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The Dirt on the Collins Mounds Site

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The Dirt on the Collins Mounds Site

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Abstract

Building monumental architecture has been one method used by humans to rise above an earthbound existence. In the United States, large earthen mounds were constructed from the Archaic period to the Mississippian period. The Collins Mound Site in Arkansas was recently dated to the Late Woodland period. For this study, soil samples were extracted from the northern section of the site for description and particle-size analysis. Erosion from plowing, wind, water, and gravity is the most likely process causing a decreased mound height and increased basal diameter. Mound fill likely originated near the river for two of the mounds and was collected from the topsoil in close proximity to the third mound. The absence of an A horizon indicates the mound builders prepared the surface before construction.

Acknowledgments

This thesis would not have begun, progressed, or concluded without the aid of many people. First, the author would like to thank Dr. Marvin Kay for encouragement, guidance, and patience throughout this whole process. A special thank you to the rest of the committee members, Dr. Margaret Guccione and Dr. George Sabo. Dr. Guccione provided, not only access to the coring machine, sieve shaker, and a lab, but also invaluable instruction and advice on coring, soil description, and Sigmaplot. Thanks to the Department of Geosciences for the use of the equipment and labs.

Many of my fellow Graduate students were vital in the extraction of the cores. The 2014 fieldwork was possible with the help of Stephanie Sullivan, Ben Donnan, and Sam Arman, with technical support from Mike Evans and Jared Pebworth at the Arkansas Archaeological Survey and Jessica Howe. The 2015 fieldwork was possible because of Michelle Rathgaber, Cheyenne Lewis, and Sarah Livengood. I also had help from two of my fellow archaeological technicians, Katelyn Ingersoll and Trevor Iliff. Michelle Rathgaber also provided results from the cores along the river. Stephanie Sullivan provided GPS advice, the Digital Elevation Model of the site, and the geophysical survey that helped direct the placement of the cores. She also provided the radiocarbon date of Mound C. Chris Fletcher provided GIS technical support.

Particle size analysis wouldn't have been possible without the generosity of Dr. Kristofor Brye and Graduate student, Taylor Adams, in the Department of Crop, Soil, and Environmental Sciences at the University of Arkansas. They provided endless advice and information regarding the hydrometer method and time and use of the equipment in the Soil Physics Lab.

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1. Introduction

Monumental architecture has been built around the world for thousands of years by different cultures and for different reasons. Monuments elevate an earthbound being to a higher plane. For me, it's not just the change in worldview that I find fascinating, but the act of building such a large structure. In the United States, these large structures are earthen mounds. Treating mounds as artifacts can provide insights into the builder's social structures, ritual and symbolic beliefs, and technological knowledge (Kay, Sabo III, & Merletti, 1989; Sherwood and Kidder, 2011). This thesis is only a small step towards understanding the mound builders of the Collins Mound Site (Figure 1).

Figure 1. View of Mound C and Mound B to the north at the Collins Mound Site (Photo By Author).

This thesis is a continuation of a project that began in the fall of 2014. The next phase of the project involved extracting cores in the fall of 2015, including the five cores used in Rathgaber's study on the velocity and migration of the Whiter River. While the results of Rathgaber's study are notable and applicable, they are not within the scope of my research. For my research, three areas of interest were focused on, with the following questions as guidelines.

1. Mound height – Have the mounds decreased in height? Can this be seen by comparing the quantities of sand from the summit, slope, and base of the mounds?
2. Mound fill origin – Is it possible to determine the location of the source of mound fill using particle size analysis? Were the builders seeking out a specific texture of sediment?
3. Human and natural influences – Is it possible to see the effects of human influences, particularly plowing, and natural influences, such as flooding, on the mounds through the use of particle size analysis? Is it possible that the mounds have been significantly altered by these influences?

The study of mounds has a long history, crossing many disciplines, and utilizing many approaches, all with the goals of discovering the use, construction, chronology, and/or beliefs involved with these large structures. There have been several research projects conducted on mound sites within close proximity to the Collins site. At the Norman site in eastern Oklahoma, digital photography was used to study mound stratigraphy, ultimately exhibiting the importance of sediment color to the mound builders (Vogel, Kay, and Vogele, Jr., 2005). In 1982, the excavation of the Copple Mound at the Spiro Mounds site found a highly complex mound stratigraphy with multiple stages of use and capping episodes (Leonhardy, 1989). Kerr (1992) and Mulvihill (1996) used phosphate analysis to research two mounds at the Huntsville site. Kerr's research focused on the ceremonial and burial activities of Mound A. Mulvihill focused on the use of phosphate signatures in identifying and comparing different features, activities, and historic influences on Mound C. My study continues and adds to a long, multi-faceted tradition of evaluating and treating mounds as artifacts in the search for a greater understanding of the prehistoric people who built them. By using coring and particle-size analysis to examine the cultural and natural processes that have formed and transformed the Collins site, this research contributes to the ongoing conversation concerning these large earthen structures.

1.1 The Collins Site

The Collins Site is located near the town of Elkins in Washington County, Arkansas (Figure 2). It consists of five mounds, labeled A, B, C, D, and E, within an 18 hectare area (Figure 3). The mounds are on private land, with two different owners. Mounds A and E, the southernmost mounds, are inaccessible. Mounds B, C, and D, along an east-west line in the northern section of the site, are accessible for investigations, excluding excavation. Mound D lies slightly southwest of Mounds B and C. Mound heights range between 0.5 and 3 meters above the surrounding landscape and have basal diameters between 21 and 51 meters (Kay et al., 1989; Sullivan & McKinnon, 2013). Though Mound B is shorter than Mound A, it is about 2.5 m high and the tallest of the three accessible northern mounds. Mound C is about 61 cm shorter than Mound B and Mound D about 89 cm shorter than Mound C and 1.5 m shorter than Mound B.

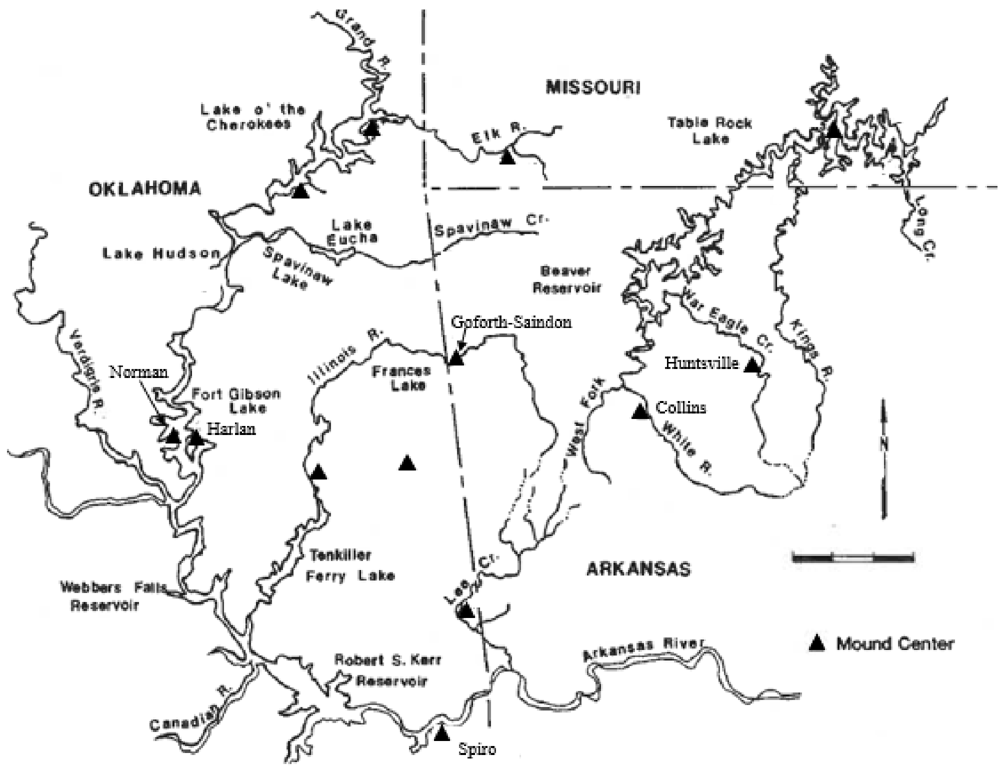

Figure 2. Location of the Collins site and nearby mound centers (after Vogel, Kay, & Vogele Jr., 2005; Kay, Sabo, & Merletti, 1989).

Historically, the land has been used for agriculture and grazing cattle. The last evidence of plowing, including on the mounds, was in an aerial photograph from 1941 (Vogel, 2005). The land has been used for pasture for at least the last 50 - 60 years (Fritz, 1986). Reports indicate that the study area was plowed using horse and mule teams (Fritz, 1986) and "maybe never chisel plowed" (Flenniken, 1971). Due to plowing and erosion, the mounds are likely shorter and wider than when originally constructed (Fritz, 1986; Kay et al., 1989).

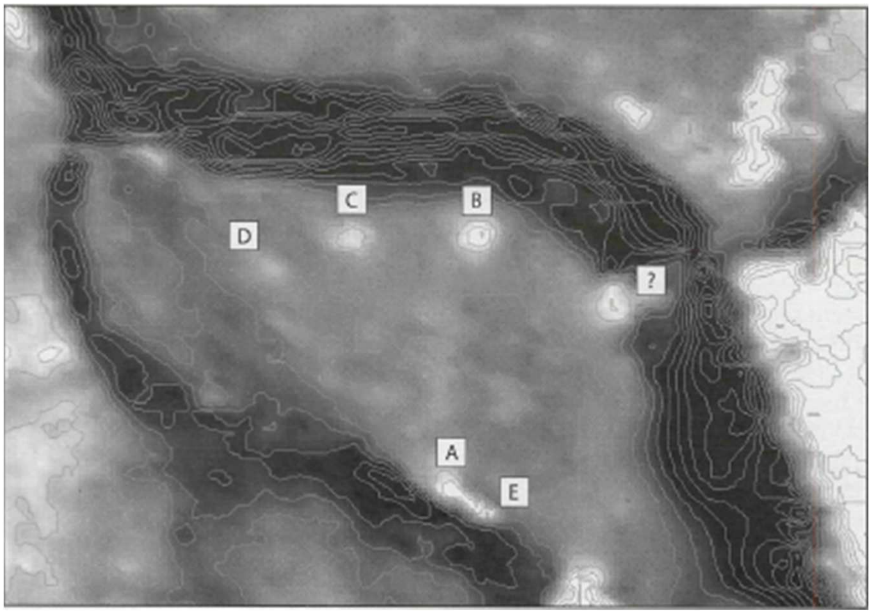

Figure 3. Mounds A - E at the Collins Site (from Sullivan & McKinnon, 2013). Darker area near B, C, and D is the current channel of the White River. Darker area near A and E is an old channel. Contours indicate elevation.

Over the years, there have been reports of trenches, excavation, and looting in the mounds. Mounds A and E were looted in 1979 (Fritz, 1980). Mound A was trenched in the 1940s (Flenniken, 1971; Fritz, 1978; Vogel, 2005). Mound B might have been trenched in the 1930s (Fritz, 1978) and excavated in 1941 (Fritz, 1986). An undocumented excavation of Mounds C and D by the University of Arkansas (U of A) museum took place in the 1930s (Kay et al., 1989).

In 2013, Sullivan and McKinnon published an article on their geomagnetic survey of Mounds B, C, and D, which drew similarities between the structures in the mounds to structures on Caddo sites. Mound B contains a 20 x 20 m square structure with off-mound structures to the east and west. Mound C contains a 45 x 30 m rectangular structure with internal and off-mound structures. The contours of Mounds B and C show possible ramps departing from the mounds south into the “plaza area” between the northern and southern groups. Mound D contains a 30 x

15 m structure with no off-mound structures. Sullivan and McKinnon (2013) propose that Mound C had a ceremonial purpose based on indications that it may contain remnants of a charnel house, similar to those found at the Harlan, Goforth-Saindon, and Huntsville sites (Kay et al., 1989; Kay & Sabo, 2006), and a south-facing entranceway opening onto a central open area, a feature commonly found on Caddo sites (Pertulla, 2009).

1.2 Regional Setting

The East Fork of the White River near Elkins, Arkansas is located near the escarpment between the Springfield and Boston Mountain Plateaus (Figure 4). These plateaus are two of three plateaus located in the Ozark Plateaus. The most northern plateau of the three is the Salem Plateau, which includes north-central Arkansas and the St. Francois Mountains in southeastern Missouri. The southern border of the Salem Plateau is separated from the Springfield Plateau by an escarpment with relief that is less than 30 m (Guccione, 1991). On the southern border of the Springfield Plateau, the escarpment relief begins at about 150 m and increases to 300 m where the Boston Mountain Plateau begins (Guccione, 1991). The Ozark Plateaus create the southern slope of a dome, with the apex at the St. Francois Mountains in Missouri. Originating in the Boston Mountains, the White River flows north as three branches, the West, Middle, and East Forks, and joins at a confluence near Fayetteville, Arkansas at the southern edge of the Springfield Plateau border (Guccione and Rieper, 1988).

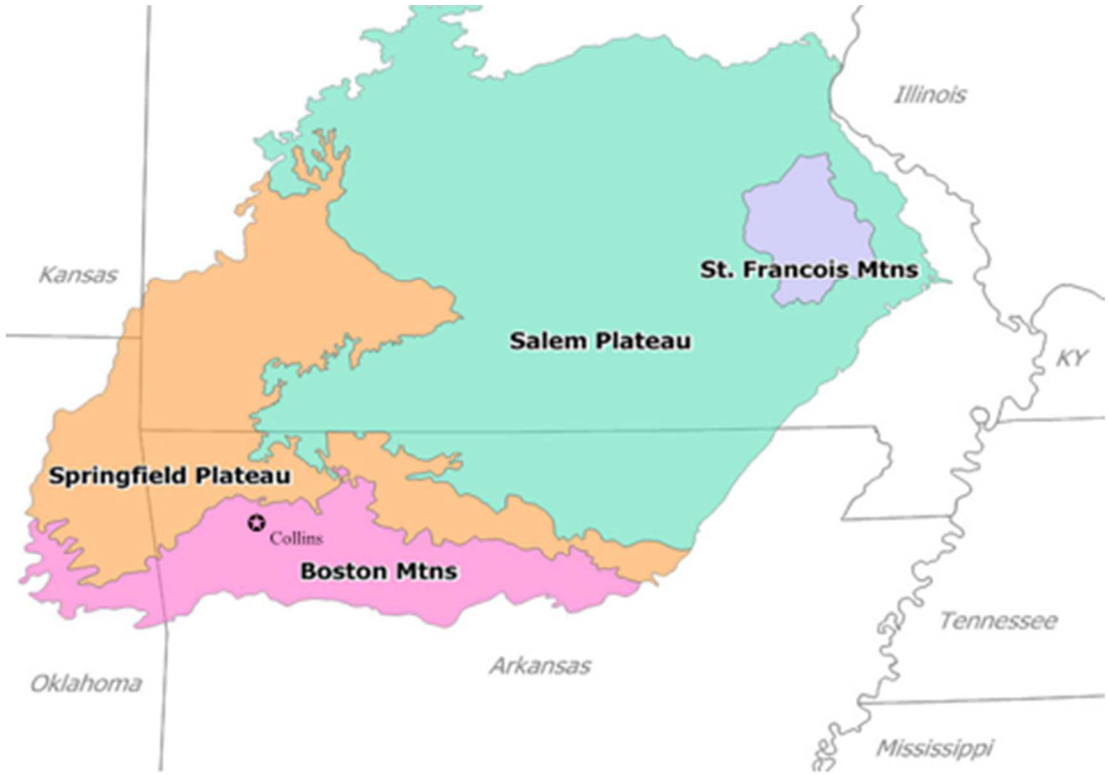

Figure 4. The Collins Site within the Ozark Plateaus (modified from open source image, Wikimedia Commons).

The St. Francois Mountains are Precambrian Era (4700 to 570 MYBP) intrusive and extrusive rocks (Guccione, 1993a). This area, including that at what is now the Collins site, was later covered by a shallow sea, about 200 meters deep. Occasionally, this area would be exposed to weathering when the sea level dropped (Guccione, 1993a). The sedimentary bedrock exposed at the Collins site would form from the carbonate and mudstones that accumulated during the Late Paleozoic Era (570 to 245 MYBP) (Guccione, 1993a). During the late Pennsylvanian, the Ozarks were uplifted above sea level exposing the area to weathering and erosion. The glaciers that covered a large portion of the North American continent during the Quaternary Period (1.65 MYBP to today) never extended as far south as Arkansas. Instead, fluvial systems, such as the

White River drainage, incised the uplifted Ozark Dome, forming the floodplains and terraces, and providing landforms conducive to habitation by humans (Guccione, 1991, 1993a).

The current channel of the White River borders the Collins site on its north and east sides. A paleochannel is about 300 meters to the west of Mounds B, C, and D (Fritz, 1978) and west and south of Mounds A and E (Figure 3) (Kay et al., 1989). The White River is a small, meandering stream, with point bars of gravel and sand and up to three terraces in some areas (Guccione, 1993b). When the water level is low, Boone Formation limestone with chert inclusions is visible in several areas in the White River channel (Guccione and Reiper, 1998; Soil Survey Staff, 2014).

The soil from the river to the bases of Mounds B and C on the north and east sides is a Cleora sandy loam (Soil Survey Staff, 2003). This well-drained soil is commonly found on floodplains and has loamy alluvium parent material. A typical profile includes sandy loam that becomes a loam at depth. The rest of the study area is a Razort loam. This is also a well-drained soil and common to stream terraces. Like Cleora, it also derives from a loamy alluvium parent material. The typical profile has a loam surface, overlying a silt loam and becomes very gravelly at depth.

Although further tests are needed, preliminary results from Rathgaber's study (2015) suggest a migrating river with at least three large flood events and a possible shift in channel position to the south (Figure 5). The site has been known to flood during significant rainfall, with the level reaching the base of the mounds (M. Kay, personal communication, 2015). Frequent flooding accounts for the vertical accretion of sediments seen on the floodplains of Ozark streams (Guccione, 1991).

Figure 5. Possible coarse change (the purple lines) of the White River at Collins (from Rathgaber, 2015).

Because there has been no documented formal excavation at Collins, less information is known about the subsurface of the mounds. Goforth-Saindon and Huntsville are the closest mound centers to Collins. Mound 1 at Goforth-Saindon and Mound A at Huntsville have been excavated. The stratigraphic evidence at both of these mound sites demonstrates the complexity of layers that were developed over centuries of mound construction. Surfaces are repeatedly prepared for specific ritualistic purposes. The sediments used for these surfaces are commonly specific in their color and texture. Kay et al. (1989) propose that the builders of these mounds, either the Caddo or a group affiliated with the Caddo, linked the sediments, surfaces, structures, and site configurations to cosmological beliefs and rituals and not just technological needs.

What little is known comes from a report submitted after the looting of Mounds A and E (Fritz, 1980), aerial photographs taken in 1936 and 1941 (Vogel, 2005), and the geophysical survey done by Sullivan and McKinnon (2013). During the looting of 1979, a rough description of mound stratigraphy was noted using clods of soil from the backhoe excavation (Vogel, 2005). Textures included sand and clay with dark yellowish brown, strong brown, and very dark gray colors. Within the clods, the colors of the sediment changed in less than one centimeter, suggesting a "loading of contrasting matrix" (Vogel, 2005).

From the aerial photographs, Vogel noted changes in soil color where the mounds are located (2005). In the 1936 photograph, Mounds B, C, and D are patches of lighter color surrounded by rings of soil that are darker. In the 1941 photograph, Mounds B and C are still the lighter color. However, Mound D is a darker patch. In both photographs, the fields are still cultivated. Vogel (2005) suggests that the darker line between Mounds C and D is another paleochannel of the White River.

1.3 Fluvial Setting

Meandering streams in the Ozarks have low gradients and a fairly stable flow of water (Figure 6) (Waters, 1992). Flooding of adjacent landforms occurs once or twice a year. During normal levels of flow, water travels between concave and convex banks. The velocity of the water increases near the concave bank of the stream, eroding sediments, and slows on the convex bank, depositing sediment. The repetition of erosion, or degradation, and deposition, or aggradation, causes a lateral movement of the stream's channel. Lateral accretion of sediments, in the channel, as a result of this migration creates the coarser bottom stratum of gravel and cobbles. Vertical accretion produces the top stratum, which contains fine sand, silt, and clay. The aggradation of the top stratum gradually increases the elevation of the floodplain (Brackenridge, 1988; Waters, 1992). A period of stability, when little erosion and deposition occurs, allows soil formation (pedogenesis). Erosion, deposition, and pedogenesis contribute to the formation of point bars, levees, and terraces on the floodplain.

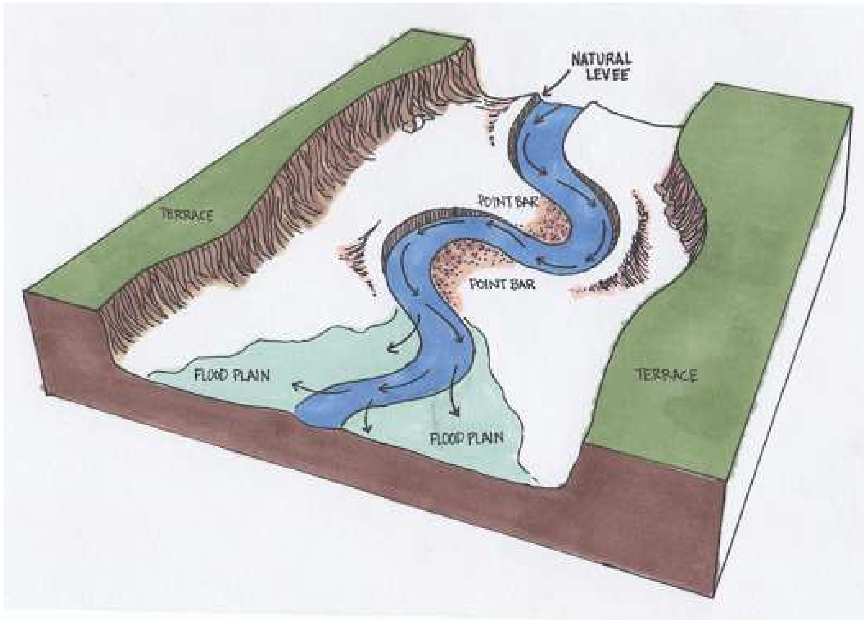

Figure 6. Cross-section of a meandering stream. Arrows indicate movement of water.

In a meandering stream, the highest velocity and turbulence are found on the channel floor (Waters, 1992). Above the bedrock, channel lag, the bedload gravel and sand, accumulates along with blocks of eroded sediments and saturated plant debris in the deep area of the channel on the concave bank of the meander. Finer silts and clays are incapable of settling in this environment. During normal flow, point bars form on the convex bank of the channel. Sediments eroded from the concave bank accumulate on the point bar as the water velocity slows. Finer particles, fine to coarse sands, settle further from the channel and higher on the point bar and coarser particles, channel lag, lower down on the point bar and closer to the channel (Brown, 1997). This creates a lateral fining up sequence. The types of sediments that are deposited on a point bar depends on the consistency of the sediments carried by the river. When overbank flooding occurs, a vertical fining up sequence may also be seen with the deposition of silts and clays on the surface of the point bar.

Natural levees are also a product of overbank flooding. Sediments deposited are a combination of sand, silt, and clay, usually with a higher, weakly structured sand content (Waters, 1992; Holliday, 2004). These sediments become thinner and finer as the levee extends away from the channel. Levees are commonly heavily vegetated and plant debris becomes interspersed with the laminations of sediments.

Beyond the levee, in the low lying, flat area adjacent to the channel is the flood basin of the floodplain, or simply, the floodplain. During overbank flooding, as the water velocity slows with distance from the channel, larger quantities of finer sediments, like silt and clay, are deposited. The combination of lower elevation and more poorly draining sediments can produce mottling and gleying. Like the point bar, the vertical accretion of these finer sediments creates a fining up sequence in the soil profile. Often the floodplain develops above an old point bar and a bottom stratum is seen below the finer sediments. When a meander is cut off from the channel, meander scars can also be seen in a floodplain. The remaining area can eventually fill in with sediment and creates a crescent shaped area with a profile that has an old channel at the bottom (bedrock and gravel) and a top stratum above. Overlapping meander scars are common to migrating meandering streams, such as the White River.

1.4 Coring in Archaeology

Coring is valuable when studying archaeological sites in depositional environments like fluvial settings (Price, Hunter, & McMichael, 1964; Mandel & Bettis, 2001), especially in areas with high water tables and wet sand (Rapp & Hill, 2006). In comparison to excavation, it is efficient, less costly, and less destructive (Stein, 1986; Rapp & Hill, 2006; Arco, Adelsberger, Hung, & Kidder, 2006). Deeply buried sites are more likely to be discovered (Price et al., 1964; Mandel & Bettis, 2001; Holliday, 2004; Rapp & Hill, 2006; Arco et al., 2006) and with "modern safety requirements", coring is a viable alternative for finding such sites (Canti & Meddens, 1998). Coring can provide carbon samples for dating, pollen, microartifacts, pottery, and many other materials for laboratory analysis (Reed, Bennet, & Porter, 1968; Stein, 1986; Mandel & Bettis, 2001; Holliday, 2004; Rapp & Hill, 2006). Samples are kept intact when extracted, quickly providing a window into the natural and cultural stratigraphy of sites (Figure 7) (Stein, 1986; Holliday, 2004), and mounds (Reed et al., 1968; Saunders & Allen, 1994; Mehta, Lowe, Stout-Evans, & Connaway, 2012). Coring accurately and efficiently provides the boundaries of large sites and focuses excavation efforts, saving time and expense (Stein, 1986; Saunders and Allen, 1994; Holliday, 2004). Coring can also verify and enhance the results of geophysical investigations, such as magnetometry and down-hole magnetic susceptibility (Rapp & Hill, 2006, Mehta et al., 2012).

Even though coring is highly beneficial, it does have limitations. It provides only a narrow 3 to 9 cm window into the stratigraphy of a site (Figure 7). The miniscule size of a core sample limits the amount of information gained (Canti & Meddens, 1998; Holliday, 2004). Soil compaction is another issue, which can be resolved to some extent with a compression calculation (Appendix B) (Reed et al., 1968; Canti & Meddens, 1998; Rapp & Hill, 2006; Mehta et al., 2012). During extraction, cores can accumulate and mix materials from the sides of the hole, or even lose material (Reed et al., 1968). Care must be taken when describing cores and calculating depths of layers by taking these possibilities into account. Lastly, the high cost of a Giddings machine, similar to the one used for this study, can be prohibitive (about $29,000 (www.soilsample.com).

