84	9.73	2.05	0.65	0.24
V	701	3.98	4.58	4.94	10.35	3.08	1.54
VI-a	418	3.95	4.55	5.45	6.28	0.88	0.49
VI-b	147	4.15	4.75	19.59	1.97	0.51	0.28
VII	500	3.97	4.57	6.20	7.51	0.73	0.22

Table 2b. Mound A Borrow Pit Core Chemical Analysis data

Stratum V in the Borrow Pit core is distinct. Almost all of the chemicals that were tested for are unusually low in this stratum; Ca, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, Zn, and even Organic Material and carbon. There is an increase in Fe at strata IIb and III, where they are both in the 200s (254.1 ppm and 237.5 ppm respectively), while almost every other stratum is in the low to mid 100's. Cr increases after stratum V, and the pH is mostly steady until strata V and VIa, where it is slightly lower.

The data shows that these two cores are very different chemically. The borrow pit has significantly less Ca than the wetland core does, on average 700 ppm less. The Wetland core has much more Cd than the borrow pit core does. The borrow pit core also has more Cr than the wetland core does, as well as more Cu, Fe, K, Mg, Mo, P, and Zn. Rarely any of the chemicals tested for are close in both of these cores, just Pb and Na. Every other chemical is the opposite. The borrow pit has a lower pH in every single stratum, for both CaCl2 and Equivalent Water pH.

	mg/kg (ppm)												
Samp	Ca	Cd	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn
0-10	625	<0.04	<0.22	9.5	42.85	60.27	20.36	0.06	4.87	0.11	2.72	0.04	0.28
10-20	311	<0.04	<0.21	7.6	18.32	38.35	13.74	0.07	3.41	<0.04	1.92	0.05	<0.21
20-30	250	<0.05	0.37	7.0	26.26	61.67	17.53	0.09	7.26	<0.05	4.09	0.09	<0.23
30-40	222	<0.05	<0.27	8.3	25.38	35.05	17.24	0.09	5.10	<0.05	4.86	<0.02	<0.27
40-50	256	<0.05	<0.24	7.0	21.54	24.04	15.22	0.10	4.35	<0.05	4.60	0.06	<0.24

Table 3a. Unit 37 Extension Chemical Analysis data – Elements

						%	
Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH $_{CaCl2}$ [2]	Equiv. water pH	Base Satur- ation %	CEC meq/100g	OM [3]	C
0-10	368	4.94	5.54	54.69	6.88	2.79	1.85
10-20	183	5.16	5.76	61.78	3.14	1.44	0.81
20-30	233	5.03	5.63	50.48	3.69	1.50	0.64
30-40	263	4.68	5.28	36.19	4.11	1.51	0.47
40-50	262	4.77	5.37	38.58	4.03	1.49	0.37

Table 3b. Unit 37 Extension Chemical Analysis data

The pH in the Unit 37 extension is on average around the high 4s, but is it higher from 10 – 30 cm. There is a jump from 50 meq/100g to 36 meq/100g in base saturation at 30 cm. At stratum 20 – 30 cm, there is a higher ppm in Cu, Mg, and Na, and in stratum 10 – 20 cm there is a lower than normal K, Mn, and P.

								mg/kg (ppm)								
Samp	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn	OM [3]	C
0-10	195	<0.04	<0.04	0.37	8.4	30.75	41.79	19.43	0.09	4.57	0.11	25.83	1.39	0.55	2.31	1.18
10-20	108	<0.05	<0.05	0.31	8.2	43.46	31.66	26.45	0.10	4.07	0.05	7.25	0.09	0.24	1.82	0.79
20-30	104	<0.05	<0.05	<0.24	9.6	62.26	23.26	35.34	0.11	4.36	0.05	6.19	<0.02	<0.24	1.57	0.42
30-40	171	<0.05	<0.05	<0.25	8.6	54.92	26.26	29.91	0.11	3.64	<0.05	4.97	<0.02	<0.25	1.40	0.34
40-50	220	<0.05	0.06	<0.25	8.0	52.98	30.72	27.17	0.10	9.76	<0.05	4.66	<0.02	0.32	1.35	0.29
50-60	259	<0.05	<0.05	<0.26	7.0	38.34	37.82	22.76	0.13	8.09	<0.05	4.71	<0.02	<0.26	1.33	0.27