Figure 7. Example of half a soil core Site (Photo By Author).

Though there are some definite disadvantages to coring, its popularity as a research tool in archaeology can be traced as far back as the 1930s. Stein (1986) provides a brief history of coring in archaeology, dividing it into Period I and Period II. During Period I (1935 to 1955), researchers in the Department of Geography and Anthropology at Louisiana State University combined geology's approach to dating, that of stratigraphy and fossils, with archaeology's approach, that of dates based on ceramic typology. Coring was used to measure the depths of archaeological sites and the subsurface sediments of the Mississippi River Delta. A correlation between these two measurements resulted in a mutually beneficial method for dating subsurface geological and archaeological layers of sediment. This method became antiquated when radiocarbon dating was invented. Thus, Stein's Period II (1964 to present) of coring in archaeology focused more on collecting samples for chemical and biological analyses and for radiocarbon dating, as well as, to reconstruct the natural and cultural subsurface stratigraphy of sites. It was at the beginning of this period that truck-mounted hydraulic drilling machines, like the Giddings rig, were introduced to archaeology.

2. Methods

2.1 Coring and GPS

Cores for this study were extracted using a trailer-mounted Giddings Hydraulic Soil Sampling, Coring, and Drilling Machine and 1 ¾" x 48" PETG Plastic Soil Tube Liners. GPS coordinates were documented with a Leica Geosystems Viva GS15 antenna and CS15 controller (GNSS/GPS surveying equipment) in WGS84 reference coordinate system and converted to meters above mean sea level with Geoid 12A. Geoid heights were obtained from the National Oceanic and Atmospheric Administration's National Geodetic Survey website for Geoid 12A computations (http://www.ngs.noaa.gov/cgibin/GEOID_STUFF/geoid12A_prompt1.prl). Orthometric height (meters above mean sea level (m amsl)) was manually calculated using Microsoft Excel. GPS coordinates for the 2014 fieldwork and the Digital Elevation Map used to create the contours for the maps in this thesis were provide by Stephanie Sullivan (Sullivan, Ostrowski, & Kasper, 2015; Sullivan, 2016).

Cores 1, 2, 4, 5, and 6 were extracted for Rathgaber's study on river velocity and were placed close to the river at roughly equal intervals before, at, and downstream from the bend in the river (Figure 8). Rathgaber analyzed and discussed these cores in a paper for her Quaternary Environments class (2015). The rest of the cores focused on Mounds B, C, and D. In 2014, Core 3 was extracted near the river and north of Mound C to study the origin of the mound fill.

To attempt studying erosion on the mound's slopes, cores were placed at the summit of each mound, slightly downslope from the summit, and at or near the base. These locations were also placed where structures found by Sullivan and McKinnon (2013) might be encountered, in an attempt to extract carbon for dating. For Mound B, these cores include Core 8 (base), Core 9 (summit), and 10 (slope). For Mound C, this included Core 18 (south base), Core 25(summit), Core 26 (slope), Core 19 (near west base) and Core 27 (north base). For Mound D, this included Core 20 (near east base), Core 21 (summit), and Core 22 (slope).

To study flooding across the site, locations were selected between the mounds and the river. For Mound B, this includes cores 4, 12, and 11. For Mound C, these cores are 3, 28, and 27. For Mound D, these cores were 2, 24, and 23. Where possible, cores were extracted between the mounds and the southern fence line to look for prepared surfaces in what might have been a plaza area between the northern and southern mound groups. From east to west, these are cores 7, 15, 16, and 17.

In addition, cores were extracted between Mounds B and C, Core 13 and Core 14, and between Mounds C and D, Core 19 and Core 20, to determine whether these areas had prepared surfaces and to aid in answering the questions about flooding and erosion on the mounds. The cores between Mounds B and C were also selected to determine whether the area was intentionally elevated. A possible borrow pit north of Mound B was explored by extracting Core 12. Core 25 and Core 26 were chosen by Sullivan based on her geophysical data (Sullivan and McKinnon, 2013). Core 25 was intended to sample a magnetic anomaly in the center of the mound and retrieve carbon for dating. Results for Sullivan's radiocarbon dating are found in Appendix A. Core 26 was intended to sample a wall of the structure.

To present the results of this study, I have divided the cores into six areas (Table 2, Figure 12).

Table 1. Division of areas with correlating cores and designation as fill, alluvium, or presence of prepared surface.

Division of cores into areas	Core Numbers (Mound Fill (F), Alluvium (A), Prepared Surface (S))
North – South Transect	2 (A), 20 (A), 21 (F, A), 22 (F, A), 23 (A), 24 (A)
Fence Line	7 (A), 15 (A), 16 (A), 17 (A)
River	1 (A), 2 (A), 3 (A), 4 (A), 5 (A), 6 (A)
Mound B	8 (S, A), 9 (F, A), 10 (F, A)
Mound C	18 (S, A), 19 (A), 25 (F, A), 26 (F, A), 27 (S, A)
Area Between Mounds Band C	13 (A), 14 (A)
Area Between Mounds B and C and the White River	11 (A), 12 (A), 28 (A)

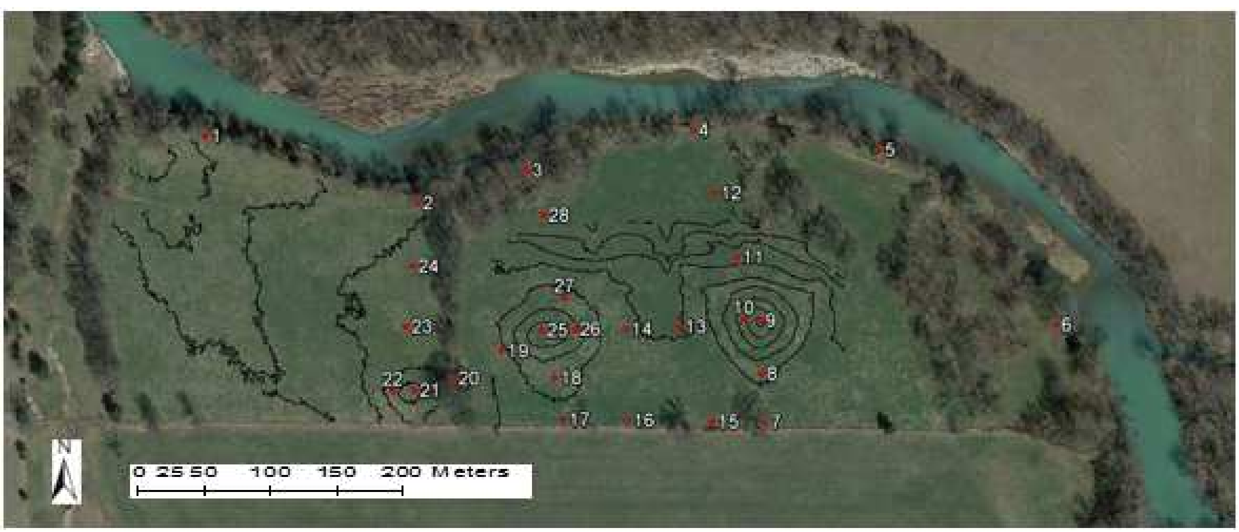

Figure 8. Core locations on the Collins site (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

2.2 Soil Description, Particle-Size Analysis, and Sand Fraction Analysis

After extraction, the cores were described using the texture diagram on the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) website, the USDA Soil Survey Manual, the Munsell Soil Color Chart, and the Field Book for Describing and Sampling Soils (Version 2.0, National Soil Survey Center, NRCS, USDA, Lincoln, Nebraska, 2002). A list of soil horizon nomenclature and definitions used in this thesis are in Appendix C. Tables of the descriptions for all the cores are included in Appendix D.

Particle size was determined using a modified hydrometer method (Day, 1965; Gee, Bauder, & Klute, 1986; Gee & Or, 2002; Brye, 2014) supplied by the Department of Crop, Soil, and Environmental Sciences at the U of A. Measurements were taken with an ELE International, Inc. Soil Hydrometer Type 152H ASTM Model # CL-277A. The reading taken at 40 seconds measures the amount of silt and clay left in suspension and is used to calculate the sand percentage of the soil. The readings taken at 6 and 11 hours provide a more accurate reading for calculating the percentage of clay. Once the clay and sand fractions are known, the silt fraction can be calculated. Calculations for the sand, silt, and clay percentages are explained in Appendix B and were processed using a Microsoft Excel spreadsheet. During disposal of the cylinder contents, sand was retained using a U.S.A. Standard Sieve #230 (0.0625 mm). Graphs and a list of all the PSA results and correlating textures can be found in Appendix E.

Sand fractions were determined using a WS Tyler Ro-Tap Model RX-29 Test Sieve Shaker and U.S.A Standard Testing Sieves. The sizes of the sieves were selected to separate very coarse, coarse, medium, fine, and very fine sand sizes (Table 1). All sand fraction results and graphs are in Appendix F and the calculation is in Appendix B.

Table 2. Sieve number with correlating sand size and fraction (based on Guccione, 1993b, USGS Wentworth Grain Size Chart (http://pubs.usgs.gov/of/2003/of03-001/htmldocs/nomenclature.htm)).

Sieve Number	Sand Size Range (mm)	Sand Fraction
10	>2.0	Gravel
18	2.0-1.0	Very Coarse
35	1.0-0.5	Coarse
60	0.5-0.25	Medium
120	0.25-0.125	Fine
230	0.125-0.0625	Very Fine

3. Results

3.1 North – South Transect

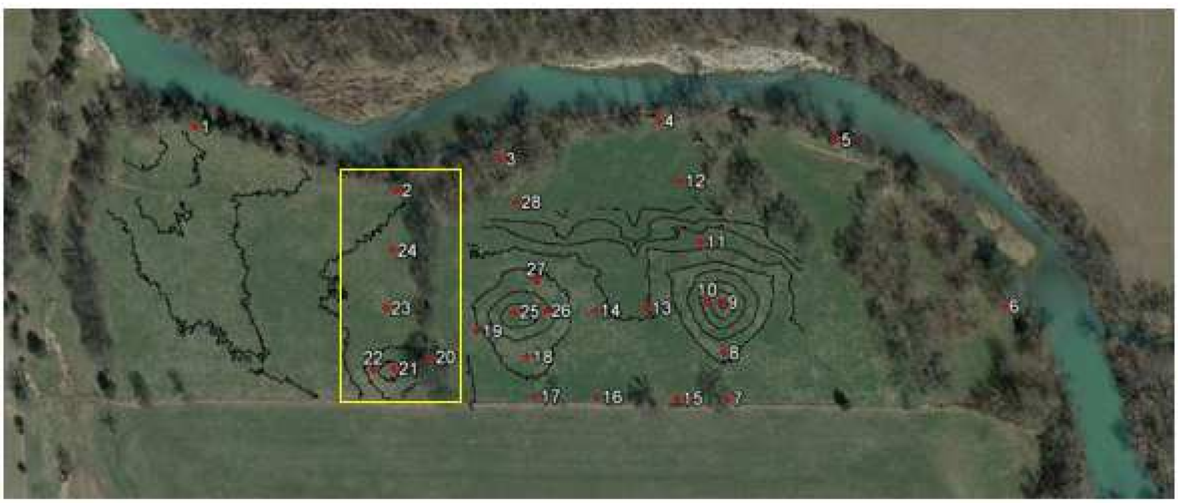

Figure 9. Cores on the North – South Transect (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

The North – South Transect includes Cores 2, 20, 21, 22, 23, and 24 (Figures 9). Core 2 is closest to the White River. Core 23 and Core 24 are in the flat area between the river and Mound D. Core 21 and Core 22 are in Mound D. Core 20 is near the east base of Mound D.

This transect was selected for further sand fraction analysis because of the consistency between particle sizes in each core, making them more readily comparable. When comparing particle size, Cores 2, 20, 23, and 24 have very similar fining up sequences for the B and C horizons until just below the A horizon near the ground surface (Figure 10). The A horizon coarsens for all of them but with different percentages of clay, silt, and sand. For more detail on these percentages see Appendix E. Below the mound fill, Core 21 and Core 22 have fining up sequences more similar to each other than with the rest of the cores on the transect (Figure 11). The sequences for these two cores occur at elevations about 40 to 50 cm higher than for Core 23 and Core 24.

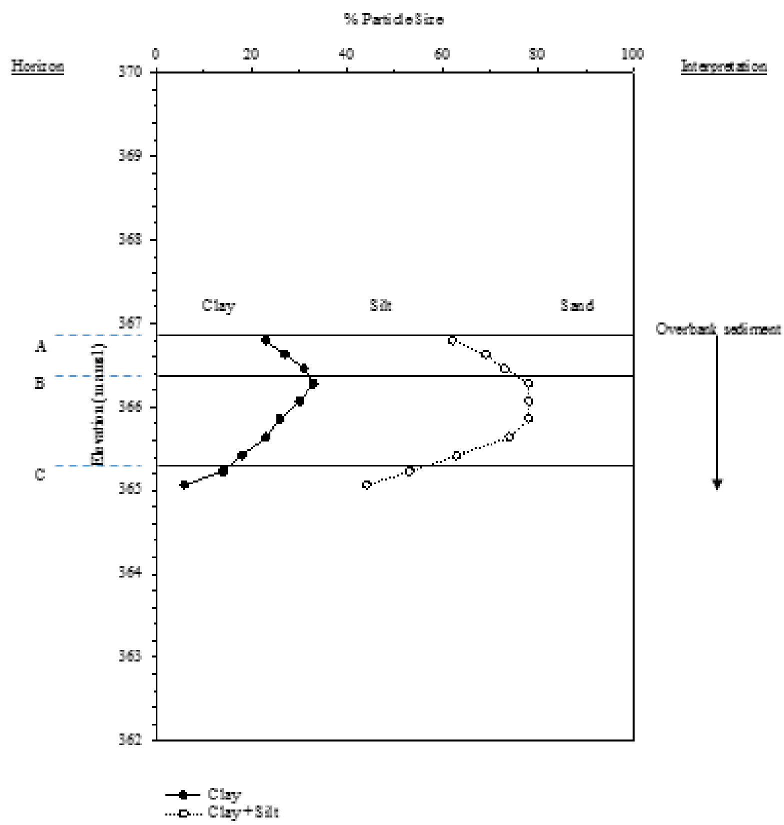

Figure 10. Core 24 (off mound), particle size graph with elevation (m amsl), Horizon (label shown for the top of each horizon on left side), and Interpretation of a sedimentary environment on the right side of the graph.

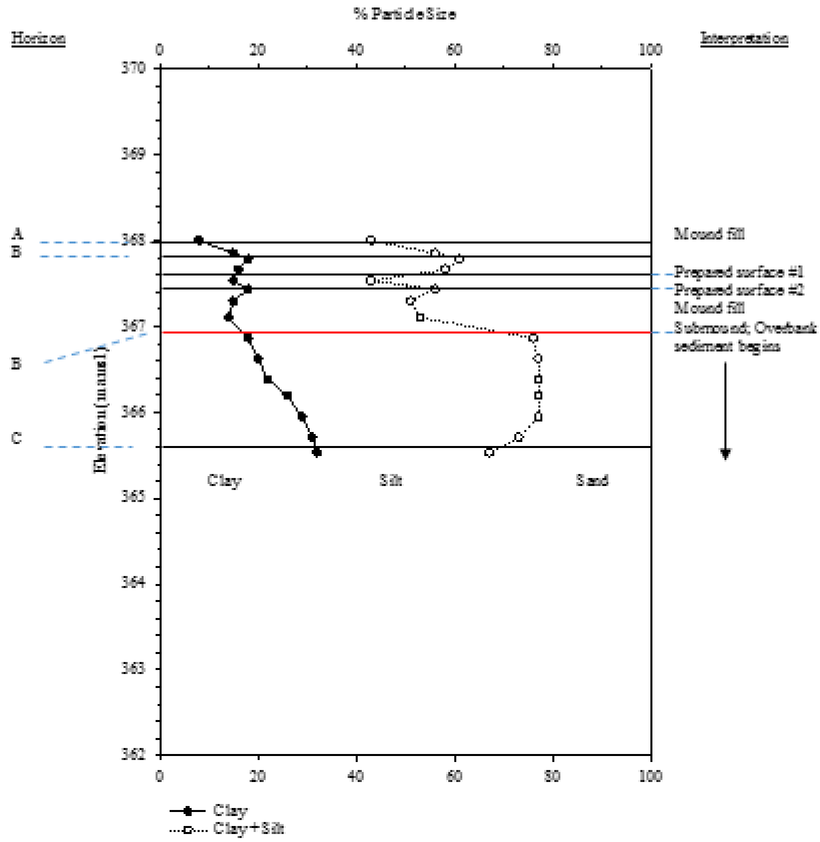

Figure 11. Core 21 (in mound), particle size graph with elevation (m amsl), Horizon (label shown for the top of each horizon on left side), and Interpretation of a sedimentary environment on the right side of the graph.

The fining up sequence continues for the sand fraction. The sand fractions for Core 23 and Core 24 are most similar to each other (Figure 12). Core 2 and Core 20 are only different in that they coarsen at the top more than Core 23 and Core 24. However, Core 2 begins to coarsen at a depth of about 150 cm, whereas Core 20 coarsens at about 36 cm. The sand fraction below the mound fill for Core 21 and Core 22 exhibits the same fining up sequence as the rest of the cores on this transect (Figure 13).

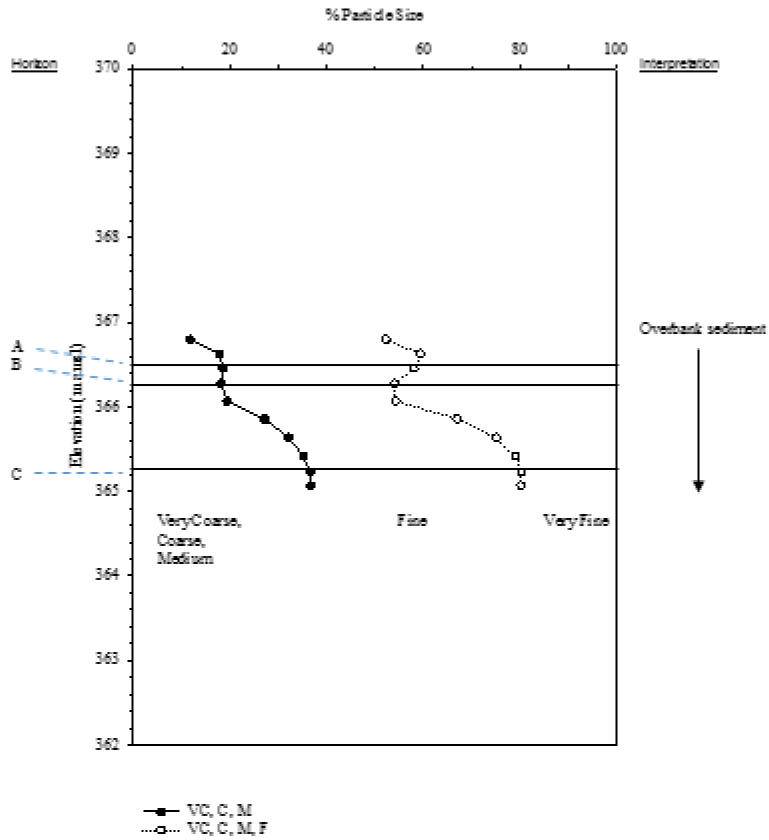

Figure 12. Core 24 (off mound), sand fraction graph with elevation (m amsl), Horizon (label shown for the top of each horizon on left side), and Interpretation of a sedimentary environment on the right side of the graph.

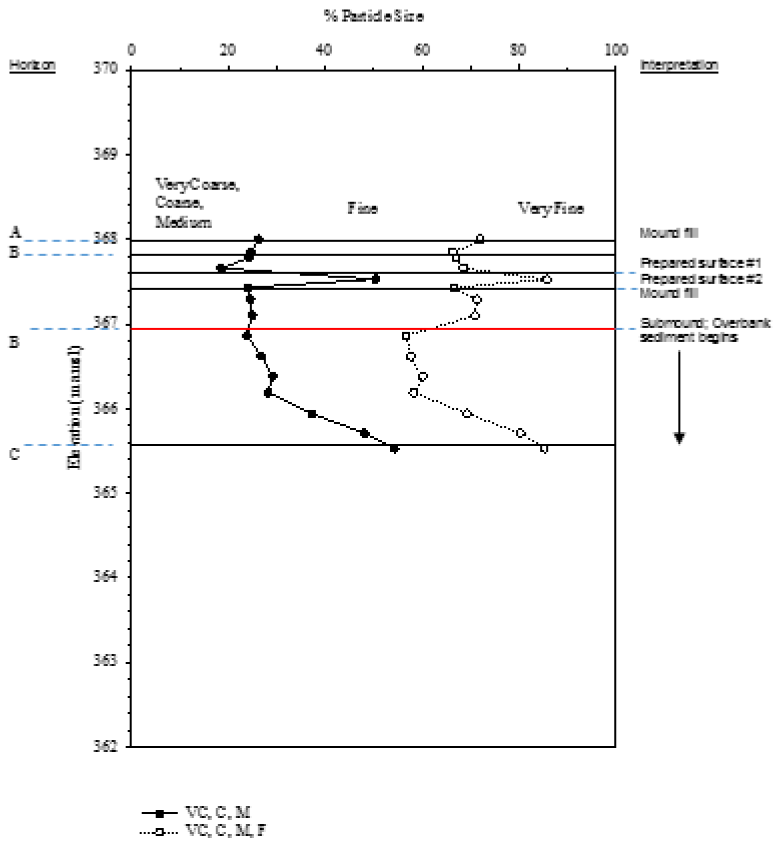

Figure 13. Core 21 (in mound), sand fraction graph with elevation (m amsl), Horizon (label shown for the top of each horizon on left side), and Interpretation of a sedimentary environment on the right side of the graph.

All of the cores, excluding Core 2, have plow zones that are 10 cm or less. Core 2, along with all of the cores at the river except for Core 3, were described by Rathgaber and I use her descriptions in discussing this core. Because our methods and observations are slightly different, terminology is also slightly different but the particle sizes are easily compared. In the off mound cores, there is a 15 to 40 cm A horizon following the plow zone (Figure 14). Below the A horizon, there is a Bt horizon until the very bottom of the cores where there is a C horizon. For Core 2, Rathgaber labels everything below the A horizon a B horizon with soil development occurring until the last 52 cm, which is labeled alluvium. This is the area I typically labeled the C horizon with very little to no soil development, more redoximorphic features, and occasionally gravel and cobbles. In all the cores except Core 21 and Core 22, this C horizon has much higher sand content than the rest of the core. In Core 21 and Core 22, the sand content was not as high and the clay content was much higher. These cores reached a depth about 20 to 30 cm shallower than cores 20, 23, and 24 and about 2.65 meters shallower than Core 2. This may be why these two cores are missing the increase in sand and decrease in clay seen in the other cores.

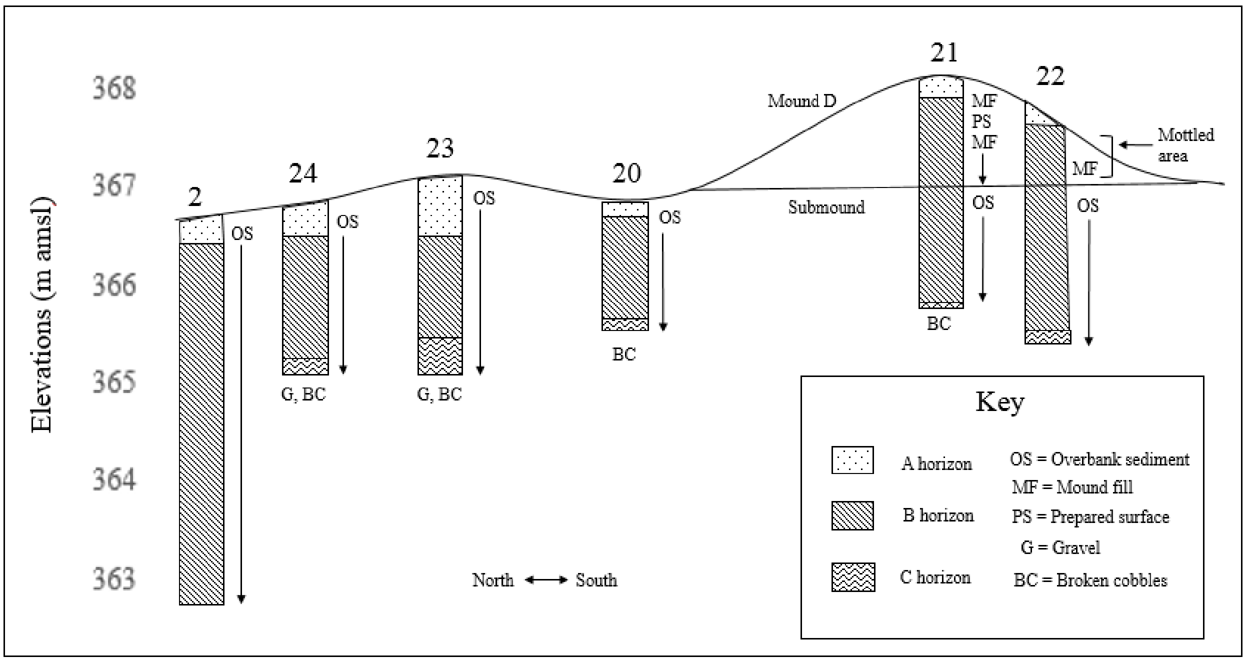

Figure 14. Core profiles on the North – South Transect with elevation.

Core 21 and Core 22 differ from the others in several other ways. Both the particle-size and sand fraction analysis shows that the mound fill alternates between finer and coarser particles and finer and coarser sands, indicating multiple sources for the fill (Figures 11 and 13). The particle size for Core 22 doesn't exhibit this variation quite as intensely as Core 21. This might be due to the location of this core in the backfill from a previous excavation. The sand fraction for Core 22 shows some variation, but, like the particle size, not as highly varied as Core 21. The lack of an A horizon where the submound elevation begins can be seen in the steep increase in the sand content going from 24 to 47 percent in Core 21 and 24 to 40 percent in Core 22 (Figure 11). The change from a B horizon to A horizon in the cores off mound is much more gradual (Figure 10). The mound fill has particle sizes and sand fractions most similar to the A horizons of the cores located nearby (Figure 15) and to Core 3 and Core 6 near the river (Figure 16).