Table 4a. Mound A Plaza Unit Chemical Analysis data – Elements

					%	
Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH $_{CaCl2}$ [2]	Equiv. water pH	Base Satur- ation %	OM [3]	C
0-10	310	4.40	5.00	28.32	2.31	1.18
10-20	337	4.40	5.00	19.23	1.82	0.79
20-30	501	4.31	4.91	12.84	1.57	0.42
30-40	317	4.55	5.15	26.57	1.40	0.34
40-50	292	4.68	5.28	34.52	1.35	0.29
50-60	276	4.86	5.46	41.44	1.33	0.27

Table 4b. Mound A Plaza Unit Chemical Analysis data

The Plaza Unit pH is slightly lower from 20 – 30 cm, and this is clearer in the equivalent water pH. In this stratum there is also a high Fe, K, and Mn, as well as a low Mg and Pb. There is also an increase in base saturation percentage after 30 cm. Also at 30 cm is an increase from 104 to 171 ppm in Ca. At 20cm there is a decrease from 0.31 to <0.24 ppm in Cu, as well as a decrease from 0.09 to <0.02 ppm in Pb.

These two units were closer to each other than the two cores were. Unit 37 only had more Mg ppm. The Plaza Unit had more in Ca, Fe (slightly), K, Mn, and P. Everything else they were roughly equal. In both there seemed to be some sort of anomaly around 20-30 cm. In the plaza unit it is more distinct, but there are a few in the Unit 37 extension as well.

When looking at these comparisons, there are a few things that indicate human alteration. First, when considering the two cores that were taken, the Borrow Pit and the Wetland cores, the profiles indicate that Stratum V in the Wetland core and Stratum VIa in the Borrow Pit core are very similar. Because these are the only stratum that are similar in the cores, other than both stratum I's, this may indicate that the borrow pit starts at Stratum VIa. This is also indicated through the particle analysis, because in the Borrow Pit core, from VIb to VIa the sand volume percentage drops from 97% to 86%. Stratum VIa in the Borrow Pit core is not as important in the chemical analysis. The transition seems to be more in stratum V. The pH of almost all of the samples was very low, around 4, which was much lower than the 6 to 6.5 that is best for most plants. This may indicate that the soil was depleted.

Conclusions and Recommendations

The plaza seems to start around 30 cm because the artifacts completely drop off below 30 cm. While the plazas were kept clean, some material remains would have still ended up there. The soil above the 30 cm boundary is very similar to the particle size of the control, unit 37. Because of this and the fact that at 30 cm there seems to be a boundary in the particle size, I think that the soil above 30 cm was brought in from nearby, maybe even from somewhere else on the plaza. This is a common practice called cut and fill, where if there is a place that is too low, and a place that is too high, the soil from the higher elevation is moved to the zone with the lower elevation, in order to level out the entire area.

In the plaza unit, the organics decrease gradually as the stratum go farther down, but the strata at 0-10cm and 10-20 cm are noticeably higher than the rest of the soil (see Table 4b). The higher OM count can be explained easily from 0 – 10 cm, because that contains the O horizon, and is after both the original occupation and the reoccupation. This is when organics are allowed back on this space. The layer 10 – 20 cm may contain the reoccupation layer, because there are more artifacts found on this layer, as well as a higher organic matter percentage. This would indicate the reoccupation because this second group of people would not have been as reverent to this plaza space as the people who originally created it. It was still kept much cleaner than any other space, as there were less artifacts found here than in unit 37.

The borrow pit shows two possible periods of alteration. From Stratum VII through to stratum V is one, and the other is from stratum IV and up. This is first shown through the profiles. Stratum V is very similar to stratum I because they are both a darker layer. Strata V and I both have a higher amount of organic matter and carbon. These two dark, organic rich strata may indicate the abandonment periods, as something happened to the plant life to allow it to grow in this location again. Stratum VII would have been the original bottom of the borrow pit, and then stratum V would have been where the first occupation abandoned the site. These natural strata, VII, V, and I, are very similar to the particle size of most of the wetland core strata. When looking at the chemical data for the borrow pit, stratum V is a boundary. The calcium, cadmium, copper, iron, potassium, magnesium, molybdenum, sodium, nitrogen, and potassium are all higher than they were in stratum IV. The borrow pit core has a much lower average pH, as well as lower calcium and cadmium. The wetland core has lower chromium, copper, and iron. This helps support my claim that the borrow pit is an artificial site. There are more elements that are connected to human occupation in the borrow pit, like the metals, and the pH is leeched from the borrow pit, where it is at a healthier level in the wetland core.

As stated earlier, the Heritage Mounds had been abandoned and then reoccupied by the Mississippians (Blanton 2017). These two strata, V and I, could display these abandonment periods. When the site was abandoned the first time the lack of people being around the area would have allowed the organic material to continue growth. One explanation for these two periods could be the reoccupation of the Mississippians, and once they left again, is when stratum I was created. Another could be that the period after stratum V could have been the plantation period, and the agriculture that happened then. In this assumption stratum V could either be the abandonment from the reoccupation of the Mississippians, or it could be from the initial occupation.

In order to find out more precisely what this data means, if it was Mississippian reoccupation, or if it was plantation period, more research is needed. Dating of these deposits would be one of the most important things to consider when doing further research. More cores would need to be taken to gain an appropriate amount of material to date, but the dates would be able to more accurately determine which period each stratum means.

Pollen analysis would also be an interesting topic for further research. In the units, there is some data that indicates that the soil was brought in from elsewhere. When the artifacts almost cease to exist after 30 cm, or when the chemical data matches up are a couple examples. One problem with this is that the particle sizes do not match where they are expected to, as stated above. By doing pollen analysis, it may provide more data on where the soil originates, if it matched or did not match the soil in the control, or around it.

Pollen analysis would also be helpful in determining what trees were around near the abandonment periods shown in the cores. The Mississippians and the plantation owners would have cleared different trees, and planted others. When looking at the pollen data, it would help identify what was around during the time the strata were being formed, and it could help date them.

Appendix

Unit 37 Extension Artifact Inventory

Strat (cm)	Ceramics	Weight (g)	Lithics	Weight (g)	Daub	Weight (g)	Concretions	Weight (g)	Burned Wood	Weight (g)	Charcoal	Weight (g)
0 to 10	21	37.6	6	30.2	6	9.5	17	47.9	2	1.7	0	xxx
10 to 20	26	65.6	14	9.6	1	1.5	21	58.7	13	3.7	0	xxx
20 to 30	11	20.9	3	2.4	2	2	0	xxx	5	0.5	0	xxx
30 to 40	0	xxx	3	1.7	0	xxx	5	7.9	0	xxx	0	xxx
40 to 50	0	xxx	0	xxx	0	xxx	0	xxx	0	xxx	0	xxx

Mound A Plaza Unit Artifact Inventory

Strat (cm)	Ceramics	Weight (g)	Lithics	Weight (g)	Daub	Weight (g)	Concretions	Weight (g)	Burned Wood	Weight (g)	Charcoal	Weight (g)
0 to 10	5	6	3	1.1	1	0.4	9	5.9	0	xxx	0	xxx
10 to 20	5	6.8	6	10.2	1	0.2	20	18	0	xxx	0	xxx
20 to 30	1	0.6	3	3	0	xxx	11	7.2	0	xxx	1	0.1
30 to 40	0	xxx	0	xxx	0	xxx	0	xxx	1	0	0	xxx
40 - 50	0	xxx	0	xxx	1	0.8	0	xxx	0	xxx	0	xxx
50 - 60	0	xxx	0	xxx	1	0.2	0	xxx	0	xxx	0	xxx