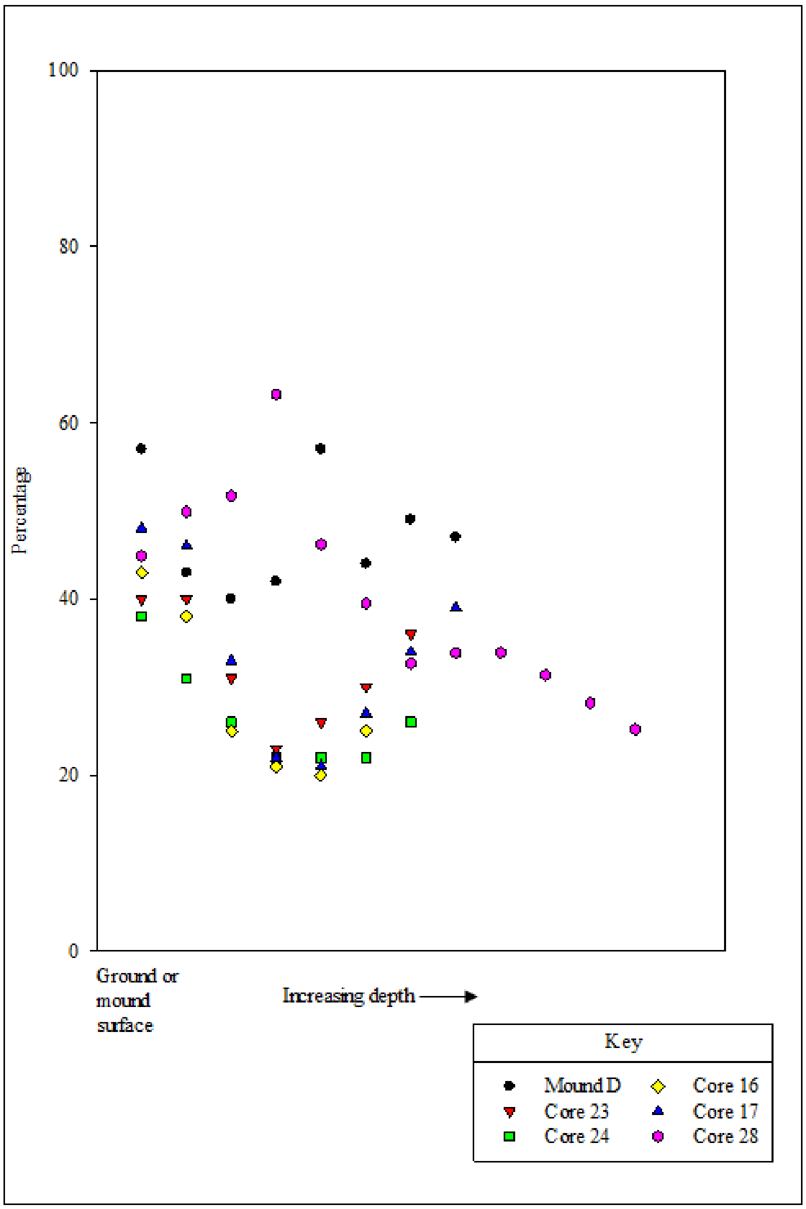

Figure 15. Comparison of sand percentages in Mound D fill to cores in nearby flat areas.

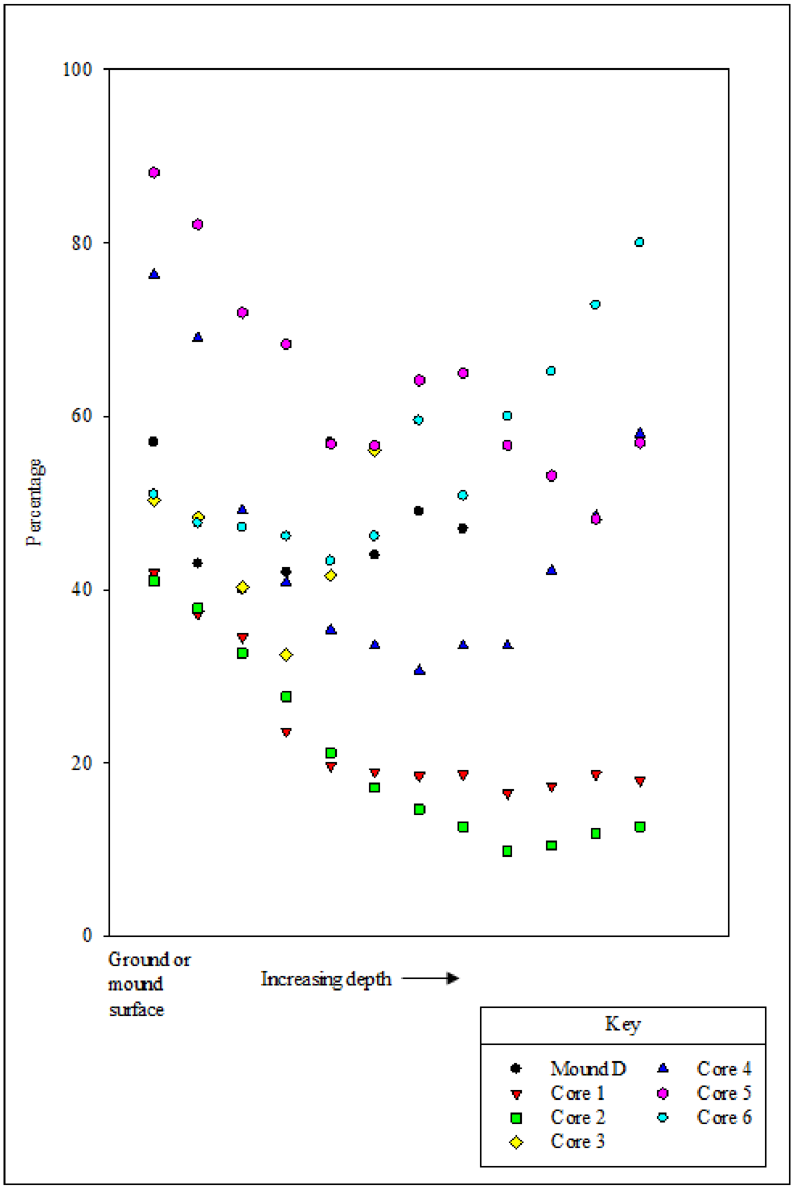

Figure 16. Comparison of sand percentages in Mound D fill to the cores on the river.

The particle-size analysis shows that off mound the cores have higher total clay and silt fractions than the cores on the summit and slope of Mound D (Figure 17). Because the velocity of the flooding would slow as the water moves farther from the channel, higher amounts of the finer particles, clay, silt, and very fine sand, are deposited on these lower elevation areas. Core 20, at or near the base of the mound, is in an area that may have been more disturbed by the building of a north – south fence line and is at a lower elevation and may see more flooding. In general, its particle sizes more closely resemble Cores 23, 24, and 2.

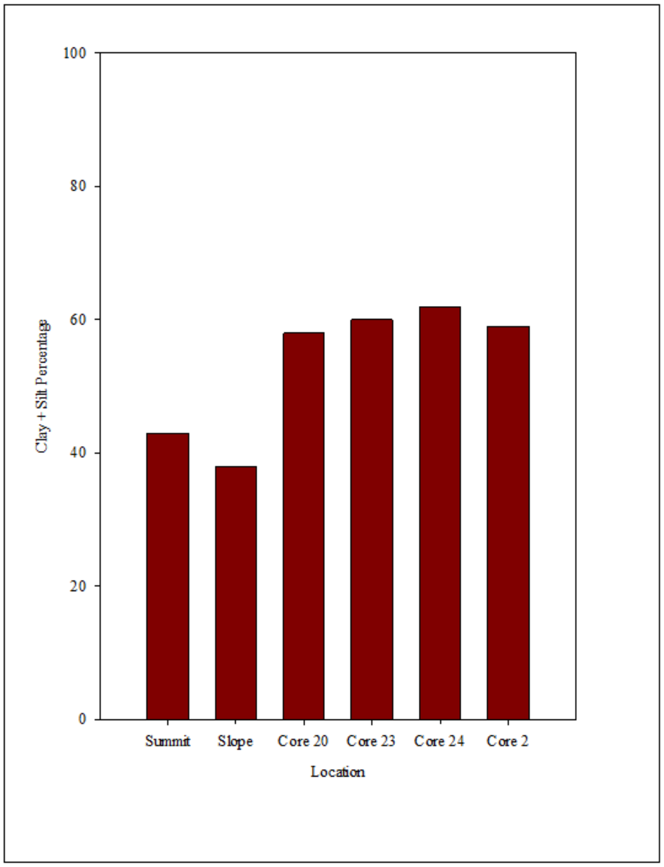

Figure 17. Total clay and silt percentage for Mound D compared to other North – South Transect cores.

From the summit, Core 21, to the slope, Core 22, to the base, Core 20, the very fine sand increases very slightly (Figure 18). Fine sand decreases slightly and the coarser sands stay close to the same. Fine sand would be the most likely fraction of the total sand fraction to be susceptible to erosion due to water and gravity.

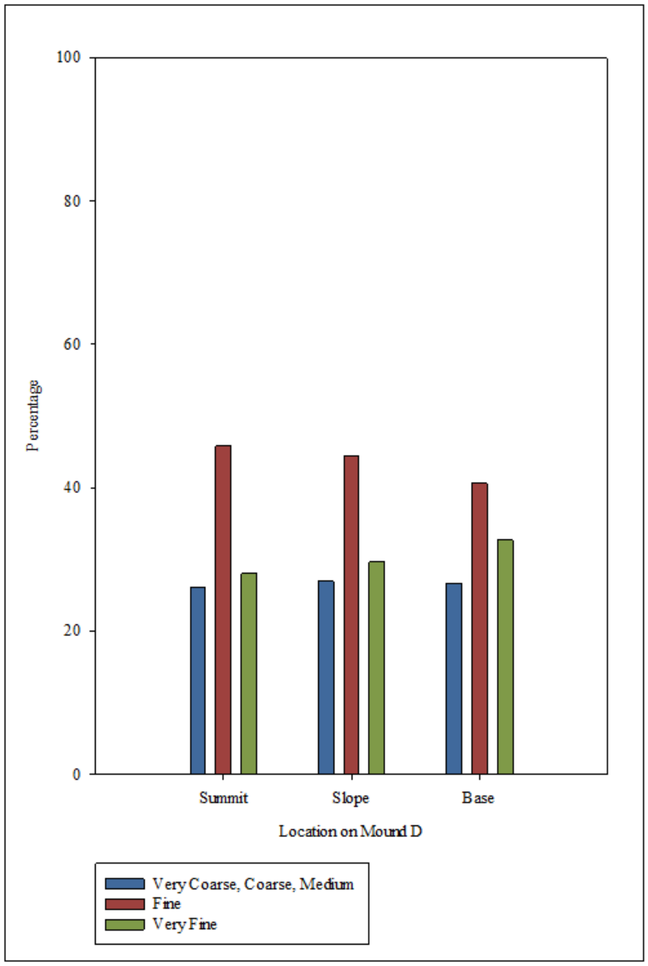

Figure 18. Comparison of very fine sand to fine and very coarse, coarse, and medium sand on Mound D.

Off mound and submound, the clay percentages in the B horizon exhibit clay illuviation with percentages between 18 and 33 percent, gradually increasing with depth until the C horizon. The B horizon for the mound fill is also different from the rest. Clay percentages within the mound are between 10 and 18 percent. In the mound fill, Core 21 the clay content alternates between a higher and lower percentage, giving this core alternating Bw and Bt soils. Core 22 has only one Bw and Bt sequence, again, likely due to a disturbance of the mound in this area, which is visible in the mottled appearance of the soil (Figure 19) and in the undulating surface of the mound.

Figure 19. Mottled area in Core 22 (Photo By Author).

Core 21 is more representative of the mound fill. In this core, two prepared surfaces are visible (Figure 20). The first is between 33 and 48 cm and is a dark brown loam. The second is between 48 and 57 cm and is a dark grayish brown sandy loam. Mound fill continues below these two surfaces until the submound stratigraphy starts at 109 cm deep and at a very similar elevation to the tops of Core 23 and Core 24. As mentioned earlier, the submound stratigraphy starts with a Bt horizon and lacks an A horizon.

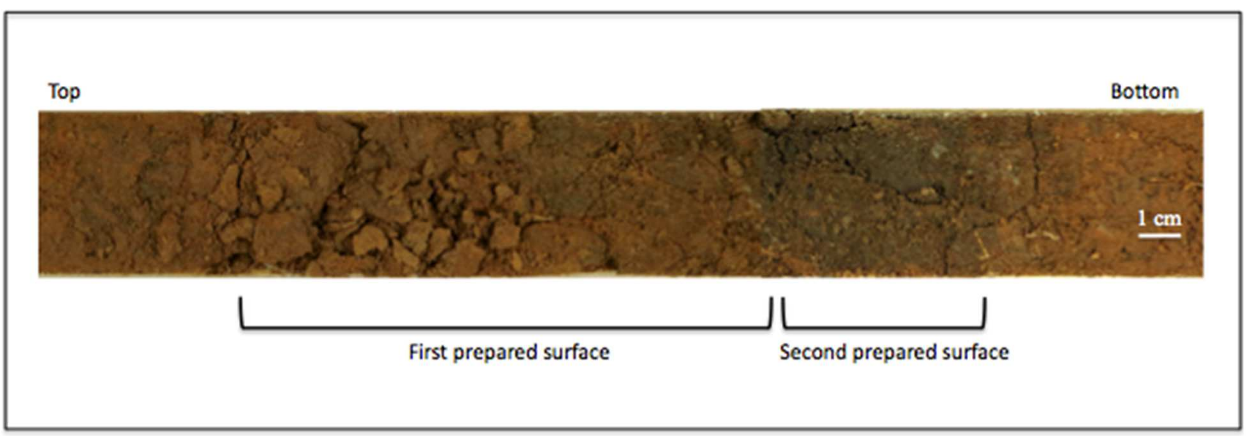

Figure 20. Core 21 prepared surfaces (Photo By Author).

Core 2 is slightly different than the other cores on this transect. It has higher silt and clay content beginning higher up in the core. It also has lower sand content but a higher very fine sand fraction after the A horizon until the bottom where it becomes more similar to the bottom half of the rest of the cores only at a much deeper elevation. The profile of Core 2 is likely more directly influenced by its close proximity to the river. Graphs for the particle-size and sand fraction analysis are available for this core in Appendices E and F.

The bottoms of the cores on this transect vary. Core 20 and Core 21 have a broken cobble at the bottom that spanned the width of the core liner. Core 22 and Core 24 have a few subround pebbles. Core 23 has 6 cm of gravel and small pebbles at the bottom, with an additional 2 cm layer of similar consistency about 10 cm above (Figure 21). These additional layers were not seen in nearby cores. The layers of gravel and cobbles at or near the bottoms of these cores are evidence of either a high turbulence flood event or channel deposits that occurred long before the mounds were built.

Figure 21. Core 23 flood event and channel deposit at bottom of core (Photo By Author).

3.2 Fence Line

Figure 22. Core locations on the southern fence line (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

The cores along the south fence line are located in what might have been the plaza area of the site (Figure 22). Along the transect, ground surface rises by about 17 cm moving from east to west (Figure 23). The location of Core 15 was recorded by the GPS unit, but no reliable elevation is available. Thus, for Core 15, an estimated elevation was assigned based on the trend seen in the other three, consistent with field observations. It was hoped that prepared surfaces might be visible in these cores. Though there are minute differences among the horizons at each location, no prepared surfaces were noted.

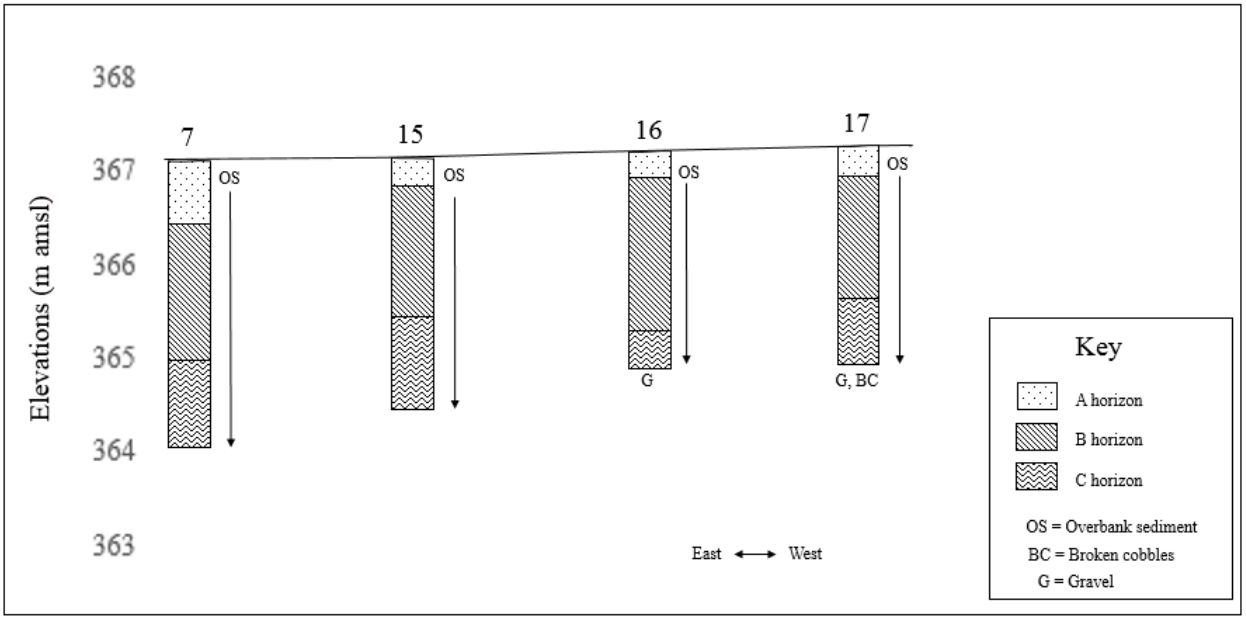

Figure 23. Core profiles on the Fence Line with elevation.

The particle sizes are fairly uniform, with all exhibiting the fining upward sequence until the coarsening up in the A horizon that was seen in Core 23 and Core 24 on the North – South Transect. However, the sequence occurs at different elevations for these four cores. Core 7 and Core 15, which are adjacent, have similar elevations. The sequence in Core 16 occurs about 5 cm higher than in Core 7 and Core 15 and in Core 17 occurs about 5 cm higher than in Core 16. In all four cores, sand percentages are between 36 and 48 percent at the ground surface, decrease in intermediate depths, and increase to percentages greater than those near the ground surface in the basal portion of the cores. Silt percentages are between 44 and 53 percent and gradually decrease to between 12 and 23 percent. Clay content is low in the A horizon, between 8 and 12 percent, increases in the middle to form a clay bulge by illuviation, and decreases with depth as the profile gets closer to what was either a high turbulence flood event or channel gravel. This gravel is only visible at the bottom of Core 16 and Core 17 (Figures 24 and 25).

Figure 24. Channel gravel in Core 16 (Photo By Author).

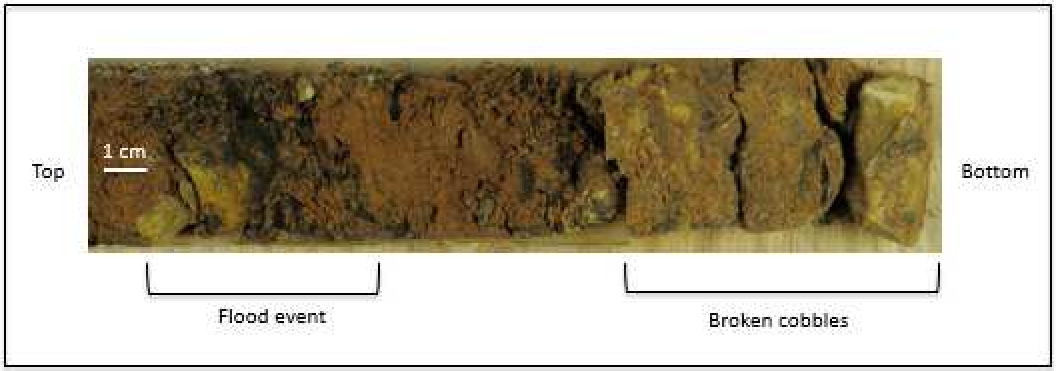

Figure 25. Bottom of Core 17 (Photo By Author).

Core 7 and Core 15, on the east end of the transect, share profiles more similar to each other than to Core 16 and Core 17. The only difference between the two is that Core 7 contains more redoximorphic features at the bottom and Core 15 has the occasional round or subround pebble in its bottom half.

Core 16 and Core 17, on the west end of the transect, are more similar to each other than to Core 7 and Core 15. Core 16 and Core 17 have slightly higher sand content in the upper horizons, with 43 and 48 percent, respectively, compared to 36 and 38 percent in Core 7 and Core 15. The other difference is the presence of bedded pebbles, cobbles, and shale fragments at the bottom of Core 16 and Core 17, indicating a high turbulence flood event. The layer in Core 16 is 13 cm (Figure 24). In Core 17, the layer is 23 cm and includes a broken cobble very similar to the ones seen at the bottom of Core 20 and Core 21 (Figure 25). The high turbulence flood layer is similar to the one seen at the bottom of Core 23. The particle size percentages in the A horizons of Core 16 and Core 17 are very similar to the percentages seen in the some of the fill for Mound D (Figure 15).

3.3 River Bank

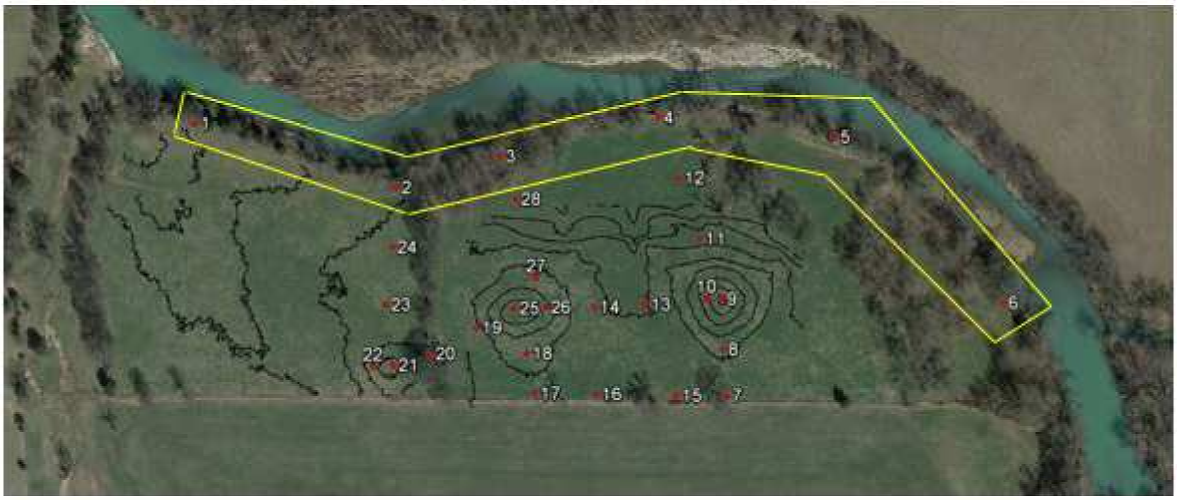

Figure 26. Core locations near the river (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

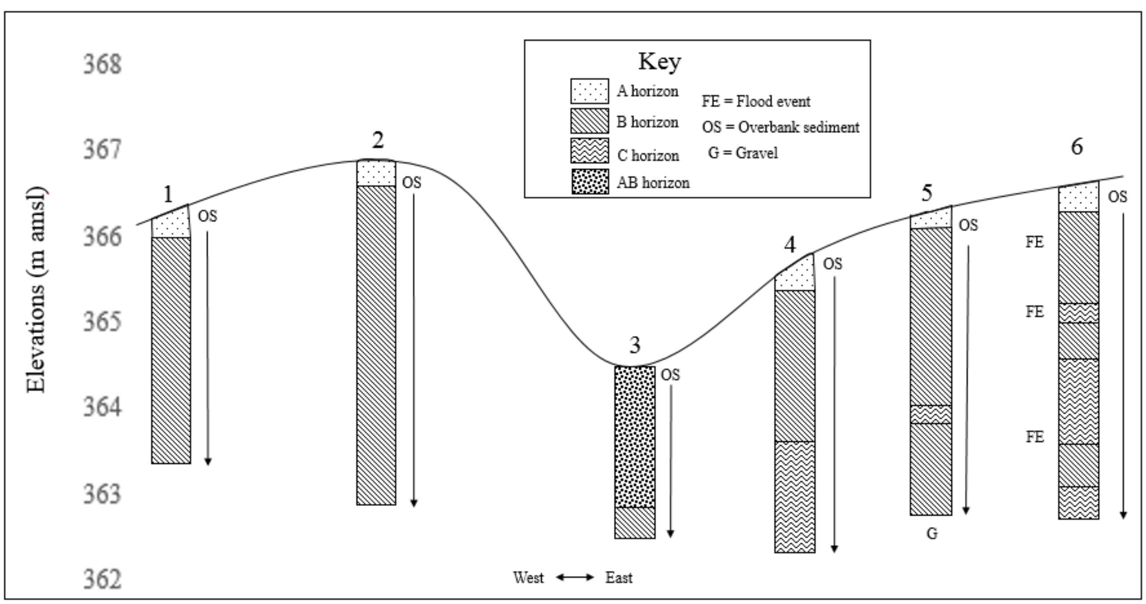

Figure 27. Core profiles on the River with elevation.

This area includes cores 1 through 6. Rathgaber's (2015) study of the cores along the river (Figures 26 and 27) shows that Core 6, at the east end of the transect, exhibited at least three large flood events (Figure 28). The noticeable increases in coarser grains in adjacent Core 5 and Core 6 are indicative of flooding along the inside river bend. As noted by Rathgaber, the cores downstream of the bend exhibit the typical gradual fining upward sequence. Cores 3, 4, 5, and 6 have sand percentages similar to those seen in the mound fill (Figure 29). Because of this similarity, it is possible that the mound builders were utilizing the more readily available and easily attainable sediment close to the river and to the mounds (Angeles, 2014).

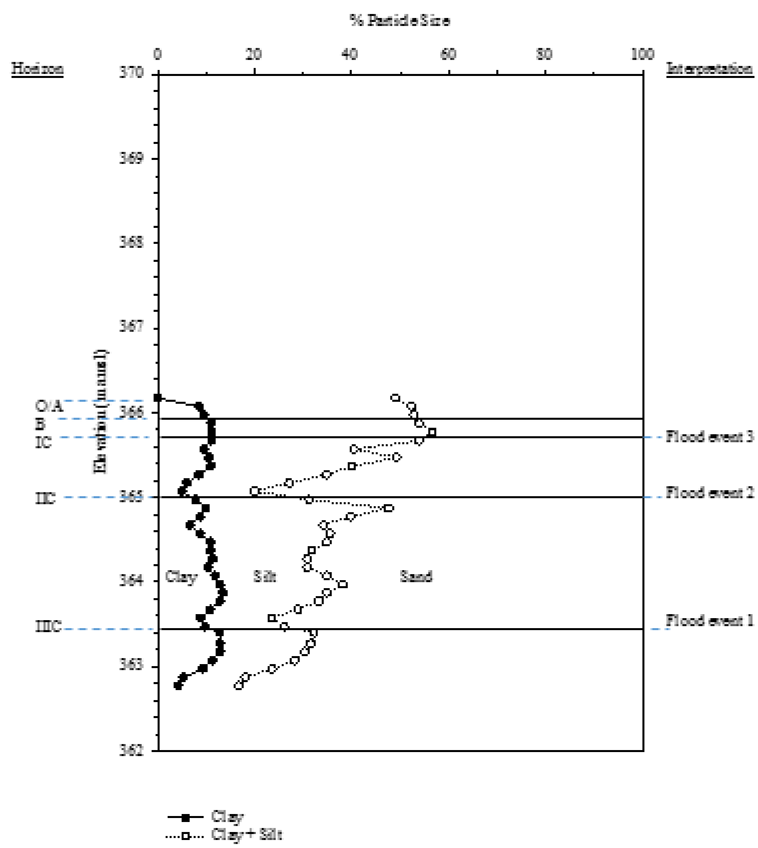

Figure 28. Core 6 particle size graph with flood events (modified from Rathgaber, 2015) with elevation (m amsl), Horizon (label shown for the top of each horizon on left side), and Interpretation of a sedimentary environment on the right side of the graph.

Sand is the least weathered fraction of sediment, making it the most stable percentage for making a comparison between mound fill and possible locations of fill origin on the site. Assuming that the mound builders would acquire the materials at or near the surface, I have restricted my consideration of the sand percentages to the upper 120 cm. In addition, the sand fraction in the first 120 cm is an adequate representation of the sand percentages for the entire length of the core.

For Core 1, located at the west end of the transect and northwest of Mound D, the percentage of sand ranged from 17 to 42 percent. Directly north of Mound D, Core 2 ranges from 9 to 41 percent. Only the upper 30 cm of Core 1 and the upper 10 percent of Core 2 have sand percentages similar to the mound fill (Figure 29). Directly north of Mound C, Core 3 ranges between 32 and 56 percent. This core's similarity to mound fill begins at ground surface. Directly north of Mound B, Core 4 ranges between 33 and 76 percent, with similarity to mound fill beginning between 10 and 20 cm. Core 5, northeast of Mound B, ranges between 53 and 88 percent, with similarity to mound fill beginning between 20 and 30 cm. East of Mound B, Core 6 ranges between 43 and 65 percent, with similarity to mound fill beginning at the ground surface. The highest sand fraction for most of the cores along the river are found in the upper 40 cm, with one exception. Below the upper 10 cm, the sand percentage in Core 6 increases with depth. It is possible that the increase in sand is simply due to the decrease of silt and clay as a result of historic plowing.

In 2014, a profile of the riverbank was done just slightly north of Core 3. Particle-size analysis showed the sand fraction in most of the bank ranges from 45 to 85 percent, with the closest similarity to mound fill between 19 and 69 cm and 110 to 130 cm. A basal sample directly above the river level was almost 93 percent sand. A sand percentage this high was never noted in the mound fill and gaining access to this area would depend on the river level.

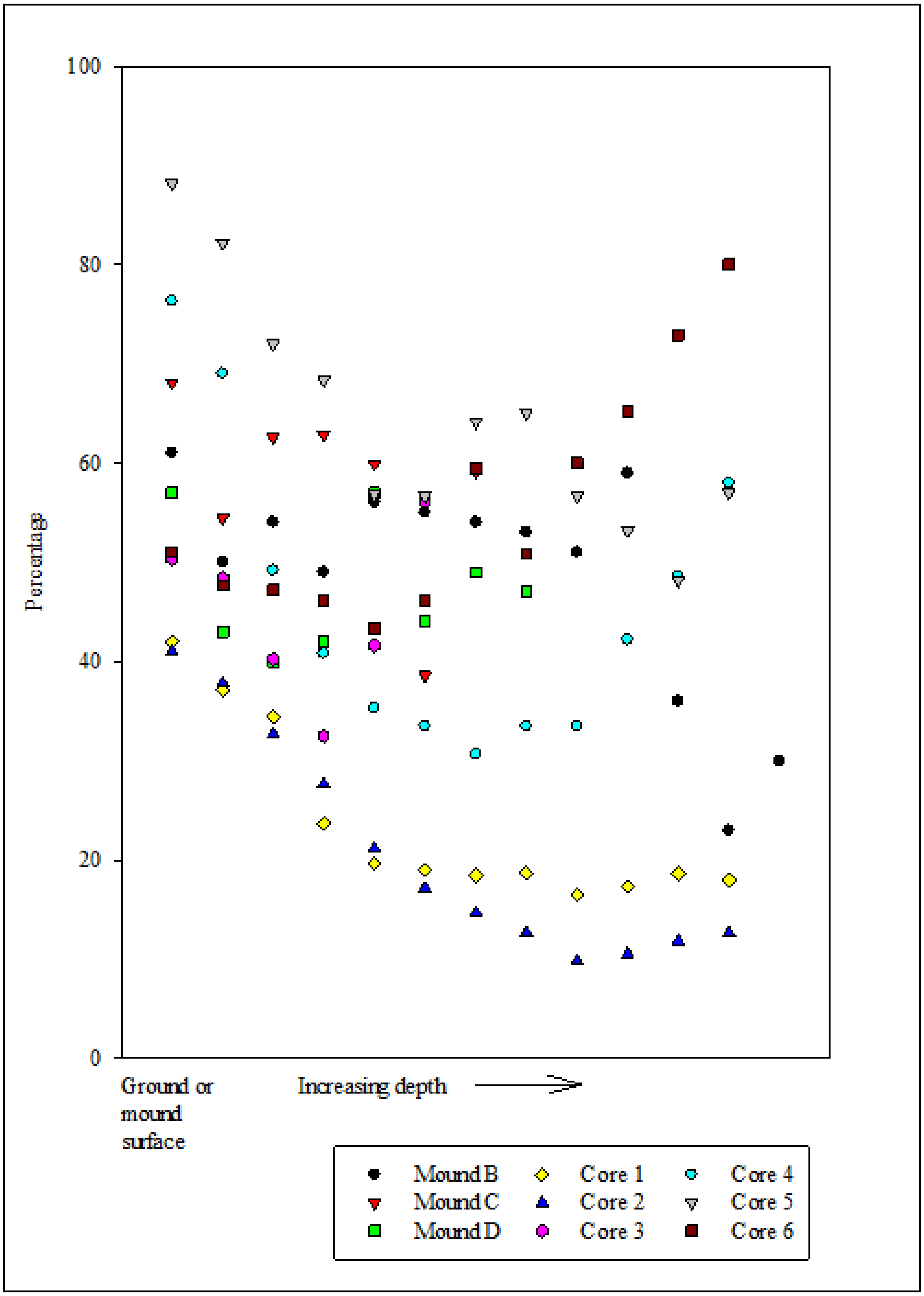

Figure 29. Sand percentage comparison between the mounds and the cores near the river (upper 120 cm of core where available).

3.4 Mounds B and C

For this section, I'll describe the cores that were within the mounds and the ones closest to or within what was likely the original base of the mounds. For Mound B, those cores are 8, 9, and 10 (Figures 30 and 31). For Mound C, those cores are 18, 19, 25, 26, and 27. Though likely not directly within the base of Mound C, Core 19 was the most similar to Core 18 and is included in the Mound C discussion.

3.4.1 Mound B

Figure 30. Core locations in the Mound B area (modified from Google, 2016; Sullivan et al., 2015; Sullivan, 2016).

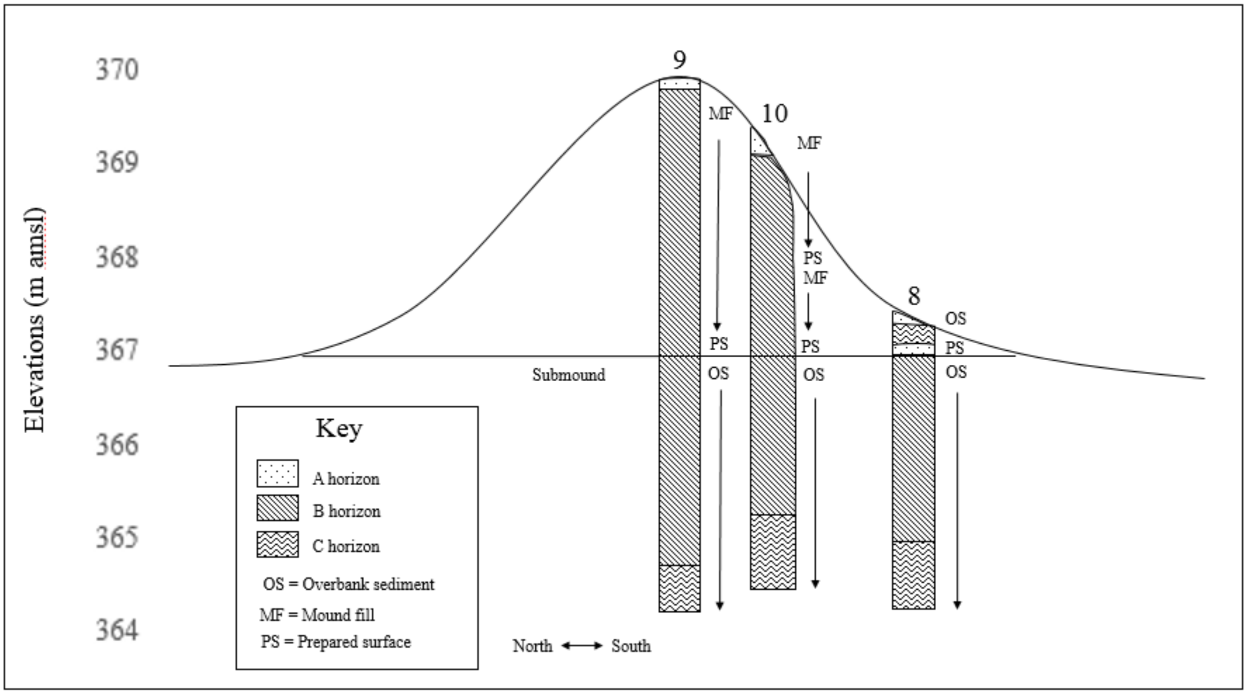

Figure 31. Core profiles on Mound B with elevation.

Core 9 is located on the summit of the mound, with Core 10 at an elevation 68 cm lower and downslope from Core 9. These cores have similar profiles and particle size graphs to each other and to Core 21 in Mound D. The upper horizons of both have higher sand content, 61 percent in 9 and 68 percent in 10, above mound fill with alternating strata of anthropogenic sediments. Within the mound fill, there are frequent changes in colors, some very subtle (Figure 32). It is possible that these are individual basket loads, changes in source materials, or a result of the effects of pedogenesis. The percentages of sand range from 23 to 63, with the majority in the 50th percentile. Like the colors, the sand fraction changes frequently and may further support the presence of basket loads or a change in fill origin (Cremeens, 1995). These are sand percentages most similar to those found in the cores near the river (Figure 29). Like Mound D, directly below the most basal anthropogenic strata, the submound stratigraphy lacks an A horizon and starts with a Bt horizon. Also similar to Mound D, the Bt horizon below the mound exhibits a clay bulge and continues until the C horizon at the bottom of the cores, where sand content increases.

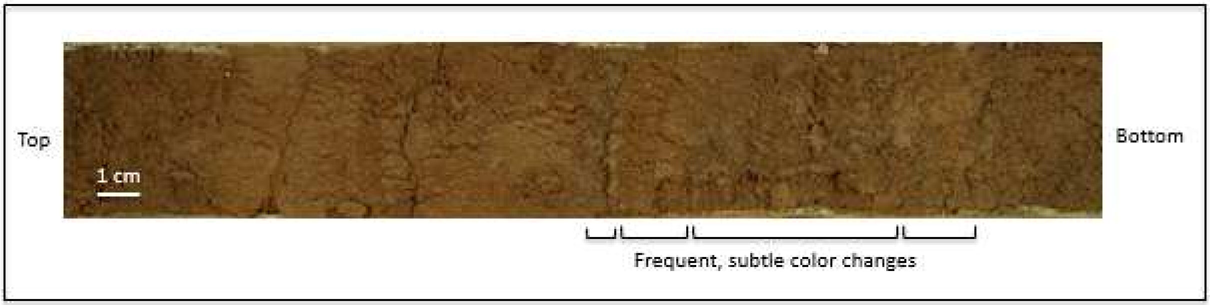

Figure 32. Frequent subtle changes in Mound B fill (Photo By Author).

The differences between Core 9 and Core 10 are found in the anthropogenic strata. In Core 9, small flecks of charcoal are present at 24 cm and gradually increase in frequency with depth. Two pebbles found in the fill, one at 15 cm and another at 102 cm, were likely transported in with the fill. At a depth of 240 cm, and continuing for 20 cm, there are thin and thick alternating layers (Figure 33). These layers contain a mixture of charcoal, a pale brown sediment, which has been depleted of color by exposure to rain, and sediment similar to the fill, which is mixed with flecks of red clay or daub. At about 249 cm, there is a large chunk of charcoal, followed by an area at 252 cm that includes nodules of burnt daub and a small area of brownish yellow sediment. Immediately following this section, the alternating layers continue. It is possible that these are multiple prepared surfaces. Where there are larger quantities of charcoal may have been ritual burns with the deepest and larger one being the remains of a burnt structure.

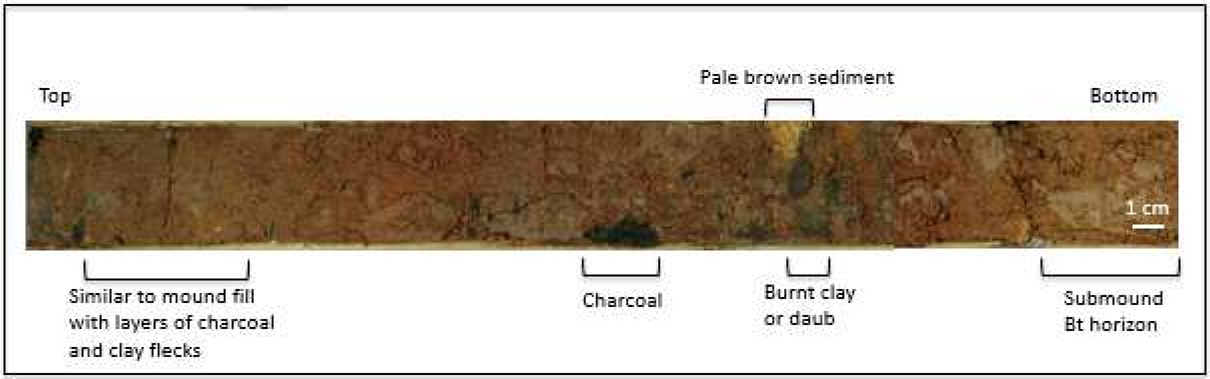

Figure 33. Multiple prepared surfaces with charcoal, daub, and layers exposed to weathering in Core 9. Lack of A horizon after prepared surfaces (Photo By Author).

Core 10 has two distinct strata of prepared surfaces. The first stratum starts at a depth of 110 cm and ends at 118 cm (Figure 34). It includes alternating layers of dark brown concentrations and very pale brown depletions, which are indicative of exposure to weathering, particularly, rain (Vogel, Kay, & Vogele, Jr., 2005). The basal prepared surface is similar to the one in Core 9, except that there are no large pieces of charcoal, burnt daub, or pockets of brownish yellow sediment (Figure 35). Interestingly, in both cores, these cultural surfaces at the base of Mound B have low sand fractions, ranging between 23 and 30 percent. This range of percentages is similar to that found in the top 167 cm of Core 12, an area thought to possibly be a borrow pit. Core 12 is discussed in more depth in section 3.5.

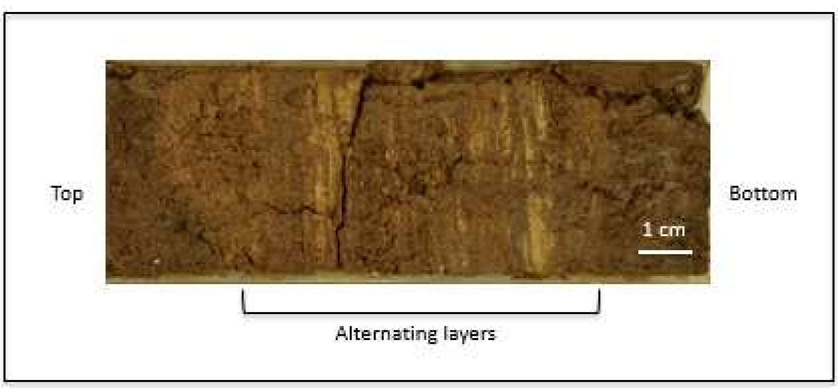

Figure 34. Alternating layers exposed to weathering in Core 10 (Photo By Author).

Figure 35. Prepared surface before submound stratigraphy in Core 10, Mound B (Photo By Author).

Core 8 was extracted from an area in the south base of Mound B that might have been a slightly elevated ramp leading to a southwestern facing entryway of the structure within the mound (Figure 35). The top elevation is 2 meters below the top of the mound and 64 cm above the base elevation. It is about 134 cm below the top of Core 10. The profile for this core is very different. The first 20 cm contain 70 percent sand, 2 percent more than the top of Core 10 and 9 percent more than the top of Core 9. This increase in sand content moving down the slope from the summit to the base is a good indicator of erosion down the slope. In addition, the layers with higher percentages of sand increase in length moving from summit downslope to base (Figure 36).

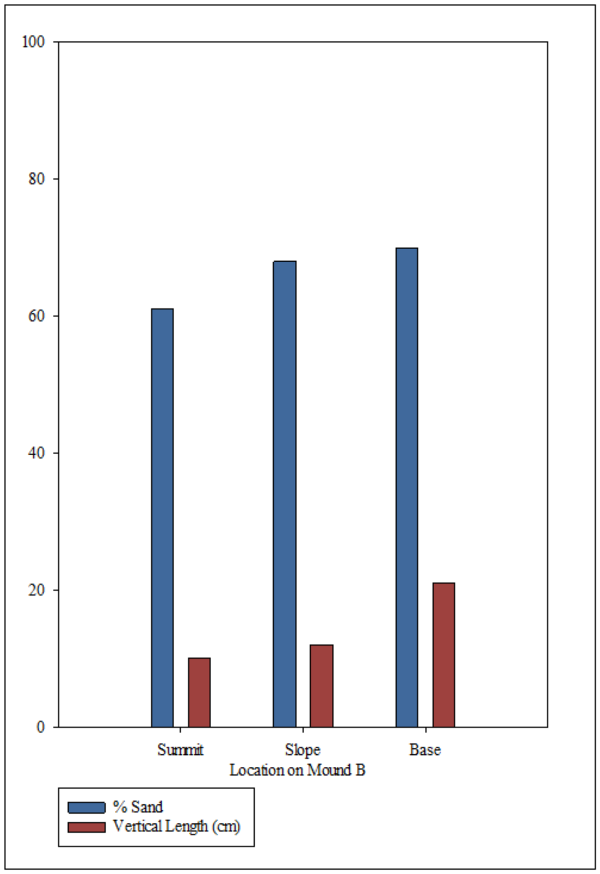

Figure 36. Cores 9, 10, and 8 – sand percentage and vertical length increase moving from summit to base of Mound B.

Up to 40 cm, the sediment is a dark yellowish brown sandy loam. At 40 cm, the sediment changes to a very dark brown sandy loam with flecks of charcoal and the sand fraction drops to between 46 and 53 percent for the next 20 cm. Fractions like this are more reminiscent of those seen within the mound. This layer occurs at approximately the same elevation as the basal prepared surfaces in the mound and has been interpreted as a prepared surface, possibly related to a south ramp (Figure 37).

Figure 37. Prepared surface, possibly south ramp of Mound B (Photo By Author).

The 10 to 20 cm below the prepared surface gradually lighten in color and have similar particle size percentages to the A horizons of the off mound cores. It is possible that the builders did not remove the A horizon in the ramp area as they did with the mound.

While this core exhibits a Bt and C horizon and a fining up sequence of sediments like the other cores on the site, it is slightly different (Figure 38). The fining up sequence is not as smooth and gradual, with two spikes in the finer sediments, silt and clay. These increases may be a result of the large flood events noted by Rathgaber in Core 6 (Figure 28).

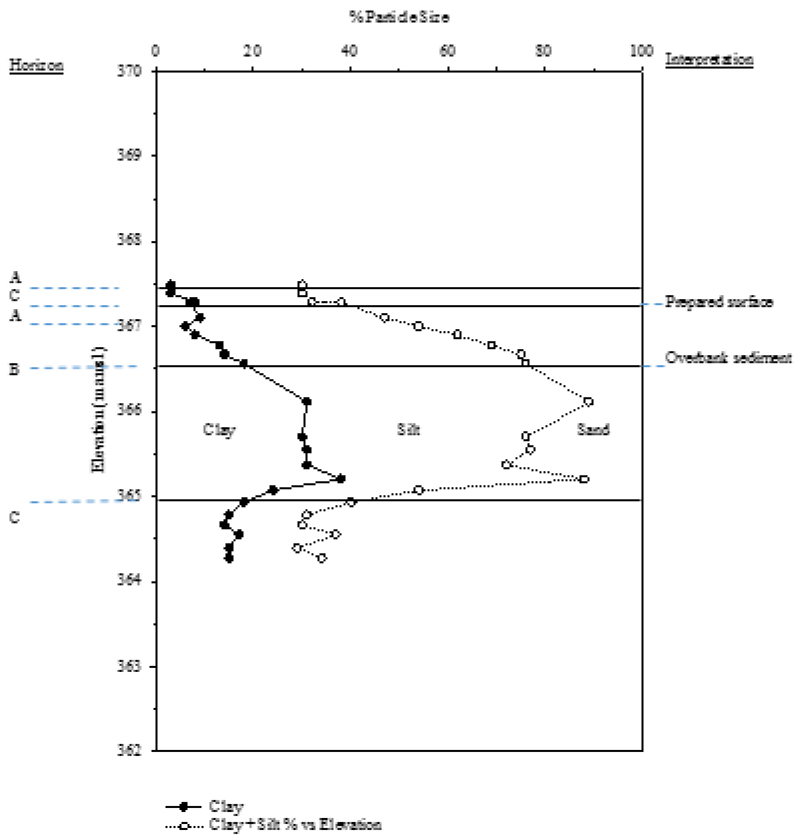

Figure 38. Core 8 particle size analysis graph. Top layers show erosion from mound.