Mound A Wetland Core Particle Size Data

Sample	Class (Volume %)						
	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Very Coarse Sand	Total Sand
Strat 1	1.327007	8.697741	47.153062	37.116245	5.4700503	0.23588615	89.97524
Strat 2	1.058687	4.118941	31.2073615	45.648825	15.2447795	2.721396755	94.82236
Strat 3	1.358287	7.151379	37.5274825	38.43167	14.4472385	1.083937916	91.49033
Strat 4	2.56062	20.69406	28.14108	32.50756	13.2984895	2.7981812	76.74531
Strat 5	2.88693	19.12416	27.108082	36.50141	12.4434305	1.936000711	77.98892
Strat 6	3.325877	16.91521	31.651209	39.756835	8.049119143	0.301738954	79.7589
Strat 7	1.207071	6.383153	33.827808	40.787345	16.2629615	1.531658015	92.40977
Strat 8	3.781324	8.559636	31.316842	43.362615	12.113094	0.866472675	87.65902

Mound A Borrow Pit Core Particle Size Data

Sample	Class (%)						
	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Very Coarse Sand	Total Sand
Strat 1	2.139638	17.73222	39.151845	32.763765	8.17347385	0.039087371	80.12817122
Strat 2a	3.4479	16.20455	25.2469615	33.93464	18.1755905	2.990357965	80.34754997
Strat 2b	1.727529	10.86744	31.3717165	33.831	19.27065	2.931663792	87.40503029
Strat 3	1.768451	11.475	34.4457685	33.099905	17.4744525	1.73643633	86.75656233
Strat 4	3.483652	16.43038	15.4680645	29.778015	25.747	9.0928805	80.08596
Strat 5	1.61948	10.69536	33.2948035	32.03818	18.29339	4.05877625	87.68514975
Strat 6a	3.188513	10.45918	19.5747235	35.84182	24.67229	6.263476	86.3523095
Strat 6b	0.726754	2.277657	13.6537875	38.11688	37.05175	8.1731711	96.9955886
Strat 7	1.280102	7.747341	30.974404	38.08614	19.234475	2.677552415	90.97257142

Unit 37 Extension Particle Size Data

Sample	Class (Volume %)						
	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Very Coarse Sand	Total Sand
0 - 10 cm	1.930704011	11.389239	47.528843	33.317835	5.7270532	0.106325006	86.68005621
10 - 20 cm	1.366564217	5.41408115	36.6284965	40.552645	14.272358	1.76586689	93.21936639
20 - 30 cm	0.09859561	7.21652655	36.4281315	41.905145	13.0709185	1.280670803	92.6848658
30 - 40 cm	1.17556688	5.99472095	30.894653	41.249055	19.3738805	1.312120279	92.82970878
40 - 50 cm	0.990057792	4.9201616	34.297185	42.291555	16.323698	1.177333641	94.08977164

Mound A Plaza Unit Particle Size Data

Sample	Class (%)						
	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Very Coarse Sand	Total Sand
0 - 10 cm	1.861056411	10.89731835	35.808995	34.58296	14.626357	2.223318669	87.24163
10 - 20 cm	1.447521366	7.20011955	37.975764	38.05935	13.918589	1.39864828	91.35235
20 - 30 cm	1.090184427	5.3643205	34.664463	42.03754	15.783229	1.060264101	93.5455
30 - 40 cm	3.933026526	13.164916	26.573292	36.73052	16.171464	3.4267828	82.90206
40- 50 cm	4.132455131	12.5449495	28.035774	38.11133	15.845478	1.3300243	83.32261
50 - 60 cm	4.403724713	13.286214	28.365624	35.253415	16.10881	2.582212855	82.31006