3.4.2 Mound C

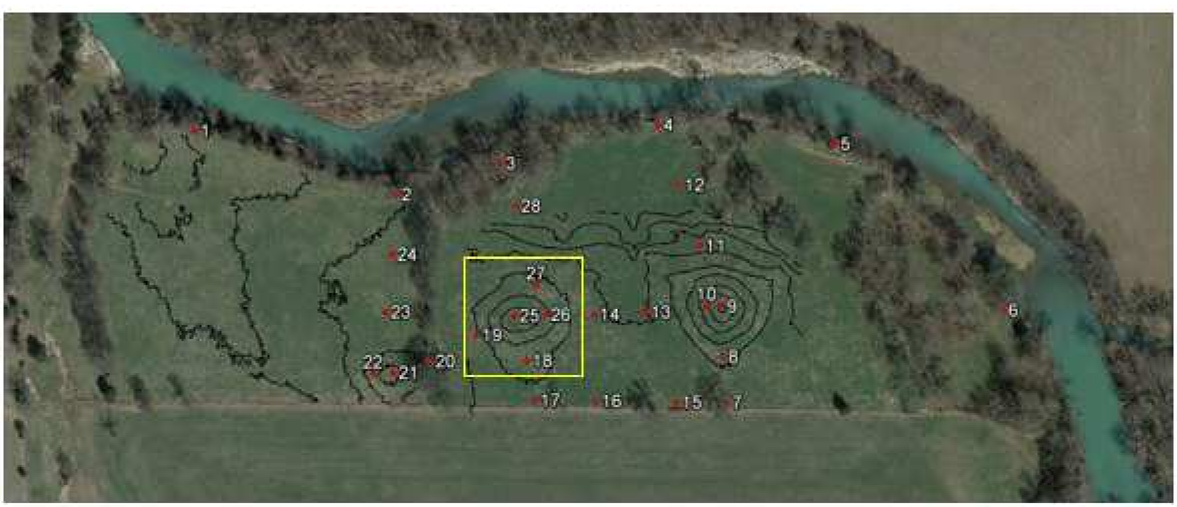

Figure 39. Core locations in the Mound C area (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

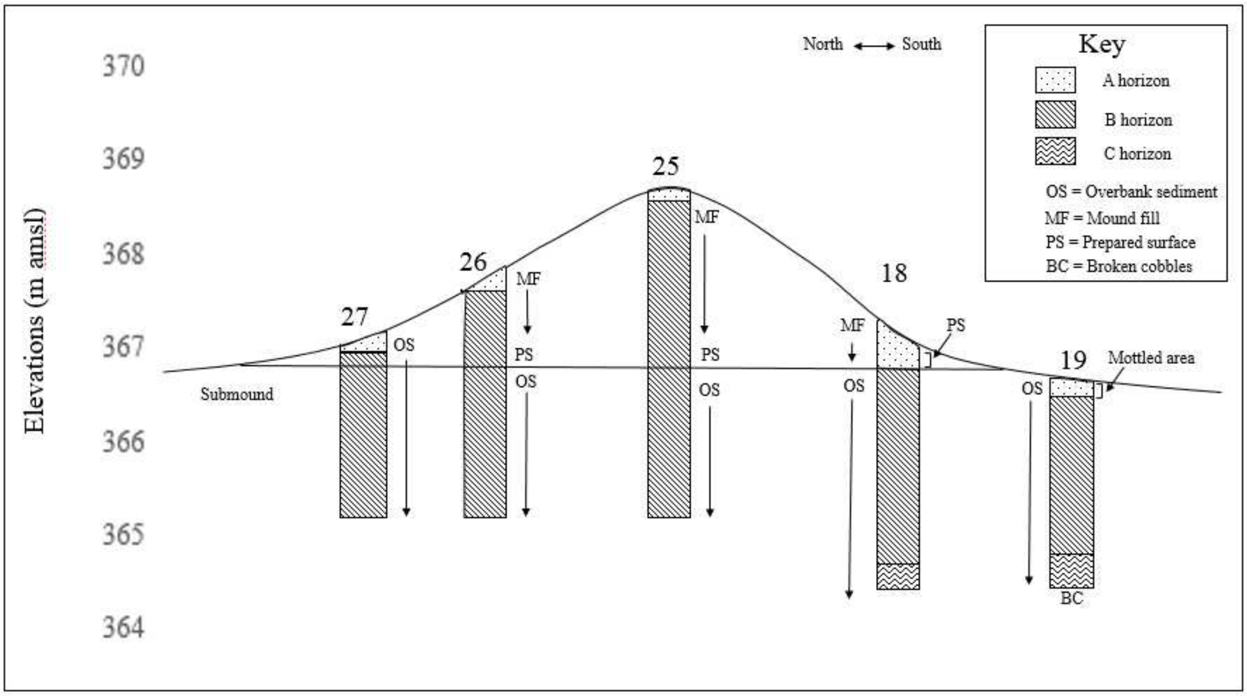

Figure 40. Core profiles on Mound C with elevation.

This area includes Cores 18, 19, 25, 26, and 27 (Figures 39 and 40). Core 18 and Core 27 are within the slope near the base of the mound at 1.33 m and 1.24 m, respectively, below the summit, Core 25. Core 19 is near the west base of the mound. Core 26 is downslope from 25 at an elevation 76 cm lower than the summit. The fining up sequence of overbank sediment remains true for the soil profiles of all the cores in this group, excluding the strata that are within the mound. Cores 18, 19, and 27 are almost identical to the cores along the fence line. The differences are in the sand content in the upper horizons and the depth attained by these cores.

Core 18 reached a depth only about 7 cm shallower than Core 17, which is located south of 18 on the fence line. However, the sand content in the upper horizon of 18 is at 63 percent and 17 is at 48 percent. The depth of Core 19 is 23 cm shallower than 18 and the sand content is

64 percent at the ground surface. Core 27 is near the north base of the mound, has a sand content of 73 percent at ground surface and a depth of roughly equivalent to Core 19. The increase in the sand percentage in the upper horizons of these cores might be due to erosion on the slope of the mound (Figure 43).

A prehistoric anthropogenic stratum was identified in Cores 25, 26, and 18. In Core 25, the feature is at about 2 meters from the surface and carbon was extracted for radiocarbon dating (Appendix A) (Sullivan, 2016). In Core 26, the structure is between a depth of 1.19 and 1.45 m. This layer has alternating layers of concentrations and depletions, similar to those seen in Core 10 from Mound B (Figure 41). In Core 18, below the upper horizons, there is a 6 cm buried A horizon that looks like a prepared surface (Figure 42). At a similar elevation to the surface in the possible south ramp of Mound B, this buried A might be the south ramp of Mound C.

Figure 41. Alternating layers in Core 26 (Photo By Author).

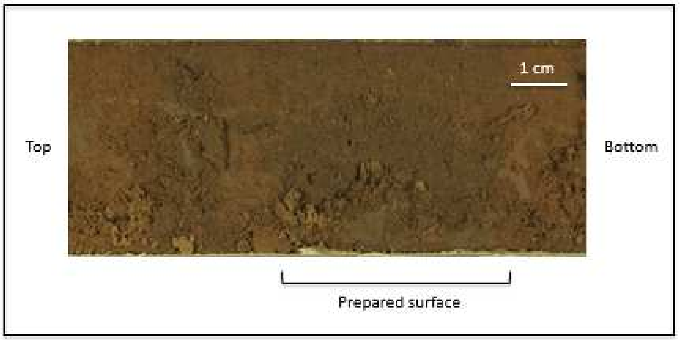

Figure 42. Core 18 prepared surface, possibly a south ramp of Mound C (Photo By Author).

The mound fill for Core 25 has sand fractions between 38 and 68 percent. For Core 26, the sand fraction ranges between 65 and 78 percent. These are percentages most similar to cores 3 through 6, which are close to the river, and at the riverbank (Figure 29). The top layer of Core 25 is at 68 percent, while slightly downslope, the top layer in Core 26 contains 78 percent sand. The increase in sand content in the upper horizons from summit to base seen in Mound B and in the very fine sand for Mound D does not hold true for Mound C (Figure 43). The sand percentages in the upper horizons of Cores 18, 19, and 27, while still high, are lower than those for the summit and slope. It is possible that historic plowing in the area around Mound C has affected the base of this mound differently.

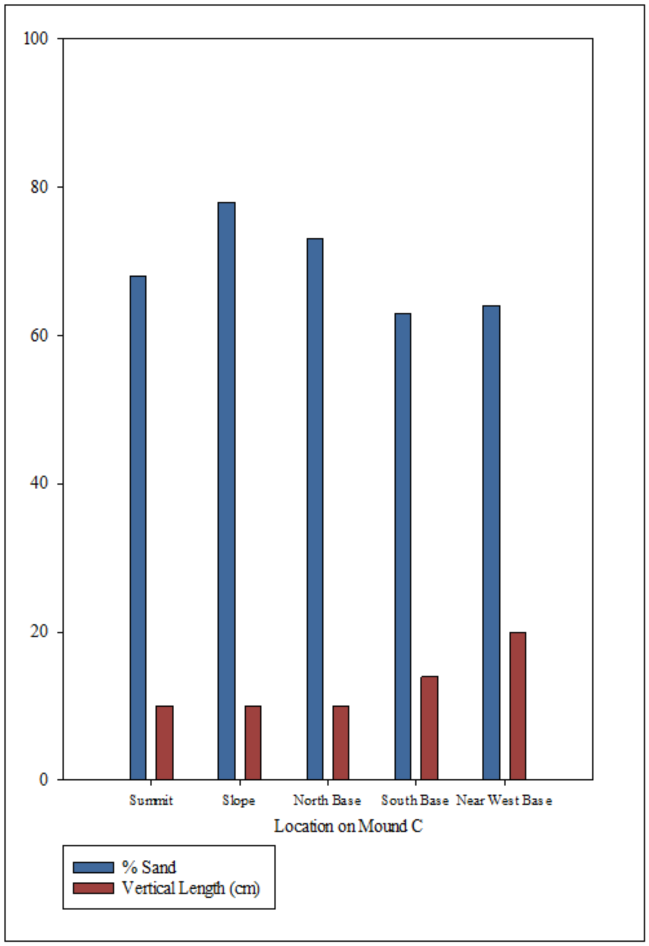

Figure 43. Sand percentage and vertical length increase moving from summit to base of Mound C.

3.5 Area between Mounds B and C

Figure 44. Core locations in the area between Mounds B and C (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

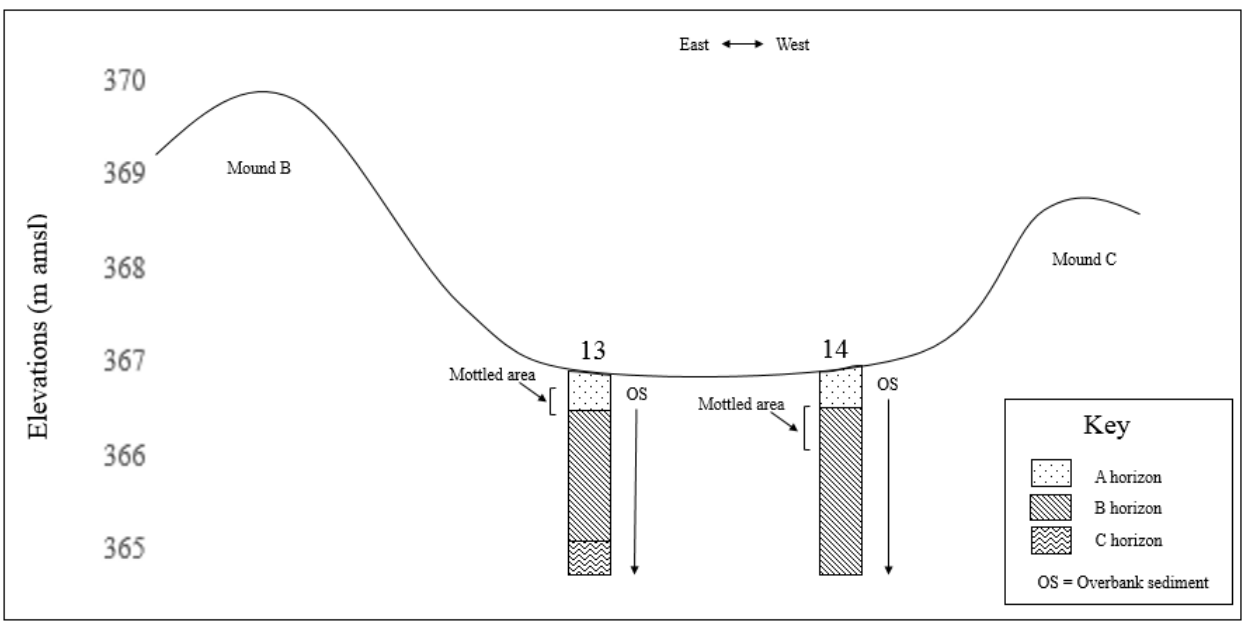

Figure 45. Core profiles on Mound B with elevation.

Core 13 and Core 14 are in the area between Mounds B and C, near the bases of each mound (Figures 44 and 45). The purpose of this placement was to determine whether there might have been an elevated prepared surface between the two mounds as was seen with the Norman Site's "double-mound arrangement" (Vogel et al., 2005). In addition, it was also hoped that they each might be in a structure or have evidence of slope wash from the mound. This area is relatively flat and is presumed to have experienced a greater amount of historic plowing than the mounds. Unfortunately, there is no visible prepared surface or evidence of a structure. The sand fraction at the top of the cores was 42 percent in Core 13 and 49 percent in Core 14. Any slope wash from the mound either didn't reach this far or was translocated by plowing.

Although slightly different from each other, both of these cores have the typical fining up sequence. The top of Core 13 is about 21 cm above the submound of Mound B and 2.58 m below the top elevation for Core 9. The soil profile closely mirrors those of the cores along the fence line. Core 14 has the same sequence until the bottom. Although, the bottom depths of both these cores are only about 4 cm apart, the particle sizes at the bottom of Core 14 are most similar to a depth about 74 cm higher in Core 13. So, while Core 14 has a sand percent of 25 at the bottom, the sand percent in Core 13 is at 56.

These cores also have a layer of mottled sediment. This layer is visible between 23 and 50 cm in Core 13 (Figure 46). In Core 14, this layer is deeper, between 59 and 96 cm. Because the top elevations for both Core 13 and Core 14 are higher than the start of the submound stratigraphy for both Mounds B and C and have similar top elevations and soil profiles to the cores on the fence line, it's likely that the area between the mounds was not a purposefully elevated prepared surface. Although the mottled layer in both cores may indicate some manipulation of the area, it is hard to link it to a particular influence, either human or natural.

Figure 46. Mottled layer in Core 13. Similar layer present in 14 (Photo By Author).

3.6 Area between Mounds B and C and the White River

Figure 47. Core locations in the area between Mounds B and C and the White River (modified from Google, 2016, Sullivan et al., 2015, and Sullivan, 2016).

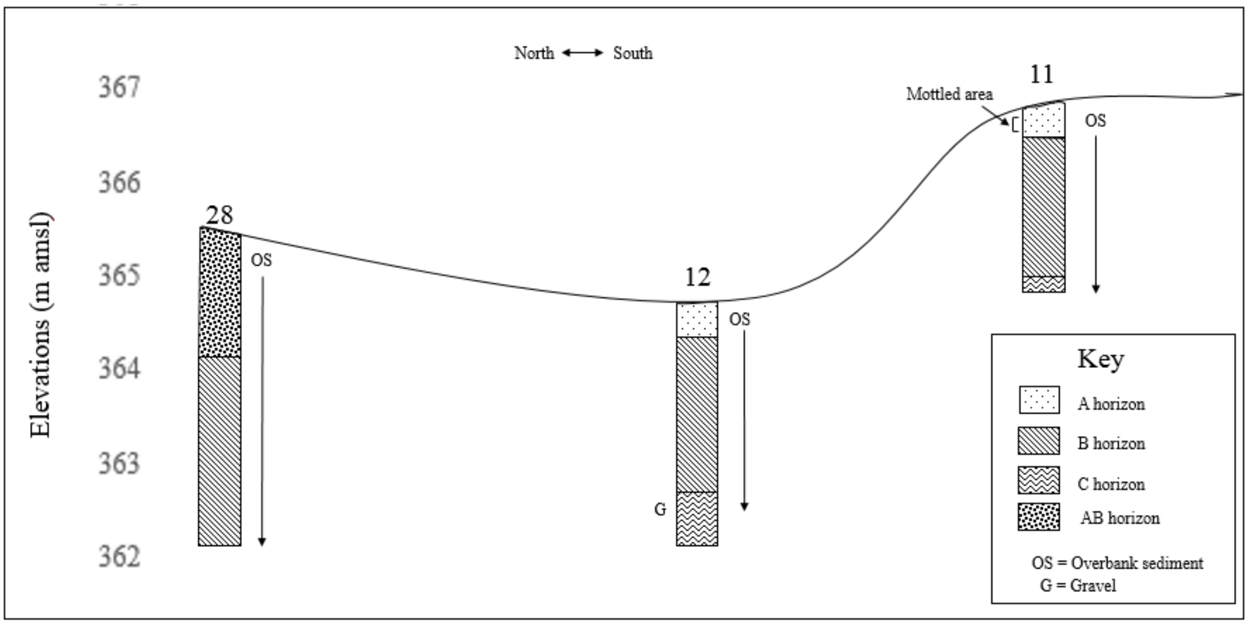

Figure 48. Core profiles on Mound B with elevation.

Cores 11, 12, and 28 are discussed together because they are located in the low elevation between Mounds B and C and the White River (Figures 47 and 48). During floods, this area is likely to be the first inundated by water and the last to dry out. The profiles for these cores are not only dissimilar to each other but also to most of the cores outside this area. The only exception is Core 28.

Core 28 is most similar to Core 3, which is one of the cores near the river and is located about 25 m north and 9 m east of Core 28. This core has the short fining up sequence for about 50 cm and then coarsens up for the next 1.5 meters above that, where the upper horizons again fine up. This is different from the usual coarser materials found in the A horizons. The sand content in the top 120 cm ranges between 28 and 63 percent, similar percentages to those found in the fill for all three mounds. The first 30 cm have a high silt content, 42 to 50 percent, similar to the other off-mound cores.

Core 11 is located near the north base of Mound C. I chose this location to not only study the erosion and flooding effects on the mound but also because this area may have been disturbed by an old farm track. For approximately the upper 70 cm, the particle sizes of the sediment are highly variable, similar but different to the mound fill. Percentages within the mound fill stay fairly consistent. There is no consistency in the percentages for this first 70 cm and percentages cover wider than usual ranges. Sand content is between 12 and 50 percent. Silt content is between 41 and 63 percent. Clay content is between 7 and 27 percent. Below these variable layers, which are possibly due to historic disturbance, the trend exhibits very stable overbank deposits with no fining or coarsening up sequence. Had this core gone deeper, it is likely, given the pattern across the site, that a fining up sequence would be noted.

Core 12 was extracted in the depression between Mound B and the river that resembles a borrow pit. In general, this core exhibits a fining up sequence. However, like the mound fill, Core 5 and Core 6, and the upper horizons of Core 11, the sequence is highly variable with very little consistency in particle sizes. As previously mentioned, this area holds water the longest (Figure 49). Because of this, after flooding, silt and clay would have adequate time to settle out of suspension. Supporting this is the high percentage of silt and clay, 56 and 12, respectively, near the ground surface. This is the highest clay content at this depth in all of the cores. The bottom 35 cm of this core also make it unique. Within these last centimeters, sand content spikes to between 87 and 93 percent, similar to the sample collected at the river. Above the coarse sand bedding, there is 19 cm of gravel (Figure 50). If this was a borrow pit, the only location within any of the mounds that has sand percentages similar to the ones in this core is the basal prepared surfaces of Mound B.

Figure 49. Location of Core 12 in the low area north of Mound B (in the background) (Photo By Author).

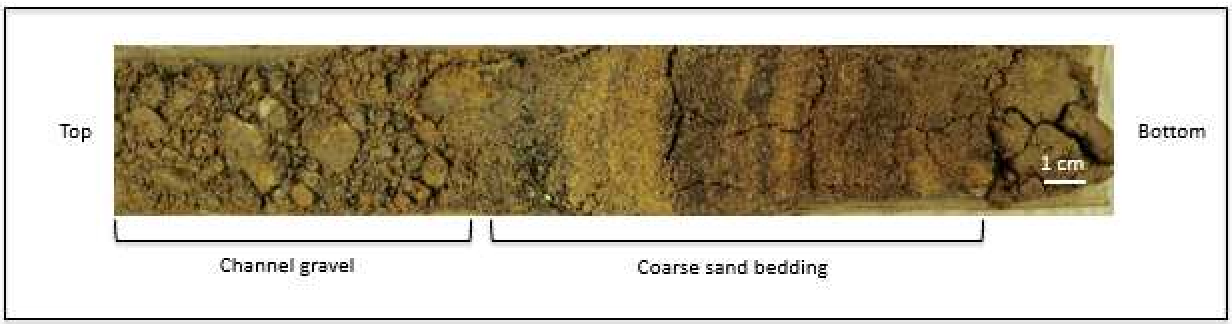

Figure 50. Bottom of Core 12 – gravel and bedding (Photo By Author).

4. Discussion

With the recent radiocarbon dating of Mound C placing its construction between 730 and 960 A.D. (Sullivan, 2016), the Collins site has a long history of being altered by human activity and natural processes. The purpose of this study was to increase our knowledge about the site by using soil descriptions and particle size analysis to explore the change in mound height, the origin of mound fill, and how the human and natural influences have affected the mounds.

While this study adds some information, there are some definite limitations and problems that need to be addressed and continuing investigations at the site could potentially solve these issues.

This study suggests that flooding was a less likely factor in any decrease in mound height. During flooding, textures become finer as overbank sediment is deposited farther from the channel (Guccione, 1993; Brown, 1997). Mound D is the lowest of the three mounds and the farthest from the river. However, in comparison to the other cores on the North – South Transect, the sand fraction on the surface of the summit, slope, and base of the mound have less of the very fine sand and a larger percent of coarse sand. The top layers of the cores on the summit and slope also contain less clay and silt and a higher total sand fraction (57 percent) than the cores at the base and in the surrounding floodplain. It is possible that unless the flood event is one of great magnitude the summit of Mound D would stay above the level of the water.

The summits of Mounds B and C are both at higher elevations than Mound D but also progressively closer to the river. Like Mound D, both have surface sand fractions larger than the surrounding floodplain surface. Mound B has a 61 to 70 percent surface sand fraction and Mound C, 63 to 78 percent. This indicates that during the majority of flood events at the site, water levels rarely exceed the height of the mounds or if they do, recede too quickly for clay and silt to settle out of suspension.

Erosion caused by plowing, wind, water (from rainfall), and gravity more likely factored into the decrease in the height of the mounds. Each one begins eroding by loosening the structure of sediment. Once the structure is broken, sheet erosion from water can more readily carry particles downslope. Sand, being the least cohesive fraction of sediment, is one of the more likely particles to erode (Goldberg & Macphail, 2008). As the sand collects at the base of the mound, the original border becomes obscured, the diameter of the mound enlarges, and height decreases (Kay et al., 1989; Vogel, 2005). The top one to two layers of sediment on the mounds at Collins contain the highest sand fraction and are the most exposed to surface erosion. In Mounds B and C, these layers become thicker from the summit to the base. For Mound D, this is true for the cores in the summit and the slope.

Core 20, which was likely at the base of Mound D, is in an area that was disturbed by the installment of the fence line. The top of this core has a higher silt than sand fraction. In addition, while there is very little change in the total amount of fine and very fine sand from the summit of Mound D to the slope, there is a very small increase of 1.5 percent in just the very fine sand. This pattern continues with Core 20, which is at or near the base of Mound D and has a 3 percent increase in very fine sand. This further supports the movement of sediment from the summit to the base of the mound.

While factors like plow depth, slope gradient, direction of plowing, and moisture content of soil determine the level of erosion, plowing is known to not only physically translocate soils down a slope, it also worsens wind and water erosion (Olson, Jones, Gennadiyev, Chernyanskii, Woods, & Lang, 2003). Wind erodes by sorting out and removing the finer particle sizes (Lyles, 1988). Therefore, it is possible that wind erosion might have contributed to the lower fractions of silt, clay, and very fine sand noted in the top layer of Mound D and the lower silt and clay fractions on the surface of the other two mounds. Regardless, the mounds likely decreased in height with both human and natural influences factoring into the alteration.

While there is sufficient support for the conclusions stated above, like Mound D, Mound C is an interesting conundrum. It has the increase in the sand fraction from the summit to the slope. However, the bases vary. Near the east base, Core 14 has a sand fraction of only 49 percent. As mentioned in the Result section, this could be because it is located slightly beyond the base of the mound and the sand simply does not erode that far out. Core 27, in the base to the north, is at 72 percent. Core 18, in the base to the south, is at 63 percent. Core 19, near the base to the west, is at 64 percent. Some of this variation could be due to differences in the gradient of each slope and differences in the amount of historic agricultural alterations in each area.

The final purpose of this study was to locate the source of mound fill and determine whether the builders were selectively choosing particular textures. Trying to understand the reasoning behind the selection of building materials by mound builders has been a subject of many investigations (Parsons, Scholtes, & Riecken, 1962; Reed et al., 1968; Kay et al., 1980; Saunders & Allen, 1994; Arco et al., 2006; Sherwood & Kidder, 2011; Mehta et al., 2012; Schilling, 2012; Sherwood, Blitz, & Downs, 2013). The results of the 2014 particle-size analysis for Mound C showed that the builders were likely collecting mound fill from areas close to river with higher sand fractions (Core 3, Core 28, and the riverbank) (Angeles, 2014). The sandy, weak structure of these sediments allows large quantities of fill to be more easily acquired. With the addition of the particle-size analysis results from the cores extracted in 2015, the sand fractions of the mound fill in B and C are found to be most similar to those found in Cores 3, 4, 5, and 28, with Core 3 being the best match.

However, Mound D is different. The majority of the mound fill in Core 21 and Core 22 contains between 40 and 49 percent sand. Fractions in that range are found only in the top 5 to 10 cm of a handful of scattered cores, most notably Core 23 and Core 24, which are close to Mound D, and Cores 1, 2, 16, and 17, which are farther away. There are similar sand percentages in Core 3, Core 28, and the top 60 cm of Core 6, which is on the opposite side of the study area. If the builders were in fact using the most easily attainable sediments, it would appear that for Mound D, they were simply scraping up the loamy topsoil from nearby areas.

While Core 3 and Core 28 aren't as far as Core 6, it would still be a considerable distance over which to transport a heavy basket load of sediment.

One question that carried over from 2014 was whether the low-lying area to the north of Mound B might have been a borrow pit. The first prepared surface of Mound B was the only part of any of the mounds that could be tied to this area. The sand fraction for this surface, between 23 and 30 percent, matches the top 120 cm of Core 12, which is between 16 and 37 percent.

The majority of the fill in Mounds B and C has a sand fraction between 51 and 78 percent. I offer three possible reasons for this seemingly purposeful selection. First, the mound builders were selecting sediments that were easy to dig up. Second, they were selecting sediments with higher drainage capability, believing this would be more structurally advantageous. Third, there was a ritual or belief surrounding the selection. If color was a factor in the selection of building materials, it was not noticeable in the narrow window provided by the cores. The layers of alternating color are visible but subtle. They are not the "zebra-stripe" layers seen at Goforth-Saindon (Kay et al., 1989) or the "alternating layers of light and dark colored sediments" at Huntsville (Sabo, 1986). They could just represent natural processes, like slope wash or animal burrows. Alternatively, they could be evidence of basket loads, prepared surfaces, or veneers and were purposefully selected based on color and/or texture (Kay et al., 1989; Vogel et al., 2005; Sherwood & Kidder, 2011). Answers to questions about the true nature of these layers will best be discovered through excavation, or even close interval coring.

Mound fill origin wasn't the only interesting information learned about the mounds from the cores. First, none of the mounds had an A horizon below the initial cultural layer, indicating that the ground surface was prepared before building began. This practice has been seen on other mound sites. Sherwood and Kidder (2011) took note of this practice at the Late Archaic sites of Nolan (Arco et al., 2006) and Watson Brake (Saunders et al., 2005) and at the effigy mounds from the Late Woodland period in the northern United States (Barrett, 1933; Barrett & Hawkes, 1919; Birmingham & Eisenberg, 2000). Like the purposeful selection of sandy textures in the mound fill, the removal of the A horizon could be of ritual or technological significance.

Second, the Bt horizon designated as the beginning of the submound stratigraphy for the mounds is higher in elevation than the first Bt horizon for the cores between the mounds and the river and at elevations very close to or slightly above those along the fence line. This indicates that the mounds were purposefully placed on a slightly elevated area of the floodplain.

Lastly, if all other reasons, such as erosion and deposition, are ruled out, it is possible that the mounds were purposefully capped with sediments containing higher fractions of sand. Sediments used for mound fill with the highest sand fraction were found at the summits of Mounds B and C. The summit of Mound D was not as significantly high in sand but also may be the most disturbed. The undulating surface of the mound and the mixture of horizons in Core 22 would suggest that the reports of an excavation of this mound by the U of A museum are true.

4.1 Problems and Future Investigations

There is a general consensus that the hydrometer method for particle size analysis is less accurate in comparison to the pipette method. While this may be true, the hydrometer method has provided results with adequate accuracy for this particular study. There was an effort to acquire a more accurate clay fraction, by taking measurements at 6 and 11 hours, providing the clay more time to fall out of suspension.

Another issue is that the procedure for selecting samples was different between the 2014 and 2015 samples and between Rathgaber's samples and my samples from 2015. For 2014 and Rathgaber in 2015, the cores were cut into 10 cm samples regardless of horizons. For my 2015 cores, samples were selected based on horizon change with a buffer in between horizons. While the difference in results might be negligible, it should be mentioned that there was a difference in procedure.

The depth of bedrock would have added to understanding the fluvial processes across the site. An assumption was made that the depth at which the Giddings rig refused to proceed was at or close to the bedrock. Access to the necessary geophysical and GPS equipment would have solved this problem. Time was also a factor in this and many other aspects of this project.

With more time, a long list of additional analyses could have been performed. The main one among them would be processing the sand fraction for all of the cores, not just the North – South Transect. This would have increased the understanding of the natural and cultural processes across the whole study area with much more precision. It would especially help with more closely determining the source of the mound fill as comparisons could be made across the site. In addition, sand fractions on the slopes of Mound B and C would help to verify the results for Mound D and help explain the variation in sand fractions around the base of Mound C. More cores at closer intervals would also clarify many questions or blank spots in this data. Cores at closer intervals along the slopes and at the bases would improve the visualization of slope wash and clarify to what extent the bases spread. They would also provide us with an estimation of exactly how much shorter the mounds have become.

In order to advance our knowledge of the mound stratigraphy, the best future investigation would be excavation. A major limitation of coring is the very narrow window it provides. This study could only give hints as to the meaning of the alternating colors in the mound fill. Mounds C and D might be sufficiently explored with two to three 2 m x 2 m units. Mound B would benefit from a trench, as it is likely to be deeper than Occupational Safety and Health Administration regulations would allow for a unit.

Adding a comparison of this study's data to Sullivan's (2016) geophysical survey results and GPS coordinates would benefit any future investigations at the site. Along with the new radiocarbon date from Mound C that Sullivan obtained, radiocarbon dating the sample of charcoal collected from Mound B would improve our knowledge of the chronology of the site.

5. Conclusion

The conclusions presented in this thesis, though susceptible to alteration by future investigations, add to our knowledge of the Collins site. Through the use of coring, particle size analysis, sand fraction analysis, and soil profile descriptions suggestions have been made concerning the decrease in height of the mounds, the origin of mound fill, and the human activity and natural processes that have altered the mounds. Erosion caused by plowing, wind, water, and gravity is suggested here to be the cause of the decrease in mound height and, in addition to historic plowing, the lateral spreading of the bases. The origin of the mound fill for Mounds B and C was found to be most similar to the sediments found near the river and may have been purposefully chosen for its ease of access, a ritual belief or purpose, or for a perceived structural benefit. The origin of fill for Mound D was most similar to sediments from nearby cores. Core 22 tentatively confirms a past excavation in Mound D and an unintentional discovery was the removal of the A horizon before mound construction began.

The new radiocarbon date for Mound C (Sullivan, 2016), though not a direct result of this study, is an exciting byproduct. A comparison between Sullivan's geophysical data and the coring data from this project is definitely warranted. The coring from this project might confirm the structures she has found or may have completely missed them. While this project has been an excellent learning experience for me, it is the contributions of this study to any future investigations that I find most satisfying.

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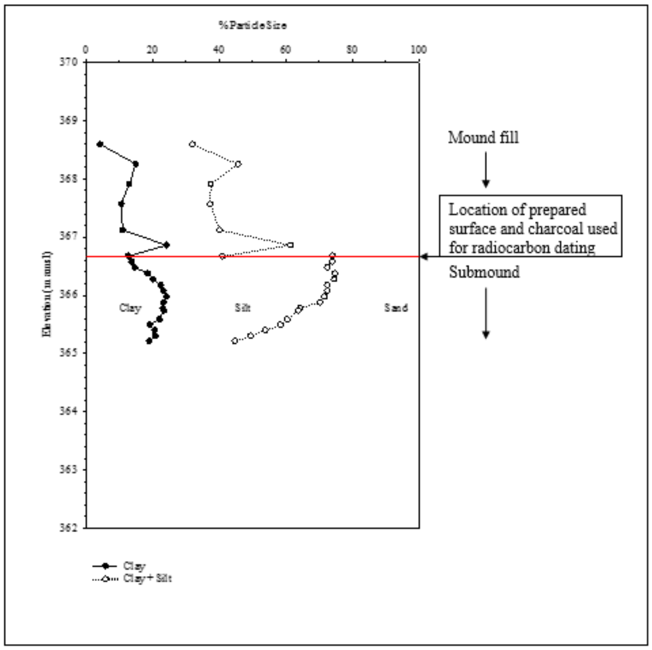
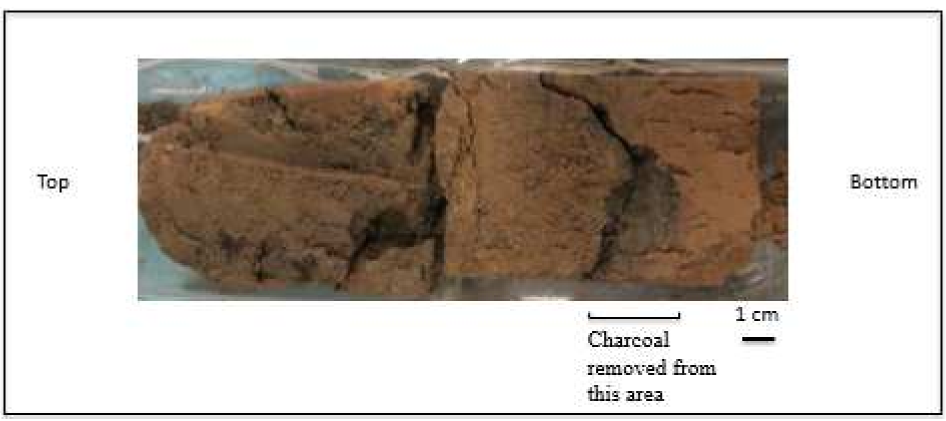
Appendix A: Radiocarbon dating of Mound C (Sullivan, 2016), calibrated using IntCal13.

Provenience and Sample ID	Conventional Radiocarbon Age Before Present	13C/12C Ratio	Calibrated Age 1-sigma range (68% probability)	Calibrated Age 2-sigma range (95% probability)
Mound C, ICA-15C/0448	1180 ± 30 B.P.	-24.1 o/oo	Cal. A.D. 780-890	Cal. A.D. 730-960
Mound E, BETA-195067	940 ± 60 B.P.	-17.6 o/oo	Cal. A.D. 1030-1150	Cal. A.D. 1000-1220



Location of charcoal used for radiocarbon dating in Core 25 particle size graph.



Prepared surface in Core 25 (Photo By Author).

Appendix B: Calculations

To decompress a soil core
Divide depth of soil core hole by length of extracted soil

Calculation for Stoke's Law (Brown, 1997)

$$F = 6\pi rnv$$

where F is the drag force on a sphere as it travels through a fluid; r is the radius of the sphere; n is the velocity of the fluid; and v is the velocity of the sphere.

Calculations for the Hydrometer Method (modified from Gee and Or, 2002)

Find C = concentration of soil in suspension using the calculation

$$C = R - R_L$$

where R = uncorrected reading and R_l= blank reading.

Find P = the summation percentage for the given time interval using the calculation

$$P = (C/C_o)/100$$

where C_o is the weight of the soil in grams.

Find X = the mean particle diameter in suspension (µm) at time t, using the calculation

$$X=(\theta t^{-1/2}) \text{ temperature correction}$$

where θ=the determination of a particle size from observed hydrometer readings and t=sedimentation time in minutes.

Temperature correction is found with the calculation

SQRT((2.0614-(0.0499*mean temperature))+(0.0005*mean temperature^2))

The 6 hour θ calculation is

12.18*(SQRT(16.295-(0.164*6 hour reading))

The 11 hour θ calculation is

12.18*(SQRT(16.295-(0.164*11 hour reading))

To find the clay fraction

$m\ln(2/X_{11}) + P_{11}$

where X_{11} is the mean particle diameter in suspension at 11 hours, P_{11} is the summation percentage at 11 hours, , $m = (P_6 - P_{11})/\ln(X_6/X_{11})$ which is the slope fo the summation percentage curve between 6 and 11 hours, where X_6 is the mean particle diameter in suspension at 6 hours and P_6 is the summation percentage at 6 hours.

To find the sand fraction

100 – ((average of the 40 second readings – mean blank reading)/oven dry weight in grams) x 100

To find the silt fraction

100 – (sand percentage + clay percentage)

Calculation for sand fraction analysis

Weight of very coarse, coarse, medium, fine, or very fine fraction divided by Total sand fraction

Appendix C: Soil Master Horizon and Subhorizon Nomenclature and Definitions (modified from Soil Science Society of America website (https://www.soils.org/publications/glossary/appendix/)).

Master horizons

O horizon **-** Layers dominated by organic material. Some are saturated with water for long periods or were once saturated but are now artificially drained; others have never been saturated.

A horizon - Mineral horizons that formed at the surface or below an O horizon, that exhibit obliteration of all or much of the original rock structure, and that show one or more of the following: (1) an accumulation of humified organic matter intimately mixed with the mineral fraction and not dominated by properties characteristic of E or B horizons (defined below) or (2) properties resulting from cultivation, pasturing, or similar kinds of disturbance.

B horizon - Horizons that formed below an A, E,, or O horizon and are dominated by obliteration of all or much of the original rock structure and show one or more of the following:

1. illuvial concentration of silicate clay, iron, aluminum, humus, carbonates, gypsum, or silica, alone or in combination;
2. evidence of removal of carbonates;
3. residual concentration of sesquioxides;
4. coatings of sesquioxides that make the horizon conspicuously lower in value, higher in chroma, or redder in hue than overlying and underlying horizons without apparent illuviation of iron;
5. alteration that forms silicate clay or liberates oxides or both and that forms granular, blocky, or prismatic structure if volume changes accompany changes in moisture content; or
6. brittleness.

C horizon - Horizons or layers, excluding hard bedrock, that are little affected by pedogenic processes and lack properties of O, A, E, or B horizons. The material of C layers may be either like or unlike that from which the solum presumably formed. The C horizon may have been modified even if there is no evidence of pedogenesis.

Subhorizons

p - Tillage or other disturbance. This symbol is used to indicate a disturbance of the surface layer by mechanical means, pasturing, or similar uses. A disturbed organic horizon is designated Op. A disturbed mineral horizon is designated Ap even though clearly once an E, B, or C horizon.

t - Accumulation of silicate clay. This symbol is used to indicate an accumulation of silicate clay that has formed and subsequently translocated within the horizon or has been moved into the horizon by illuviation, or both. At least some part should show evidence of clay accumulation in the form of coatings on surfaces of peds or in pores, or as lamellae, or bridges between mineral grains.

w - Development of color or structure. This symbol is used with “B” to indicate the development of color or structure, or both, with little or no apparent illuvial accumulation of material. It should not be used to indicate a transitional horizon.

Vertical subdivision

Used for subdividing thick layers that are slightly different. Indicated by consecutively placing an Arabic numeral after a master horizon or subhorizon. For example, C1, C2, C3 or Bt1, Bt2, Bt3….

Appendix D: Soil Descriptions

Core 1 (from Rathgaber, 2015)

Depth	Horizon	Color	Texture	Structure	Roots	Root Pores	Boundary	Sedimentalogical Interpretation
0-1	O	7.5YR 5/6 strong brown					clear	
1-28	A	7.5YR 5/6 strong brown	Silt Loam	weak, fine, granular	common, medium	few, fine	gradual	Soil Formation
28-181	Bt	7.5YR 5/6 strong brown	Silty Clay	moderate, medium angular blocky	few, medium	common, medium	n/a	Soil Formation

Core 2 (from Rathgaber, 2015)

Depth	Horizon	Color	Texture	Structure	Roots	Root Pores	Boundary	Sedimentalogical Interpretation
0-1	O						gradual	
1-27	A	10YR 4/4 dark yellowish brown	Silt Loam	weak, fine, granular	common, medium	few, fine	gradual	Soil Development
27-180	B	7.5YR 4/4 brown	Clay	moderate, medium subangular blocky	few, fine	common, fine	gradual	Soil Development
180-240	B	10YR 4/6 dark yellowish brown	Clay	weak, fine, massive	none	few, fine	diffuse	Soil Development
240-382	B	10YR 3/6 dark yellowish brown	Silt Clay	weak, fine massive	none	few, fine	n/a	Alluvium

Core 3 (from Angeles, 2014)

Core 3						
Depth (cm)	**Horizon**	**Color**	**Structure**	**Roots**	**Boundary**	**Clay Film**
0-3	AB	10YR 3/3	Granular, Weak	Common, Fine	Gradual	Y
3-50		10YR 3/3	Granular, Moderate	Few, Very fine, Very coarse	Gradual	Y
50-59	Bt1	7.5YR 3/3	Granular, Moderate	Very Few, Very fine	Gradual	N

Core 4 (from Rathgaber, 2015)

Depth	Horizon	Color	Texture	Structure	Roots	Root Pores	Boundary	Sedimentalogical Interpretation
0-2	O						clear	
2-46	A	10YR 3/6 dark yellowish brown	Sandy Loam	weak, fine granular	few medium	common, medium	clear	Alluvium 2
46-95	B	10YR 3/6 dark yellowish brown	Loam	weak, medium, angular blocky	few, fine	common, fine	gradual	Alluvium 2
95-200	B	10YR 3/4 dark yellowish brown	Sandy Loam	weak, fine, granular	few, fine	common, fine	gradual	Alluvium 2
200-250	C	7.5YR 3/4 dark brown	Sandy Clay Loam	weak, fine, massive	none	none	clear	Alluvium 1
250-320	C	10YR 3/4 dark yellowish brown	Sand	weak, medium, granular	none	none	clear	Alluvium 1
320-342	C	10YR 3/4 dark yellowish brown mottled with gley	Sand with gravels in bottom 10cm	weak, medium, granular	none	none	n/a	Alluvium 1

Core 5 (from Rathgaber, 2015)

Depth	Horizon	Color	Texture	Structure	Roots	Root Pores	Boundary	Sedimentalogical Interpretation
0-2	O						gradual	
2-15	A	10YR 4/4 dark yellowish brown	Loamy sand	weak, coarse granular	common, medium	few, fine	clear	Alluvium 3?
15-40	Bt	10YR 3/4 dark yellowish brown	Sandy Loam	weak, fine granular	common, medium	few, medium	gradual	Alluvium 3?
40-130	Bt	10YR 3/6 dark yellowish brown	Sandy Clay	moderate, medium angular blocky	few, fine	common, fine	gradual	Alluvium 3?
130-224	Bb	10YR 4/6 dark yellowish brown	Loamy sand	weak, medium granular	few, fine	few, fine	clear	Alluvium 2
224-241	IC	10YR 5/6 yellowish brown	Sand	weak medium granular	few, fine	None	abrupt	Alluvium 2
241-331	IIC	10YR 3/6 dark yellowish brown	Sandy Clay	moderate, medium granular	few, fine	None	gradual	Alluvium 1
331-342	IIC	10YR 3/3 dark brown	Loamy Sand	weak, medium granular	few, fine	None	clear	Alluvium 1
342-360	IIC	10YR 3/6 dark yellowish brown	Loamy Sand w/ gravels	moderate, medium granular	few, fine	None	clear	Alluvium 1
360-366	IIC		gravels (103cm)				n/a	Alluvium 1

Core 6 (from Rathgaber, 2015)

Depth	Horizon	Color	Texture	Structure	Roots	Root Pores	Boundary	Sedimentalogical Interpretation
0-1	O						Clear	
1-22	A	10YR 5/4 yellowish brown	Loam	moderate, fine, subangular blocky	common, fine	common, fine	Gradual	Alluvium 3
22-50	B	10YR 4/6 dark yellowish brown	Loam	moderate, fine, angular blocky	common, fine	common, fine	Gradual	Alluvium 3
50-109	IC	10YR 3/6 dark yellowish brown	Silt Loam	moderate, fine, angular blocky	few, fine	common, fine	Clear	Alluvium 3
109-130	IC	10YR 3/6 dark yellowish brown	Sand	weak, fine, granular	few, fine	few, fine	Clear	Alluvium 3
130-181	IIC	10YR 3/4 dark yellowish brown	Loam	weak, fine, granular	few, fine	few, fine	gradual	Alluvium 2
181-277	IIC	10YR 3/6 dark yellowish brown	Sandy Loam	weak, granular	few, fine	few, fine	gradual	Alluvium 2
277-323	IIIC	10YR 3/4 dark yellowish brown	Sandy Clay	weak, fine, granular	few, fine	few, fine	Clear	Alluvium 1
323-350	IIIC	10YR 3/4 dark yellowish brown	Sand	weak, granular	few, fine	few, fine	n/a	Alluvium 1

Core 7											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
0-28	Ap	10YR 4/3 Brown	Silt Loam	NA	NA	Weak,Very Coarse, Granular	Many, Fine	Many, Very Fine	NA	Clear	Plow zone
28-53	A	10YR 4/3 Brown	Silt Loam	NA	Few, faint manganese; increases with depth	Moderate, Coarse, Subangular Blocky	Common , Fine	Many, Very Fine	NA	Clear	
53-72	Bt1	7.5YR 4/3 Dark Brown	Silt Loam	NA	NA	Moderate, Coarse, Subangular Blocky	Common , Fine	Common, Very Fine	Very Few, Thin, Patchy	Gradual	Soil formation
72-182	Bt2	7.5YR 4/6 Strong Brown	Silt Loam/ Clay Loam	NA	NA	Moderate, Coarse, Subangular Blocky	Few, Fine	Common, Very Fine	Few, Thin, Patchy	Gradual	Overbank sediment begins
182-221	C1	7.5YR 5/4 Brown (mottled)	Clay Loam	NA	Few, Medium, Faint, Root Pores; Concentrations - 5YR 3/4 Dark Reddish Brown, Depletions - 10YR 6/4 Light Yellowish Brown	Moderate, Coarse, Subangular Blocky	Few, Fine	Common, Very Fine	Few, Thin, Patchy	Gradual	
221-249	C2	10YR 5/4 Yellowish Brown	Loam	NA	Few, Medium, Faint, Root Pores (very few, fine); Concentrations - 7.5YR 3/2 Dark Brown, Depletions - 10YR 7/6 Yellow	Moderate, Coarse, Subangular Blocky	Few, Fine	Common, Fine	Few, Thin, Patchy	Gradual	
249-283	C3	7.5YR 4/4 Dark Yellowish Brown	Sandy Loam	NA	Few, Medium, Distinct, Root Pores-very few, fine; Concentrations - 7.5YR 3/2 Dark Brown, Depletions - 10YR 7/6 Yellow	Moderate, Coarse, Subangular Blocky	Few, Fine	Few, Fine	NA	Clear	

Core 7 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
283-300	C4	7.5YR 3/4 Dark Brown	Sandy Loam	NA	Same as previous level	Weak, Medium, Subangular Blocky	NA	Very Few, Fine	NA		Bottom stratum

Core 8											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-11	Ap	10YR 4/4, Dark Yellowish Brown	Sandy Loam(v. fine sand)	NA	NA	Weak, coarse, granular	Common, fine	Common, fine	NA	Gradual	Plow zone
11-32	C	10YR 4/4, Dark Yellowish Brown	Sandy Loam(v. fine sand)	NA	NA	Moderate, coarse, granular	Common, very fine	Common, very fine	NA	Clear	
32-40	A	10YR 3/4, Dark Yellowish Brown	Sandy Loam(v. fine sand)	NA	NA	Moderate, coarse, subangular blocky	Common, very fine	Few, very fine	NA	Clear	
40-95 (40-60 prepared surface)	Ab	10YR 2/2, Very Dark Brown with charcoal	Sandy Loam/Silt Loam	NA	NA	Moderate, medium, subangular blocky	Common, fine	Few, very fine	NA	Gradual	Prepared surface
95-190	Bt1	7.5YR 4/6, Strong Brown	Silt Loam/Silty Clay Loam/Clay Loam	NA	NA	Moderate, coarse, subangular blocky	Very few, very fine	Few, fine	Few, thin, patchy	Clear	Overbank sediment begins
190-243	Bt2	7.5YR 5/6, Strong Brown	Clay Loam/Silty Clay Loam	NA	NA	Moderate, coarse, subangular blocky	NA	Very few, fine	Few, thin, patchy with few, fine Mn stains on cutans	Gradual	
243-253	Bt3	7.5YR 4/6, Strong Brown	Loam	NA	See Cutans	Moderate, medium, subangular blocky	NA	Few, fine	Very few, thin, patchy with Common, fine manganese films	Abrupt	
253-286	C1	10YR 4/4, Dark Yellowish Brown	Sandy Loam	NA	See Cutans	Moderate, coarse, subangular blocky	NA	Few, fine	Common, thin, continuous with Few, medium manganese films	Abrupt	

Core 8 (Cont.)											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
292-326	C3	10YR 4/4, Dark Yellowish Brown	Sandy Loam (fine sand)	NA	Concentrations - common, medium, faint (5YR 3/4 Dark Reddish Brown); Depletions - common, medium, distinct (10YR 6/4 Light Yellowish Brown); root pores present	Moderate, medium, subangular blocky	NA	Few, fine	NA	Abrupt	
326-330	C4	10YR 4/4, Dark Yellowish Brown	Sandy Loam	Few, subround	Concentrations - common, medium, faint (5YR 3/4 Dark Reddish Brown); Depletions - common, medium, distinct (10YR 6/2 Light Brownish Gray); Few, medium manganese films along root pores	Moderate, medium, subangular blocky	NA	Few, fine	NA		

Core 9											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pore	Cutans	Boundary	Interpretation
0-9	Ap	10YR 4/6, Dark Yellowish Brown	Sandy Loam	NA	NA	Weak, coarse, subangular blocky	Many, very fine	Many fine	NA	Clear	Plowzone, previously Fill
9-24	Bw1	10YR 4/3, Brown	Loam	Few, round (1 at 15 cm)	NA	Moderate, medium, subangular blocky	Common, very fine	Few, very fine	NA	Gradual	Fill
24-61(charcoal at 50 and 58)	Bt1	10YR 4/3, Brown	Sandy Clay Loam/ Loam	NA	NA	Strong, coarse, subangular blocky	Few, fine	Common, fine	Few, thin, patchy	Clear	Fill
61-132 (charcoal at 81, 110)	Bt2/Bw2	7.5YR 3/4 Dark Brown	Sandy Loam	Pebble at 102	NA	Moderate, medium, subangular blocky	Common, fine	Common, fine	Few, thin, patchy	Clear	Fill

Core 9 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pore**	**Cutans**	**Boundary**	**Interpretation**
132-222 (charcoal at 144; flake at 139 in archived half)	Bw3/Bt3	7.5YR 3/4 Dark Brown	Sandy Loam/ Loam/ Sandy Loam	NA	NA	Moderate, medium, subangular blocky	Few, fine	Common, fine	Few, thin, patchy	Clear	Fill
222-240 (charcoal increases)	Bw4	10YR 3/3, Dark Brown	Silt Loam	NA	NA	Moderate, fine, subangular blocky	NA	NA	Few, thin, patchy	Very Clear	Fill
240-260 (large charcoal, burnt clay at 252)	Bt4 (Burnt clay - 10YR 2/1 Black and lighter area - 10YR 6/6 Brownish Yellow at 257)	5YR 3/4 Dark Reddish Brown with flecks of 2.5YR 5/8 Red changing to 7.5YR 3/3 Dark Brown with charcoal	Silt Loam	NA	NA	Moderate, fine, subangular blocky	NA	Few, fine	Common, medium, patchy	Clear	Surfaces begin and continue until beginning of next horizon
260-404	1Bt/C	7.5YR 3/4 Dark Brown	Silty Loam/Silty Clay Loam	NA	NA	Moderate, coarse, subangular blocky	NA	Common, fine	Common, medium, discontinuous	Clear	Submound; No A horizon; possibly prepared ground before building or prairie mound
404-468	2Bt/C	10YR 3/6, Dark Yellowish Brown	Clay Loam	NA	Concentrations - few, fine, faint, 5YR 3/3 Dark Reddish Brown; Depletions - same, 10YR 7/6 Yellow	Moderate, coarse, subangular blocky	NA	Few, fine	Common, medium, discontinuous	Clear	Overbank sediment
468-492	C1	10YR 4/4, Dark Yellowish Brown	Loam	NA	Concentrations - few, fine, faint, 5YR 3/3 Dark Reddish Brown; Depletions - same, 10YR 7/6 Yellow	Moderate, coarse, subangular blocky	NA	Common, fine	Common, thin, patchy	Gradual	Overbank sediment
492-554	C2	10YR 3/6, Dark Yellowish Brown	Sandy Loam	NA	Concentrations - few, fine, faint, 5YR 3/3 Dark Reddish Brown; Depletions - same, 10YR 7/6 Yellow	Moderate, medium, subangular blocky	NA	Common, fine	NA		Bottom Stratum

Core 10											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
0-8	Ap	10YR 4/3, Brown	Sandy Loam	NA	NA	Weak, fine-medium, subangular blocky	Many, very fine	Many, fine	NA	Clear	Plowzone; Fill
8-24	Bw1	10YR 4/3, Brown with very small black flecks	Sandy Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Fill
24-32	Bw2	10YR 3/3, Dark Brown with few black flecks - larger than last layer - some very small charcoal	Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Fill
32-51	Bw3	10YR 4/3, Brown	Loam	Few, round, 1 6mm pebble	NA	Moderate, coarse, subangular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	Fill
51-73	Bw4	7.5YR 3/3 Dark Brown	Loam	NA	NA	Weak, medium, subangular blocky	Common, fine	Many, fine	Very few, thin, very patchy	Clear	Fill
73-91 (charcoal but less than lower levels)	Bw5	10YR 3/4, Dark Yellowish Brown	Sandy Loam	NA	NA	Weak, fine, subangular blocky	Few, fine	Many, fine	Very few, thin, very patchy	Clear	Fill
91-110 (larger pieces of charcoal)	Bw6	10YR 3/3, Dark Brown	Loam	NA	NA	Moderate, coarse, subangular blocky	Few, fine	Common, fine	Few, thin, patchy	Abrupt	Fill
110-118	Bw7	10YR 3/3, Dark Brown with 10YR 7/4 Very Pale Brown, alternating laminated layers	Sandy Loam	NA	NA	Strong, coarse, subangular blocky	NA	Few, fine	NA	Abrupt	Prepared Surfaces with sequences of weathering
118-128	Bw8	10YR 3/3, Dark Brown	Loam	Few, round, 1 2.5 cm X 3 cm pebble	NA	Moderate, coarse, subangular blocky	Few, fine	Common, very fine	NA	Clear	Alternating colors; Layers of fill?