Mound A Wetland Core Chemical Data

		Mehlich 1 mg/kg (ppm)													
Lab	**Samp**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**P**	**Pb**	**Zn**
8110	WET I	1188	0.26	0.05	0.59	123.3	38.24	36.04	14.03	<0.05	13.14	0.27	7.48	1.07	2.42
8111	WET II	572	0.14	<0.04	0.23	38.2	11.00	12.17	4.66	<0.04	6.31	0.10	2.47	0.76	0.69
8112	WET III	1017	0.16	0.06	<0.23	20.8	11.99	14.84	3.10	<0.05	7.36	0.17	1.79	0.96	0.67
8113	WET IV	782	0.14	0.09	<0.20	12.2	9.82	12.63	1.07	<0.04	6.95	0.14	1.67	0.92	0.42
8114	WET V	749	0.16	0.10	0.23	11.6	5.45	10.90	0.93	<0.04	6.80	0.12	2.08	1.23	<0.21
8115	WET VI	659	0.13	0.08	0.24	11.3	3.97	9.31	0.57	<0.04	5.23	0.10	2.63	1.12	0.24
8116	WET VII	668	0.07	0.07	0.24	12.8	5.74	7.87	<0.20	<0.04	4.93	0.05	2.48	1.39	<0.20
8117	WET VIII	594	0.05	0.10	0.32	9.8	5.83	8.25	<0.20	<0.04	4.95	<0.04	2.54	1.15	<0.20

					%	meq/ 100g	%	
Lab	**Samp**	**LBC [1] (ppm $CaCO_3$/ pH)**	**pH $_{CaCl2}$ [2]**	**Equiv. water pH**	**Base Satur- ation**	**CEC**	**OM [3]**	**C**
8110	WET I	461	5.00	5.60	63.07	10.14	4.79	3.16
8111	WET II	182	5.19	5.79	72.22	4.18	1.94	1.67
8112	WET III	260	5.36	5.96	77.07	6.84	2.95	1.85
8113	WET IV	191	5.51	6.11	81.68	4.98	2.01	1.23
8114	WET V	164	5.64	6.24	86.05	4.51	1.79	0.96
8115	WET VI	176	5.67	6.27	83.60	4.08	1.57	0.79
8116	WET VII	153	6.10	6.70	93.89	3.67	1.02	0.44
8117	WET VIII	165	6.25	6.85	96.09	3.20	0.79	0.24

Mound A Borrow Pit Core Chemical Data

		Mehlich 1 mg/kg (ppm)													
Lab	**Samp**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**P**	**Pb**	**Zn**
8101	BP I	257	0.06	0.30	1.33	119.5	61.63	30.32	12.17	0.16	14.31	0.16	7.44	1.79	1.92
8102	BP II-a	65	<0.04	0.15	0.81	117.8	12.61	10.23	2.08	0.08	5.39	0.05	7.65	0.67	0.47
8103	BP II-b	60	0.05	0.16	1.23	254.1	9.53	12.22	2.49	0.16	6.25	0.10	6.08	1.37	0.78
8104	BP III	55	0.04	0.21	1.42	237.5	7.00	10.64	1.08	0.15	6.69	0.09	8.35	0.72	0.65
8105	BP IV	27	<0.04	0.11	0.52	97.1	2.69	5.11	0.27	0.04	3.08	<0.04	5.93	0.27	0.21
8106	BP V	60	0.07	0.24	1.88	184.0	5.78	19.29	0.82	0.10	8.08	0.16	11.50	0.42	0.61
8107	BP VI-a	40	<0.04	0.39	0.72	144.7	3.70	13.16	0.45	<0.04	5.61	0.04	5.37	0.27	0.21
8108	BP VI-b	45	<0.04	0.48	0.79	155.5	3.83	14.89	0.48	<0.04	6.00	0.05	5.47	0.38	0.22
8109	BP VII	55	<0.04	0.63	0.72	173.0	7.41	17.57	1.33	<0.04	6.26	0.08	4.26	1.15	0.37