Core 10 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
128-154	Bw9	7.5YR 3/4 Dark Brown	Loam/ Sandy Loam	NA	NA	Moderate, coarse, subangular blocky	Few, fine	Many, fine	NA	Clear	Alternating colors; Layers of fill?
154-190	Bw10	10YR 3/4, Dark Yellowish Brown	Sandy Loam	NA	NA	Moderate, medium, subangular blocky	Few, fine	Many, fine	Very few, thin, very patchy	Abrupt	Fill
190-211	Bt1(Cultural)	7.5YR 3/2 Dark Brown; many charcoal flecks and	Silty Loam	NA	NA	Moderate, coarse, subangular blocky	NA	Many, fine	Common, medium, discontinuous	Clear	Cultural - structure surface?
211-216	Bt1	7.5YR 3/3 Dark Brown	Silt Loam	NA	Concentrations - common, medium, faint, 7.5YR 3/2 Dark Brown	Moderate, medium, subangular blocky	NA	Common, fine	Few, thin, patchy	Clear	Submound begins/ Overbank sediment begins
216-225	Bt2	7.5YR 3/4 Dark Brown	Silt Loam	NA	NA	Strong, coarse, subangular blocky	NA	Many, fine	NA	Clear	
225-247 (238-244 flecks of burnt clay; 243- chunk of charcoal)	Bt/C (Cultural)	7.5YR 3/3 Dark Brown with charcoal and flecks of 7.5YR 6/8 Reddish Yellow	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	NA	Common, fine	Common, medium, discontinuous	Clear	Cultural or just charcoal in B?
247-296	Bt/C	7.5YR 4/6 Strong Brown	Silt Loam/ Silty Clay Loam	NA	NA	Moderate, fine, angular blocky	NA	Many, fine	Few, thin, patchy	Clear	
296-341	Bt3	7.5YR 4/6 Strong Brown	Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	NA	Common, fine	Common, medium, discontinuous	Gradual	
341-354	Bt4	10YR 4/4 Dark Yellowish Brown	Silty Clay Loam	NA	Depletions - common, coarse, faint, masses - 10YR 8/4 Very Pale Brown	Moderate, very coarse, angular blocky	NA	Very few, very fine	Few, thin, patchy	Clear	Overbank sediment ends

Core 10 (Cont.)											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
354-429	C1	10YR 4/6 Dark Yellowish Brown	Loam/Clay Loam/ Loam/ Sandy Clay Loam	NA	Concentrations - faint, masses, few, 10YR 8/4 Very Pale Brown; Depletions - few, fine, distinct 10YR 3/2 Very Dark Grayish Brown	Moderate, coarse, angular blocky	NA	Common, fine	Very few, thin, patchy	Clear	Bottom Stratum
429-445	C2	10YR 4/4 Dark Yellowish Brown	Sandy Loam	NA	Concentrations - faint, masses, very few, 10YR 8/4 Very Pale Brown; Depletions - very few, fine, distinct 10YR 3/2 Very Dark Grayish Brown	Moderate, coarse, angular blocky	NA	Many, fine	NA		Bottom Stratum

Core 11											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
0-6	Ap	10YR 3/3, Dark Brown	Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, medium	NA	Clear	Plow zone
6-28	A	10YR 4/3, Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Common, fine	Common, medium	NA	Gradual	Soil formation
28-38 (1 - 3 cm charcoal)	A or Cultural? Surface? Deep Plowzone?	10YR 2/2 Very Dark Brown	Loam	NA	Concentrations - few, medium, distinct; spherical nodules - 10YR 6/8 Brownish Yellow	Moderate, coarse, angular blocky	Common, fine	Many, medium	NA	Clear	Historic disturbance?
38-47 (1 fleck of charcoal)	Ab or Cultural? Surface? Deep Plowzone?	7.5YR 2.5/2 Very Dark Brown	Silt Loam	NA	Concentrations - common, coarse, distinct; irregular nodes - 7.5YR 5/6 Strong Brown	Moderate, coarse, angular blocky	Common, fine	Many, fine - medium	NA	Clear	Historic disturbance?

Core 11 (Cont.)											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
47-53	Bt	7.5YR 3/3 Dark Brown	Loam	NA	Concentrations - few, fine, faint; irregular nodes - 7.5YR 5/6 Strong Brown	Moderate, coarse, angular blocky	Few, fine	Many, fine	NA	Clear	Overbank sediment begins
53-72	Bt	7.5YR 4/3 Brown	Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	
72-172	Bt	7.5YR 4/3 Brown	Silty Clay Loam	NA	NA	Moderate, coarse, subangular blocky	Few, fine	Many, fine	Common, medium, discontinuous	Gradual	
172-244	Bt/C	7.5YR 4/3 Brown	Silty Clay Loam	NA	Depletions - few, fine, faint, thin ribbons, 10YR 6/8 Yellowish Brown	Moderate, coarse, angular blocky	NA	Many, fine	Many, thick, discontinuous		Beginning of bottom stratum

Core 12											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
0-6	Ap	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Weak, medium, subangular blocky	Many, fine	Common, fine	NA	Clear	Plow zone
6-17	Ap	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Moderate, medium, subangular blocky	Common, fine	Common, fine	NA	Clear	Plow zone
17-36	A	10YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	NA	Clear	Soil formation
36-56	AB1	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Few, thin, patchy	Clear	Old channel/ Backswamp?
56-71	AB2	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Few, fine	Many, fine	Few, thin, patchy	Clear	
71-167	AB3	7.5YR 4/3 Strong Brown	Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	
167-219	AB4	7.5YR 4/3 Strong Brown	Silty Clay Loam/ Loam (fine sand)	NA	NA	Moderate, coarse, subangular blocky	NA	Common, fine	NA	Clear	

Core 12 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
219-247	AB5	7.5YR 4/2 Brown	Loam/ Sandy Loam (larger grain sand)	NA	Depletions - few, fine, faint, thin ribbons, 10YR 6/8 Yellowish Brown	Moderate, coarse, angular blocky	NA	Common, fine	NA	Abrupt	
247-256	C1/ Alluvium	7.5YR 4/2 Brown	Sandy Loam (larger grain than previous level, mixed with gravel)	Common, round to well rounded	NA	Weak to moderate, fine to coarse, granular to subangular blocky	NA	NA	NA	Abrupt	Bottom Stratum begins
256-265	C2/ Alluvium	NA	Fine Sand (very coarse with gravel)	Abundant, round	NA	Weak, granular, single grain, structureless	NA	NA	NA	Abrupt	
265-279	Alluvium (Bedding)		Silty Clay Loam	NA	Concentrations and depletions, distinct layers; 10YR 6/4 Light Yellowish Brown, 10YR 4/1 Dark Gray, 10YR 6/6 Brownish Yellow, 10YR 5/6 Yellowish Brown, 7.5YR 3/2 Dark Brown, 10YR 5/6, 7.5YR 3/2, 10YR 5/6, 10YR 3/6 Dark Yellowish Brown, 7.5YR 3/2, 10YR 5/6	Moderate, coarse, angular blocky	NA	NA	NA	Abrupt	
279-282	C3/ Alluvium (Bedding)	7.5YR 3/3 Dark Brown	Fine Sand	Few, subround	NA	Moderate, medium, subangular blocky	NA	NA	NA		

Core 13											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-6	Ap1	7.5YR 3/3 Dark Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Few, fine	NA	Clear	Plow zone

Core 13 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
6-33	Ap2	10YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone or prehistoric? 23-50 and 72 - mottled sediments similar seen in 14
33-45	Bt1	7.5YR 3/4 Dark Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Common, fine	NA	Clear	Overbank sediment begins
45-189	Bt2	7.5YR 4/4 Brown	Silt Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, medium	Few, thin, patchy	Gradual	
189-225	C	7.5YR 4/6 Strong Brown	Sandy Clay Loam	NA	Concentrations - few, fine, faint, small masses, 10YR 7/6 Very Pale Brown; Depletions - very small, distinct nodules, 7.5YR 2.5/2 Very Dark Brown	Moderate, coarse, angular blocky	NA	Many, fine	Common, medium, patchy - root pores		Bottom Stratum

Core 14											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-13	Ap	10YR 4/2 Dark Grayish Brown	Sandy Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone
13-21	A1	10YR 4/3, Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Soil formation
21-54	A2	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Many, fine	Many, fine	Common, medium, patchy	Clear	Soil formation
54-65	Ab	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, medium	Many, medium, discontinuous	Clear	Historic or prehistoric disturbance? 59-96 mottled sediments similar seen in 13

Core 14 (Cont.)											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	Root Pores	Cutans	Boundary	Interpretation
65-185	Bt1	7.5YR 4/3 Brown	Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, thick, discontinuous	Gradual	Overbank sediment
185-240	Bt2	10YR 4/4 Dark Yellowish Brown	Silty Clay Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	NA	Many, fine	Common, medium, patchy		Overbank sediment

Core 15											
Depth (cm)	Horizon	Color	Texture	Gravel	RMF	Structure	Roots	RP	Cutans	Bound.	Interpretation
0-4	Ap	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine, medium	Common, fine	NA	Clear	Plow zone
4-28	A	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	Very few, thin, patchy	Clear	Soil Formation
28-49	Bt1	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, thick, discontinuous	Clear	Soil Formation
49-128	Bt2	7.5YR 4/4 Brown	Silt Loam/ Clay Loam/ Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine (less than last level)	Many, medium	Many, thick, discontinuous	Clear	Overbank sediment begins
128-178	Bt3	7.5YR 4/3 Brown	Silty Clay Loam/ Clay Loam	Few, round, 1 - 1.5 X 1.5 cm pebble	NA	Moderate, coarse, angular blocky	NA	Many, fine	Many, thick, discontinuous	Gradual	
178-234	C1	7.5YR 5/6 Strong Brown	Clay Loam	Few, subround, 1 - 2 cm pebble at 192 in archived side	NA	Moderate, coarse, angular blocky	NA	Common, fine	Many, thick, discontinuous	Clear	
234-258	C2	7.5YR 5/3 Brown	Loam	Few, round, 1 - 0.5 cm pebble	NA	Moderate, medium, angular blocky	Few, fine	Many, fine	Few, thin, patchy	Clear	
258-277	C3	10YR 4/3 Brown	Sandy Loam	NA	Very few manganese	Moderate, medium, angular blocky	Few, fine	Many, fine	Few, thin, patchy		Bottom Stratum

Core 16											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-5	Ap	10YR 4/2 Dark Grayish Brown	Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone
5-20	A	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, medium, angular blocky	Many, fine	Common, fine	NA	Clear	Soil formation
20-30	Bt1	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Many, fine	Many, fine	NA	Clear	Soil formation
30-143	Bt2	7.5YR 4/4 Brown	Silt Loam/ Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, thick, discontinuous	Gradual	Soil formation/ Overbank sediment begins
143-191	Bt3	7.5YR 4/3 Brown	Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, medium, more discontinuous than last level	Gradual	
191-217	C1	7.5YR 5/6 Strong Brown	Sandy Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Few, thin, patchy	Abrupt	
217-230	C2/ Alluvial bands	7.5YR 4/3 Brown	Sandy Loam	Few, subangular/ subrounded, cobbles	NA	Moderate, medium, subangular blocky	NA	Many, fine	Few, thin, patchy	Abrupt	Bottom stratum
230-240	High velocity turbulent flood event	7.5YR 4/4 Brown with charcoal	Sand	Abundant, subangular/ subround cobbles and pebbles	NA	Weak, fine, granular	NA	NA	NA	Note: Fines upward to next level	Bottom stratum

Core 17											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-6	Ap	10YR 4/2 Dark Grayish Brown	Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine and medium	Many, fine	NA	Clear	Plow zone
6-21	A1	7.5YR 4/2 Brown	Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, fine	NA	Clear	Soil formation
21-32	A2	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, medium, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	Soil formation

Core 17 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
32-99	Bt	7.5YR 4/4 Brown with 2 cm of 10YR 4/3	Silt Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, thick, discontinuous	Clear	Overbank sediment begins
99-146	Bt/C	7.5YR 4/4 Brown	Clay Loam/ Sandy Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, medium, patchy	Clear	
146-211	C (banded, charcoal at 180)	7.5YR 4/4 Brown (slate or manganese?)	Sandy Clay Loam/ Sandy Loam (increasing sand with depth starting at this level)	Few, round, 1 - slate-like, black, 1.5 X 2 cm and 1 - 2 X 3 cm at 194, 1 - 1.5 X 1.75 cm at 187)	NA	Moderate, medium, subangular blocky	Few, fine	Many, fine	NA	Clear	Bottom Stratum
211-236	Alluvial bands (highly turbulent flood)	10YR 4/4 Dark Yellowish Brown with charcoal or manganese?	Sandy Loam (mostly sand)	Common, round, 1 - 3 X 4 cm and 1 - 2 X 3 cm at 218)	NA	Moderate, medium, subangular blocky	NA	NA	NA		Bottom stratum

Core 18											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-11	Ap	10YR 4/2 Dark Grayish Brown	Sandy Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, fine	NA	Gradual	Plow zone
11-24	A1	7.5YR 4/2 Brown	Sandy Loam	NA	NA	Moderate, coarse, subangular blocky	Common, fine	Many, fine	NA	Gradual	Soil formtion
24-37	A2	7.5YR 4/2 Brown	Sandy Loam	NA	NA	Moderate, medium, angular blocky	Common, fine	Many, fine	NA	Abrupt	Soil formation
37-43	Ab or prepared surface?	10YR 4/2 Dark Grayish Brown	Loam	NA	Depletions - common (quantity -2), fine, distinct, mass, 10YR 7/4 Very Pale Brown	Moderate, coarse, angular blocky	Few, fine	Many, fine	Few, very thin, patchy	Abrupt	Possible ramp of south side of mound
43-58	Bt1	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, thick, discontinuous	Clear	

Core 18 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
58-94	Bt2	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, thick, continuous	Clear	
94-171	Bt3	7.5YR 4/4 Brown	Silt Loam/Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Many, medium, discontinuous	Gradual	
171-230	Bt/C - Alluvium	7.5YR 4/3 Brown	Clay Loam (increasing sand size and quantity starting at this level)	Few, subrounded 1 pebble at 185	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Common, medium, discontinuous	Gradual	
230-264	C - Alluvium - bands of slate start at 245	7.5YR 4/3 Brown	Loam/ Sandy Loam	Few, rounded, cobbles at 256	Few, black slate-like concentrations	Moderate, coarse, angular blocky	NA	Many, fine	Few, thin, patchy		Bottom Stratum

Core 19											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-8	Ap	7.5YR 4/2 Brown	Sandy Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Common, fine	NA	Clear	Plow zone
8-23	A	7.5YR 4/3 Brown	Sandy Loam	Few, subrounded, 1 - 1X1 cm, 1 - 2 X 1.5 cm pebble	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Soil formation
23-35	A/B (charcoal? mottled? At 34)	7.5YR 4/2 Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Many, fine	Many, fine	Common, medium, discontinuous	Clear	Historic or prehistoric disturbance? Similar mottling to 13 and 14
35-73	Bt1	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Many, fine	Many, fine	Common, medium, discontinuous	Clear	Overbank sediment begins
73-136	Bt2	7.5YR 4/4 Brown	Silty Clay Loam/ Clay Loam/Silty Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, thick, discontinuous	Clear	
136-153	Bt3	7.5YR 4/3 Brown	Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, thick, continuous	Gradual	

Core 19 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
153-182	Bt4	7.5YR 5/4 Brown	Clay Loam (increasing sand size and quantity starting at this level)	NA	Concentrations - few, fine, faint, 5YR 3/3 Dark Reddish Brown	Moderate, coarse, angular blocky	Few, fine	Many, fine	Common, medium, discontinuous	Gradual	
182-212	Bt/C (Alluvial? - faint bands)	7.5YR 5/6 Strong Brown	Clay Loam/ Sandy Clay Loam	NA	Concentrations - common, fine, distinct, slate-like, 7.5YR 2.5/1 Black	Moderate, coarse, angular blocky	NA	Common, fine	Few, thin, patchy		Bottom stratum

Core 20											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-3	Ap	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Moderate, medium, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone
3-22	A	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Soil formation
22-61	Bt1	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Many, fine and one medium	Many, fine	Many, medium, discontinuous	Clear	Overbank sediment begins
61-88	Bt2	7.5YR 4/4 Brown	Clay Loam	NA	NA	Moderate, medium, angular blocky	Common, fine	Many, fine	Many, thick, discontinuous	Clear	
88-133	Bt3	7.5YR 4/3 Brown	Clay Loam/ Loam	Few, subrounded, 1 - 3 x 3 cm - broken at 88	Concentrations - few, fine, distinct, slate-like, 7.5YR 2.5/1 Black	Moderate, coarse, angular blocky	Few, fine	Many, fine	Common, medium, patchy	Clear	
133-151	C - Alluvium, banded	7.5YR 4/3 Brown	Sandy Clay Loam	Few, subrounded, 1 - 3 x 3 cm at 143, 1 - 3.5 x 4 cm at bottom (possibly bedrock)	Concentrations - common, medium, distinct, slate-like, 7.5YR 2.5/1 Black, increasing with depth	Moderate, coarse, angular blocky	Few, fine	Many, fine	Common, medium, patchy		Bottom stratum

Core 21											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-17	Ap	7.5YR 4/2 Brown	Sandy Loam	Few, subrounded, 1 - 0.7 x 0.5 cm and 1 - 1 x 1.5 cm pebbles	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone; Fill

Core 21 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
17-22	Bw1	7.5YR 4/2 Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Many, medium	Many, fine	NA	Clear	Fill
22-33	Bt1	7.5YR 4/2 Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Abrupt	Fill
33-48	Bt2; Prepared Surface	7.5YR 3/2 Dark Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Abrupt	Prepared Surface #1
48-57	Bw2; Prepared Surface	10YR 3/2 Very Dark Grayish Brown mottled with 7.5YR 3/2 at the border with previous level	Sandy Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	NA	Abrupt	Prepared Surface #2
57-66	Bt3; Fill	7.5YR 4/2 Brown	Loam	NA	Concentrations - few, fine, very faint, 7.5YR 3/2 Dark Brown	Moderate, coarse, angular blocky	Few, fine	Many, fine	Common, thin, patchy	Clear	Fill - to build up for prepared surface
66-109	Bw3; Fill	7.5YR 4/2 Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	Fill - to build up for prepared surface
109-177	Bt1	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	Submound - abrupt change in sand; Overbank sediment begins
177-245	Bt1	7.5YR 4/3 Brown	Silt Loam/ Clay Loam	NA	Concentrations - common, medium, faint and distinct, 7.5YR 3/1 Very Dark Gray	Moderate, coarse, angular blocky	NA	Many, fine	Many, medium, discontinuous	Clear	
245-258	C (Alluvium - banded)	7.5YR 4/4 Brown	Clay Loam	Few, subangular/ subrounded 1 - cobble, broken on all sides	Concentrations - few, fine, faint, 10YR 2/1 Black; Depletions - few, very faint, fine, 10YR 7/4 Very Pale Brown	Moderate, coarse, angular blocky	NA	Many, fine	Few, thin, patchy		Bottom stratum

Core 22											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-13	Ap	10YR 4/3 Brown	Sandy Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone
13-22	Bw	10YR 4/3 Brown	Sandy Loam	Few, subrounded - 1 pebble	NA	Moderate, coarse, subangular blocky	Many, medium	Many, fine	NA	Clear	Fill
22-34	Bt	7.5YR 3/3 Dark Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Clear	Fill
34-82	Ab - disturbed area	10YR 4/2 Dark Grayish Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, medium, patchy	Clear	Fill
82-107	Bt1 (1 very small charcoal at 89)	7.5YR 3/4 Dark Brown	Loam/Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Few, thin, patchy	Gradual	Submound at 94 - Overbank sediment begins
107-191	Bt2	7.5YR 4/4 Brown	Silt Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, medium, discontinuous	Gradual	
191-219	C	7.5YR 4/6 Strong Brown	Clay Loam (increased sand size and quantity)	Common, rounded, at 199 - 1.5 x 2.5 cm, at 215 - 3 x 1 cm and 2 x 1 cm, at 219 - 2.5 x 2 cm	Concentrations - common, fine, distinct, slate-like, 7.5YR 2.5/1 Black	Moderate, coarse, angular blocky	NA	Many, fine	Common, thin, patchy		Bottom stratum

Core 23											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pore**	**Cutans/Siltan**	**Boundary**	**Interpretation**
0-7	Ap	10YR 4/2 Dark Grayish Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Common, fine	NA	Clear	Plow zone
7-31	A1	7.5YR 4/3 Brown	Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	NA	Clear	Soil formation
31-50	A2	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, medium, discontinuous	Clear	Soil formation
50-113	Bt1	7.5YR 4/3 Brown	Silt Loam/ Loam/ Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, thick, discontinuous	Abrupt	Overbank sediment begins

Core 23 (Cont.)											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pore**	**Cutans/Siltan**	**Boundary**	**Interpretation**
113-146	Bt2	7.5YR 4/3 Brown	Clay Loam (increasing sand size and quantity into next level)	Common, round, 1 - 1.5 x 2.5 cm and smaller	Concentrations - many, fine to medium, distinct, slate-like, manganese?, 7.5YR 2.5/1 Black	Moderate, coarse, angular blocky	Few, fine	Many, fine	Many, medium, discontinuous	Abrupt	
146-174	C1 - Alluvium	10YR 4/4 Dark Yellowish Brown	Sandy Clay Loam	Common, round, 4 x 2.5 cm and smaller	Concentrations - same as previous	Moderate, coarse, angular blocky	NA	Many, fine	Common, thin, patchy	Abrupt	Bottom stratum begins; High velocity, turbulent flood event
174-195	C2 - Alluvium	10YR 4/3 Brown	Sandy Clay Loam	Common, rounded	Concentrations - same as previous	Moderate, coarse, subangular blocky	NA	NA	Few, thin, patchy		2 High velocity, turbulent flood event events, similar to 17

Core 24											
Depth (cm)	**Horizon**	**Color**	**Texture**	**Gravel**	**RMF**	**Structure**	**Roots**	**Root Pores**	**Cutans**	**Boundary**	**Interpretation**
0-13	Ap	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, subangular blocky	Many, fine	Many, fine	NA	Clear	Plow zone
13-30	A	7.5YR 4/2 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	NA	Clear	Soil formation
30-47	Bt1	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, medium, discontinuous	Clear	Overbank sediment begins
47-89	Bt2	7.5YR 4/3 Brown	Silt Loam	NA	NA	Moderate, coarse, angular blocky	Common, fine	Many, fine	Common, thick, discontinuous	Clear	
89-152	Bt3	10YR 4/3 Brown	Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Common, fine	Many, thick, discontinuous	Clear	
152-169	C1 - Alluvium	10YR 4/4 Dark Yellowish Brown	Sandy Clay Loam	NA	NA	Moderate, coarse, angular blocky	Few, fine	Common, fine	Many, medium, discontinuous	Clear	Bottom stratum
169-185	C1 - Alluvium	10YR 4/4 Dark Yellowish Brown	Sandy Clay Loam	Few, subrounded, at the bottom, 1.25 x 1 cm - bedrock?	Concentrations - common, fine, distinct, slate-like, 10YR 2/1 Black	Moderate, coarse, subangular blocky	Few, fine	Common, fine	Few, thin, patchy		Bottom stratum

Core 25 (from Angeles, 2014)						
Depth (cm)	**Horizon**	**Color**	**Structure**	**Roots**	**Boundary**	**Clay Film**
0-3	Oi	10YR 3/3	Subangular blocky, Weak	Common, Fine		N
3-6	Oe	10YR 3/3	Subangular blocky, Moderate	Few, Fine	Gradual	N
6-10	AB	10YR 3/3	Granular, Moderate	Few, Very fine	Gradual	N
10-53	Bt1	7.5YR 3/3	Massive, Strong	Few, Very fine	Gradual	Y
53-63	Bt1	10YR 4/6	Subangular blocky, Moderate	Few, Very fine	Gradual	Y
63-79	Bt1	7.5YR 3/3, 10YR 5/3, 7.5YR 5/8	Granular, Moderate	Few, Very fine	Abrupt, smooth	Y
79-81.5		removed for radiocarbon dating				
81.5-211.5	Bt1	7.5YR 4/4	Massive, strong	None	Abrupt, smooth	Y
211.5-242	Bt2	10YR 4/6	Subangular blocky, Moderate	None		Y

Core 26 (from Angeles, 2014)						
Depth (cm)	**Horizon**	**Color**	**Structure**	**Roots**	**Boundary**	**Clay Film**
0-20	A1	10YR 3/4	Granular, Weak	Common, Very fine	Gradual	N
20-80	A2	10YR 3/3	Subangular blocky, Moderate	Few, Very fine, and Fine	Abrupt, smooth	N
80-96	Cultural(?)	10YR 5/6	Subangular blocky/ Massive	Few, Very fine	Abrupt, smooth	N

Core 26 (from Angeles, 2014) (Cont.)						
96-106	Cult/Layer		Moderate	Few, Very fine	Abrupt, smooth	Y
106-118	Cult/Layer		Subangular blocky, Moderate	Few, Very fine	Abrupt, smooth	Y
118-208	Bt1	7.5YR 4/6	Subangular blocky, Moderate	Few, Very fine	Abrupt, smooth	
208-240	Bt2	10YR 5/8	Subangular blocky, Moderate	none	Abrupt, smooth	
240-243		rock	Subangular blocky, Moderate		Abrupt, smooth	
243-246	Bt(?)	7.5YR 3/4		none		

Core 27 (from Angeles, 2014)						
Depth (cm)	**Horizon**	**Color**	**Structure**	**Roots**	**Boundary**	**Clay Film**
0-1	O	10YR 3/6	Granular, Weak	Common, Very fine	Gradual	N
1-14	A	10YR 3/6	Granular, Weak	Few, Very fine		N
14-24	Cultural	10YR 5/6	Granular, Moderate	none	Abrupt, Irregular	N
24-143	Bt1	10YR 4/6	Subangular blocky, Moderate	none	Gradual	Y
143-144.5	Bt2	10YR 3/4, 7.5YR 3/4	Granular, Moderate	None		Y

Core 28 (from Angeles, 2014)						
Depth (cm)	**Horizon**	**Color**	**Structure**	**Roots**	**Boundary**	**Clay Film**
0-10	AB1	10YR 3/3	Granular, Moderate	Common, Very fine	Gradual	Y
10-43	AB2	10YR 3/3	Granular, Moderate	Few, Very fine	Gradual	Y
43-53	Cultural	10YR 4/6	Granular, Weak	none	Gradual	N
53-93	Bt1	10YR 3/3	Subangular blocky, Moderate	Few, Very fine	Gradual	Y
93-213	Bt1	10YR 3/3	Subangular blocky, Moderate	Few, Very fine	Gradual	Y
213-245.8	Bt2	10YR 3/3	Granular, Moderate	none		Y, less

Appendix E: Results of particle size analysis with correlating texture (when available). L = Loam, LS = Loamy Sand, C = Clay, CL = Clay Loam, SCL = Sandy Clay Loam, SiL = Silty Loam, SiCL = Silty Clay Loam, SL = Sandy Loam.