					%	meq/ 100g	%	
Lab	**Samp**	**LBC [1] (ppm $CaCO_3$/ pH)**	**pH $_{CaCl2}$ [2]**	**Equiv. water pH**	**Base Satur- ation**	**CEC**	**OM [3]**	**C**
8101	BP I	477	4.50	5.10	25.04	7.01	4.24	2.45
8102	BP II-a	197	4.33	4.93	17.42	2.68	1.18	0.52
8103	BP II-b	452	4.23	4.83	7.37	6.14	2.09	1.00
8104	BP III	427	4.14	4.74	6.84	6.01	2.08	0.81
8105	BP IV	168	4.24	4.84	9.73	2.05	0.65	0.24
8106	BP V	701	3.98	4.58	4.94	10.35	3.08	1.54
8107	BP VI-a	418	3.95	4.55	5.45	6.28	0.88	0.49
8108	BP VI-b	147	4.15	4.75	19.59	1.97	0.51	0.28
8109	BP VII	500	3.97	4.57	6.20	7.51	0.73	0.22

Unit 37 Extension Chemical Data

		Mehlich 1 mg/kg (ppm)													
Lab	Samp	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn
8090	37, 0-10	625	<0.04	<0.04	<0.22	9.5	42.85	60.27	20.36	0.06	4.87	0.11	2.72	0.04	0.28
8091	37, 10-20	311	<0.04	<0.04	<0.21	7.6	18.32	38.35	13.74	0.07	3.41	<0.04	1.92	0.05	<0.21
8092	37, 20-30	250	<0.05	<0.05	0.37	7.0	26.26	61.67	17.53	0.09	7.26	<0.05	4.09	0.09	<0.23
8093	37, 30-40	222	<0.05	<0.05	<0.27	8.3	25.38	35.05	17.24	0.09	5.10	<0.05	4.86	<0.02	<0.27
8094	37, 40-50	256	<0.05	<0.05	<0.24	7.0	21.54	24.04	15.22	0.10	4.35	<0.05	4.60	0.06	<0.24

					%	meq/ 100g	%	
Lab	Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH_{CaCl2} [2]	Equiv. water pH	Base Satur- ation	CEC	OM [3]	C
8090	37, 0-10	368	4.94	5.54	54.69	6.88	2.79	1.85
8091	37, 10-20	183	5.16	5.76	61.78	3.14	1.44	0.81
8092	37, 20-30	233	5.03	5.63	50.48	3.69	1.50	0.64
8093	37, 30-40	263	4.68	5.28	36.19	4.11	1.51	0.47
8094	37, 40-50	262	4.77	5.37	38.58	4.03	1.49	0.37

Mound A Plaza Unit Chemical Data

		Mehlich 1 mg/kg (ppm)													
Lab	Samp	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn
8095	PLAZ, 0-10	195	<0.04	<0.04	0.37	8.4	30.75	41.79	19.43	0.09	4.57	0.11	25.83	1.39	0.55
8096	PLAZ, 10-20	108	<0.05	<0.05	0.31	8.2	43.46	31.66	26.45	0.10	4.07	0.05	7.25	0.09	0.24
8097	PLAZ, 20-30	104	<0.05	<0.05	<0.24	9.6	62.26	23.26	35.34	0.11	4.36	0.05	6.19	<0.02	<0.24
8098	PLAZ, 30-40	171	<0.05	<0.05	<0.25	8.6	54.92	26.26	29.91	0.11	3.64	<0.05	4.97	<0.02	<0.25
8099	PLAZ, 40-50	220	<0.05	0.06	<0.25	8.0	52.98	30.72	27.17	0.10	9.76	<0.05	4.66	<0.02	0.32
8100	PLAZ, 50-60	259	<0.05	<0.05	<0.26	7.0	38.34	37.82	22.76	0.13	8.09	<0.05	4.71	<0.02	<0.26

					%	meq/ 100g	%	
Lab	Samp	LBC [1] (ppm $CaCO_3$/ pH)	pH_{CaCl2} [2]	Equiv. water pH	Base Satur- ation	CEC	OM [3]	C
8095	PLAZ, 0-10	310	4.40	5.00	28.32	5.02	2.31	1.18
8096	PLAZ, 10-20	337	4.40	5.00	19.23	4.84	1.82	0.79
8097	PLAZ, 20-30	501	4.31	4.91	12.84	6.97	1.57	0.42
8098	PLAZ, 30-40	317	4.55	5.15	26.57	4.63	1.40	0.34
8099	PLAZ, 40-50	292	4.68	5.28	34.52	4.45	1.35	0.29
8100	PLAZ, 50-60	276	4.86	5.46	41.44	4.21	1.33	0.27

References Cited

Barham, Anthony J., and Richard I. Macphail
1995 Archaeological Sediments and Soils: Analysis, Interpretation and Management. London: Institute of Archaeology.

Blanton, Dennis
2017 Report of Archaeological Investigations at the Heritage Mounds Archaeological Site (9DU2), 2014-2016, Dougherty County, Georgia (DRAFT). N.d. MS. James Madison University, Unpublished.

Bowne, Eric E
2013 Mound Sites of the Ancient South: A Guide to the Mississippian Chiefdoms. Athens, GA: U of Georgia Press.

Brown, A.G.
1997 Alluvial Geoarchaeology: Floodplain archaeology and environmental change. Cambridge: Cambridge University Press.

Chamblee, John Francis
2006 LANDSCAPE PATCHES, MACROREGIONAL EXCHANGES AND PRE-COLUMBIAN POLITICAL ECONOMY IN SOUTHWESTERN GEORGIA. Ph.D. Dissertation, Department of Anthropology, University of Arizona, Tucson, Arizona.

Courchesne, F., M.C. Turmel, and C. Chapdelaine
2015 Chemical and Mineralogical Signatures of Archaeological Features at the Mailhot-Curran Iroquoian Site, Eastern Canada. Geoarchaeology 30: 414–429.

Ethridge, Robbie, and Maureen Meyers
2006 The New Encyclopedia of Southern Culture: Volume 3: History. The University of North Carolina Press, Chapel Hill.

Hally, David J., and Robert C. Mainfort, Jr.
2003 Prehistory of the Eastern Interior After 500 B.C. In Southeast, edited by Raymond D. Fogelson, pp. 265-285. Handbook of North American Indians, Vol. 14, William C. Sturtevant, general editor, Smithsonian Institution, Washington DC.

Lewis, R. Barry
1996 MISSISSIPPIAN FARMERS. Kentucky Archaeology 127-60. University Press of Kentucky.

Munoz, Samuel E., Kristine E. Gruley, Ashtin Massie, David A. Fike, Sissel Schroeder, and John W. Williams.
2015 Cahokia's Emergence and Decline Coincided with Shifts of Flood Frequency on the Mississippi River. PNAS 112.

Pluckhahn, Thomas J., and David A. McKivergan
2002 A CRITICAL APPRAISAL OF MIDDLE MISSISSIPPIAN SETTLEMENT AND SOCIAL ORGANIZATION ON THE GEORGIA COAST. Southeastern Archaeology 21(2):149-61.

Rapp, George, and Christopher L. Hill.
2006 Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation. 2nd ed. N.p.: Yale U.

Rapp, George, Jr., and John A. Gifford
1985 Archaeological Geology. New Haven: Yale U Press.

Redman, Charles L.
1999 Human Impact on Ancient Environments. Tucson: The U of Arizona Press.

Schrodel, Gerald F., and C. Clifford Boyd, Jr., and R.P. Stephen Davis, Jr.
1990 Explaining Mississippian Origins. In *The Mississippian Emergence,* edited by Bruce D. Smith, pp. 175 – 196. Smithsonian Institution Press, Washington and London.

Shackley, Myra
1981 Environmental Archaeology. London: George Allen and Unwin Ltd.