Core 1 (from Rathgaber, 2015)			
Depth (cm)	**Sand %**	**Silt %**	**Clay %**
0-10	41.95	54.09	3.96
10-20	37.17	52.25	10.59
20-30	34.50	54.89	10.61
30-40	23.67	60.39	15.95
40-50	19.67	59.15	21.18
50-60	19.00	55.90	25.10
60-70	18.50	56.31	25.19
70-80	18.67	54.78	26.56
80-90	16.50	55.40	28.10
90-100	17.33	54.16	28.51
100-110	18.67	52.31	29.02
110-120	18.00	54.73	27.27
120-130	21.00	51.83	27.17
130-140	21.83	51.10	27.07
140-150	23.83	49.10	27.07
150-160	26.17	46.15	27.69
160-170	32.67	40.87	26.46
170-181	40.62	34.51	24.87

Core 2 (from Rathgaber, 2015)			
Depth (cm)	**Sand %**	**Silt %**	**Clay %**
0-10	41.00	48.97	10.03
10-20	37.83	50.06	12.11
20-30	32.67	53.72	13.61
30-40	27.67	58.66	13.68
40-50	21.17	59.41	19.42
50-60	17.17	60.41	22.42
60-70	14.66	59.70	25.56
70-80	12.67	58.62	28.71
80-90	9.83	58.85	31.31
90-100	10.50	58.81	30.69
100-110	11.83	58.42	29.75
110-120	12.67	57.06	30.27

Core 2 (from Rathgaber, 2015) (Cont.)			
110-120	12.67	57.06	30.27
120-130	12.67	56.54	30.79
130-140	12.83	55.96	31.21
140-150	13.67	54.91	31.42
150-160	13.33	54.27	32.36
160-170	13.00	53.64	33.32
170-181	12.67	53.02	34.31
180-190	14.00	51.04	34.96
190-200	12.67	52.38	34.96
200-210	14.33	50.19	35.48
210-220	14.33	49.15	36.52
220-230	17.00	49.72	33.28
230-240	20.33	48.35	31.31
240-250	22.17	44.94	32.89
250-260	25.33	42.81	31.85
260-270	26.83	42.98	30.19
270-280	27.23	42.92	29.85
280-290	27.63	42.86	29.51
290-300	28.03	42.80	29.17
300-310	28.43	42.74	28.83
310-320	28.83	42.67	28.50
320-330	35.33	37.41	27.26
330-340	39.17	35.58	25.25
340-350	34.00	38.31	27.69
350-360	41.83	32.55	25.61
360-370	45.33	29.88	24.79
370-382	49.67	24.96	25.38

Core 3 (from Angeles, 2014)				
Depth (cm)	**Sand %**	**Silt %**	**Clay %**	**Texture**
0-10	50.3	42.4	7.3	L
10-20	48.4	44.8	6.8	SL
20-31	40.3	51	8.7	SiL
31-41	32.5	56.8	10.8	SiL
41-50	41.6	48.6	9.8	L
50-59	56.1	37	6.9	SL

Core 4 (from Rathgaber, 2015)			
Depth (cm)	**Sand %**	**Silt %**	**Clay %**
0-10	76.33	15.67	8.00
10-20	69.00	20.51	10.49
20-30	49.17	42.32	8.52
30-40	40.83	48.13	11.04
40-50	35.33	54.63	10.04
50-60	33.51	57.19	9.31
60-70	30.67	58.27	11.07
70-80	33.50	54.43	12.07
80-90	33.50	56.95	9.55
90-100	42.17	48.79	9.04
100-110	48.50	42.97	8.53
110-120	58.00	34.51	7.49
120-130	67.50	25.52	6.98
130-140	64.50	27.00	8.50
140-150	62.67	29.84	7.50
150-160	58.83	32.14	9.03
160-170	65.50	25.48	9.02
170-181	65.33	27.17	7.49
180-190	60.83	30.13	9.04
190-200	59.83	30.61	9.56
200-210	59.77	30.07	10.16
210-220	59.71	29.53	10.91
220-230	59.65	28.99	11.66
230-240	59.59	28.45	12.41
240-250	59.50	27.90	12.60
250-260	66.17	33.83	0.00
260-270	66.67	21.22	12.11
270-280	68.83	19.06	12.11
280-290	73.67	26.33	0.00
290-300	75.67	14.31	10.03
300-310	79.17	11.81	9.02
310-320	80.00	13.50	6.50
320-330	78.00	13.98	8.02
330-340	79.50	12.48	8.02

Core 5 (from Rathgaber, 2015)			
Depth (cm)	Sand %	Silt %	Clay %
0-10	88.17	8.88	2.96
10-20	82.17	13.89	3.95
20-30	72.00	22.01	5.99
30-40	68.33	27.21	4.46
40-50	56.83	37.19	5.98
50-60	56.67	35.31	8.02
60-70	64.17	27.81	8.02
70-80	65.00	26.47	8.53
80-90	56.67	35.30	8.03
90-100	53.17	36.78	10.05
100-110	48.17	40.22	11.62
110-120	57.00	34.96	8.04
120-130	74.33	20.20	5.47
130-140	75.08	19.21	5.81
140-150	75.83	18.22	5.47
150-160	76.58	17.23	5.13
160-170	77.33	16.24	4.79
170-181	78.08	15.25	4.45
180-190	78.83	14.26	4.11
190-200	82.33	14.24	3.42
200-210	86.50	11.59	1.91
210-220	90.83	8.86	0.30
220-230	92.00	7.60	0.40
230-240	71.33	21.66	7.01
240-250	64.17	24.68	11.15
250-260	64.17	22.29	13.55
260-270	66.00	21.95	12.05
270-280	68.33	21.58	10.09
280-290	67.83	21.60	10.57
290-300	66.50	22.40	11.10
300-310	66.33	22.54	11.12
310-320	66.50	20.84	12.66
320-330	70.83	18.11	11.05
330-340	77.83	13.66	8.51
340-350	76.67	13.81	9.52
350-360	77.83	13.66	8.51

Core 6 (from Rathgaber, 2015)			
Depth (cm)	**Sand %**	**Silt %**	**Clay %**
0-10	51.00	49.00	0.00
10-20	47.67	43.83	8.51
20-30	47.17	43.30	9.54
30-40	46.17	42.78	11.05
40-50	43.33	45.60	11.07
50-60	46.17	42.77	11.07
60-70	59.50	30.96	9.54
70-80	50.83	38.60	10.57
80-90	60.00	28.96	11.04
90-100	65.17	26.31	8.52
100-110	72.83	21.17	5.99
110-120	80.00	15.03	4.97
120-130	68.73	23.47	7.80
130-140	52.42	37.74	9.85
140-150	60.25	30.99	8.76
150-160	65.75	27.52	6.73
160-170	64.42	26.83	8.76
170-181	65.08	24.09	10.83
180-190	68.25	20.89	10.86
190-200	69.08	19.56	11.36
200-210	69.08	20.56	10.35
210-220	65.08	23.04	11.87
220-230	61.75	25.39	12.86
230-240	65.08	21.50	13.42
240-250	66.75	20.35	12.90
250-260	71.08	18.11	10.80
260-270	76.42	14.80	8.78
270-280	73.92	16.29	9.80
280-290	67.75	19.41	12.84
290-300	68.42	18.72	12.86
300-310	69.58	17.56	12.86
310-320	71.75	16.92	11.33
320-330	76.42	14.28	9.30
330-340	81.92	12.86	5.22
340-350	83.25	12.54	4.21

Core 7				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-10	36	53	12	SiCL
15-24	32	56	12	SiCL
33-40	33	55	12	SiCL
43-49	30	57	14	SiCL
58-66	25	58	17	SiL
78-85	21	56	23	SiL
124-134	22	48	30	L
169-178	22	49	29	L
187-193	25	46	29	L
210-216	31	42	27	CL
226-231	37	38	26	CL
238-245	42	35	24	C
257-263	49	28	23	C
269-276	59	22	19	C
286-293	69	15	17	C

Core 8				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-11	70	27	3	SL
11-21	70	27	3	SL
21-32	68	24	8	SL
32-40	63	31	7	SL
40-50	53	38	9	SL
50-60	46	48	6	SL
60-71	38	54	8	SiL
71-82	31	56	13	SiL
82-94	25	61	14	SiL
94-105	24	58	18	SiL
138-149	11	58	31	SiCL
180-190	24	46	30	CL
195-205	23	46	31	CL
213-223	29	41	31	CL
231-239	12	50	38	SiCL
243-253	46	30	24	L
258-266	60	22	18	SL
274-280	69	16	15	SL
286-292	70	16	14	SL

Core 8 (Cont.)				
Depth (cm)	Sand %	Silt %	Clay%	Texture
297-303	64	20	17	SL
312-320	71	14	15	SL
326-330	67	19	15	SL

Core 9				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-9	61	32	7	SL
11-22	50	35	15	L
31-39	54	26	20	SCL
48-57	49	31	20	L
67-76	56	28	16	SL
93-101	55	32	13	SL
119-124	54	33	13	SL
137-144	53	32	15	SL
172-176	51	37	12	L
211-218	59	24	17	SL
227-234	36	50	14	SiL
239-248	23	54	23	SiL
248-257	30	52	19	SiL
265-272	18	64	18	SiL
320-331	19	50	31	SiCL
390-401	20	49	31	SiCL
411-420	22	48	30	CL
432-442	29	42	29	CL
455-462	33	40	27	CL
473-482	47	30	23	L
497-504	63	21	17	SL
517-524	67	17	16	SL
547-554	69	15	16	SL

Core 10				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-8	68	28	4	SL
12-18	60	30	10	SL
24-32	51	35	14	L
39-46	43	44	13	L

Core 10 (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
57-64	50	37	13	L
79-86	63	27	10	SL
96-102	52	35	12	L
111-118	59	31	10	SL
121-128	52	34	14	L
133-142	51	35	14	L
142-150	56	30	14	SL
157-163	58	29	14	SL
176-184	56	31	12	SL
191-201	27	56	18	SiL
201-210	23	56	21	SiL
212-216	22	58	19	SiL
217-225	23	60	18	SiL
230-238	22	58	20	SiL
252-260	20	55	25	SiL
267-274	19	53	28	SiCL
283-291	19	51	30	SiCL
302-309	19	51	30	SiCL
316-323	18	50	32	SiCL
329-337	19	51	31	SiCL
348-352	19	49	33	SiCL
355-360	20	47	33	L
372-378	28	42	30	CL
392-398	40	35	26	L
416-423	54	26	20	SCL
435-445	64	19	17	SL

Core 11				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-6	50	42	7	L
11-22	28	58	15	SiL
29-36	37	45	18	L
40-46	12	63	26	SiL
48-53	40	41	19	L
59-66	18	56	27	SiCL
77-85	14	57	29	SiCL
110-118	14	56	30	SiCL

Core 11 (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
155-164	11	58	31	SiCL
178-187	12	58	31	SiCL
208-216	15	56	30	SiCL
236-244	14	55	31	SiCL

Core 12				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-6	31	56	12	SiL
6-17	35	54	12	SiL
23-31	24	61	15	SiL
41-48	16	63	20	SiL
61-66	33	50	17	SiL
76-82	37	43	20	L
107-115	27	46	26	L
149-159	27	47	27	CL
173-182	40	38	22	SiCL
189-197	52	29	20	L
205-213	42	38	20	L
225-233	47	34	19	L
238-247	79	11	11	SL
247-256	70	22	8	SL
256-265	93	-1	7	fine sand
268-275	87	7	6	SCL
279-282	93	4	3	fine sand

Core 13				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-6	42	51	7	SiL
11-18	34	52	14	SiL
21-28	24	55	21	SiL
37-44	20	57	22	SiL
51-57	20	55	25	SiL
99-106	21	48	31	CL
146-152	24	48	28	CL
178-184	35	37	28	CL

Core 13 (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
194-202	50	27	23	SCL
218-225	56	22	22	SCL

Core 14				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-7	49	46	5	SL
14-21	37	50	13	SiL
26-32	20	59	21	SiL
42-48	19	60	21	SiL
57-66	18	59	23	SiL
70-76	17	55	28	SiCL
112-118	15	53	32	SiCL
172-178	16	49	35	SiCL
190-197	16	49	35	SiCL
212-218	20	46	33	SiCL
233-240	25	43	32	CL

Core 15				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-4	38	53	9	SiL
9-16	34	55	12	SiL
16-23	27	60	13	SiL
33-40	23	58	19	SiL
54-61	20	56	24	SiL
88-95	22	50	27	CL
116-123	19	50	31	SiCL
133-141	20	47	32	SiCL
150-158	21	48	31	CL
166-173	23	46	31	CL
182-189	23	44	33	CL
201-208	28	41	31	CL
221-228	35	37	28	CL
238-244	45	32	23	L
244-253	48	30	23	L
262-272	58	23	19	SL

Core 16				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-5	43	49	8	L
10-17	38	54	9	SiL
22-29	25	60	15	SiL
36-43	21	57	22	SiL
82-89	20	50	30	SiCL
130-135	25	43	32	CL
148-156	28	40	32	CL
172-181	36	36	29	CL
197-204	50	25	25	SCL
204-209	54	22	24	SCL
218-229	65	17	18	SL

Core 17				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-6	48	44	8	L
11-20	46	46	9	L
23-30	33	53	14	SiL
37-45	22	55	23	SiL
62-71	21	52	27	CL
86-94	27	46	27	CL
105-112	34	40	27	CL
120-127	39	34	27	CL
133-141	46	27	27	SCL
151-159	54	23	24	SCL
174-181	64	16	21	SCL
197-206	73	11	17	SL
218-234	74	12	14	SL

Core 18				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-8	63	33	4	SL
14-21	60	35	5	SL
26-32	54	38	8	SL
37-43	45	45	10	L
48-54	28	54	18	SiL
63-70	22	58	21	SiL

Core 18 (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
82-89	22	56	23	SiL
99-106	20	54	26	SiL
129-136	21	51	28	CL
159-166	24	45	31	CL
176-183	28	40	32	CL
197-204	30	39	30	CL
218-225	37	35	28	CL
235-243	46	29	25	L
253-262	60	23	18	SL

Core 19				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-8	64	32	4	SL
11-20	64	30	7	SL
24-31	50	35	15	L
40-47	22	57	22	SiL
60-68	20	55	24	SiL
79-87	20	53	27	SiCl
101-108	21	51	28	CL
122-131	20	48	32	SiCl
141-148	24	43	33	CL
156-162	30	39	32	CL
169-177	34	36	30	CL
189-197	41	31	28	CL
201-210	50	27	23	SCL

Core 20				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-3	42	52	6	SiL
8-18	36	54	10	SiL
28-36	25	55	20	SiL
39-47	23	56	21	SiL
49-56	23	54	23	SiL
66-77	25	47	28	CL
93-101	33	39	29	CL
107-117	40	32	28	CL

Core 20 (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
121-130	47	29	25	L
139-148	64	16	20	SCL

Core 21				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-10	57	35	8	SL
17-22	43	41	15	L
22-31	40	43	18	L
34-43	42	42	16	L
48-56	57	28	15	SL
58-65	44	38	18	L
71-81	49	36	15	L
94-104	47	39	14	L
114-123	24	58	18	SiL
138-148	23	57	20	SiL
162-172	23	55	22	SiL
181-191	23	51	26	SiL
206-216	23	48	29	CL
229-239	27	42	31	CL
247-257	33	35	32	CL

Core 22				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-10	63	32	6	SL
15-23	57	33	10	SL
23-32	48	36	17	L
41-50	42	42	16	L
55-64	39	43	18	L
70-77	43	40	17	L
84-94	40	42	18	L
94-103	24	55	21	SiL
113-123	23	55	23	SiL
142-150	21	51	27	CL
179-187	33	38	29	CL
196-206	37	31	32	CL
209-219	45	27	28	CL

Core 23				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-7	40	53	7	SiL
12-22	40	49	11	L
36-46	31	54	16	SiL
55-63	23	54	23	SiL
77-87	26	48	26	L
100-108	30	44	27	CL
118-128	36	35	29	CL
128-140	41	31	28	CL
153-164	53	23	24	SCL
179-190	70	14	16	SL

Core 24				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-10	38	56	6	SiL
17-28	31	55	14	SiL
35-43	26	55	18	SiL
52-62	22	55	23	SiL
73-84	22	52	26	SiL
94-104	22	48	30	CL
116-126	26	41	33	CL
138-148	37	32	31	CL
157-166	46	26	27	SCL
173-183	56	21	23	SCL

Core 25 (from Angeles, 2014)				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-10	68.1	27.8	4.1	SL
10-20	54.4	30.7	14.9	SL
20-30	62.6	24.5	12.9	SL
30-40	62.8	26.7	10.5	SL
40-53	59.9	29.1	10.9	SL
53-63	38.6	37.3	24.1	L
63-79	59.1	28.2	12.7	SL
79-81.5	removed for radiocarbon dating			
81.5-91.5	26	61.4	12.6	SiL

Core 25 (from Angeles, 2014) (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
91.5-101.5	26.1	60.3	13.6	SiL
101.5-111.5	27.6	57.9	14.5	SiL
111.5-121.5	25.3	56.3	18.4	SiL
121.5-131.5	25.4	54.4	20.1	SiL
131.5-141.5	27.6	50.1	22.3	SiL
141.5-151.5	27.6	49.2	23.2	L
151.5-161.5	28.4	47.5	24.1	L
161.5-171.5	29.8	47	23.2	L
171.5-181.5	35.8	41.2	23	L
181.5-191.5	36.3	40.4	23.3	L
191.5-201.5	39.6	38.4	22	L
201.5-211.5	41.6	39.3	19.1	L
211.5-221.5	46.3	33.3	20.5	L
221.5-231.5	50.6	28.6	20.8	L
231.5-242	55.3	25.8	18.9	SL

Core 26 (from Angeles, 2014)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-10	78.2	20.1	1.7	L(fine)S
10-20	71.4	21.9	6.7	SL
20-30	68	22	9.9	SL
30-40	65.9	23.8	10.3	SL
40-50	68.2	22	9.8	SL
50-60	70.4	23.8	5.9	SL
60-70	72	23.2	4.8	SL
70-80	67.4	26.4	6.3	SL
80-96	63	28.2	8.8	SL
96-106	56	34.5	9.4	SL
106-118	34.5	49.4	16.1	L
118-128	28.5	58.4	13.1	SiL
128-138	27.9	59.2	12.9	SiL
138-148	25.7	59.7	14.6	SiL

Core 27 (from Angeles, 2014)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-10	72.8	23	4.2	SL

Core 27 (from Angeles, 2014) (Cont.)				
Depth (cm)	Sand %	Silt %	Clay%	Texture
10-24	64	27.2	8.9	SL
24-34	21.3	56.8	21.9	SIL
34-44	19.5	61.9	18.6	SIL
44-54	21	55.9	23.1	SIL
54-64	20.5	65.3	14.2	SIL
64-74	19.8	54.1	26.1	SIL
74-84	20.8	52.1	27.1	CL
84-94	20.5	52.6	26.9	SL
94-104	23	49.4	27.6	CL
104-114	16.8	55.1	28.1	SiCL
114-124	23.8	47.4	28.8	CL
124-134	26.3	45.2	28.5	CL
134-143	25.6	47.9	26.4	L
143-144.5	55.6	30.9	13.4	SL

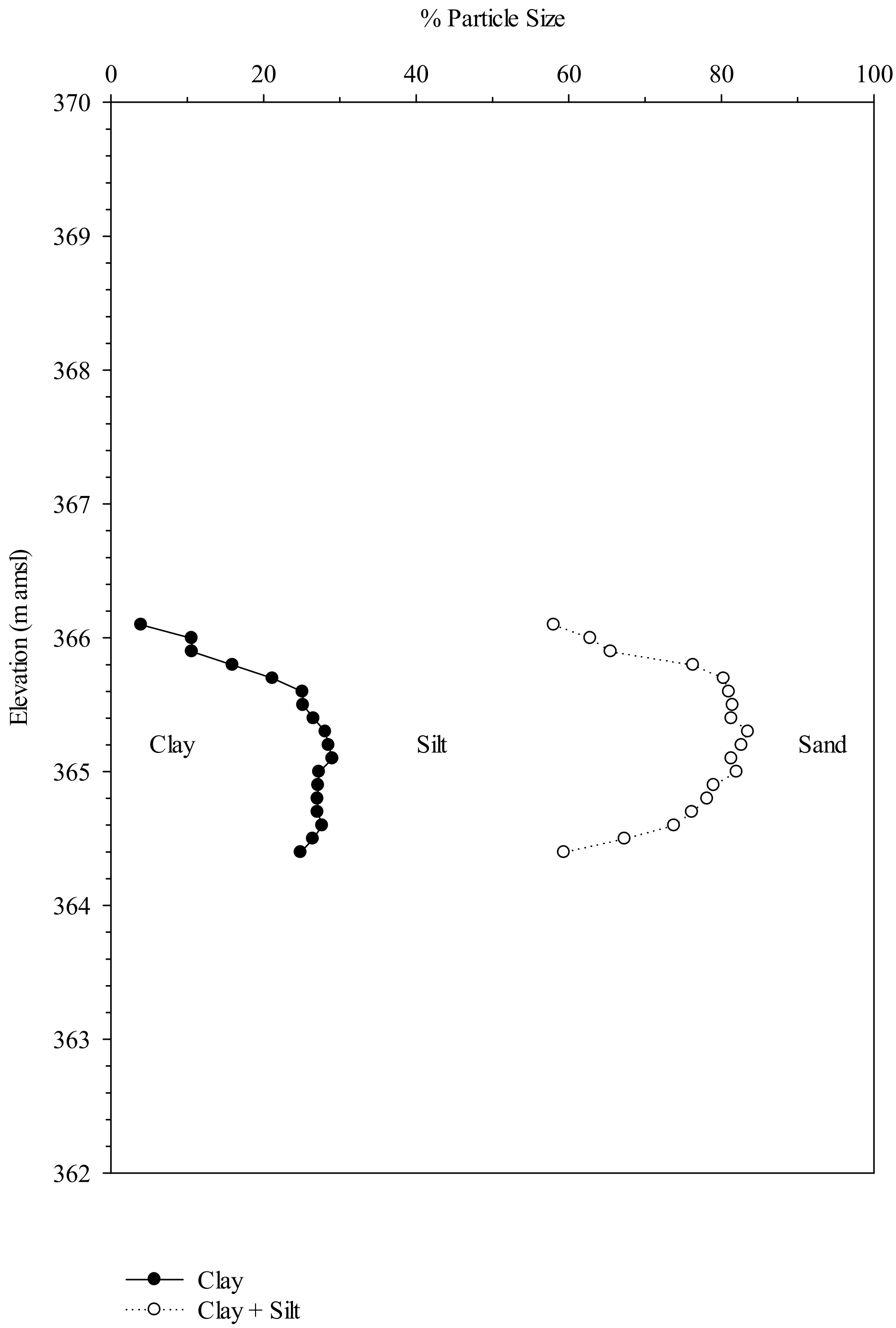
Core 28 (from Angeles, 2014)				
Depth (cm)	Sand %	Silt %	Clay%	Texture
0-10	44.9	50.4	4.7	SiL
10-20	49.9	46.6	3.6	SL
20-30	51.7	42	6.3	SL
30-43	63.2	29.3	7.5	SL
43-53	46.2	44.9	8.9	L
53-63	39.5	52	8.5	SiL
63-73	32.7	57.2	10.1	SiL
73-83	33.9	55.5	10.7	SiL
83-93	33.9	55	11.2	SiL
93-103	31.4	56.5	12.1	SiL
103-113	28.2	57.6	14.2	SiL
113-123	25.2	58.3	16.5	SiL
123-133	23.9	58.7	17.3	SiL
133-143	25	57	18	SiL
143-153	21.9	60.3	17.9	SiL
153-163	21.5	61.8	16.7	SiL
163-173	21.8	61.2	17	SiL
173-183	20.6	61.2	18.2	SiL
183-193	22	60.7	17.3	SiL
193-203	24.3	57.5	18.2	SiL

Core 28 (from Angeles, 2014) (Cont.)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
203-213	29.1	52.7	18.1	SiL
213-223	39.8	43.6	16.6	L
223-233	60	26	14	SL
233-245.8	61.3	24.3	14.4	SL

Riverbank (from Angeles, 2014)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
0-19	77.7	19.2	3.1	Llfine)S
19-69	45.2	48.5	6.3	SL
69-110	85.2	13.7	1.1	L(fine)S
110-130	60.4	36	3.7	SL

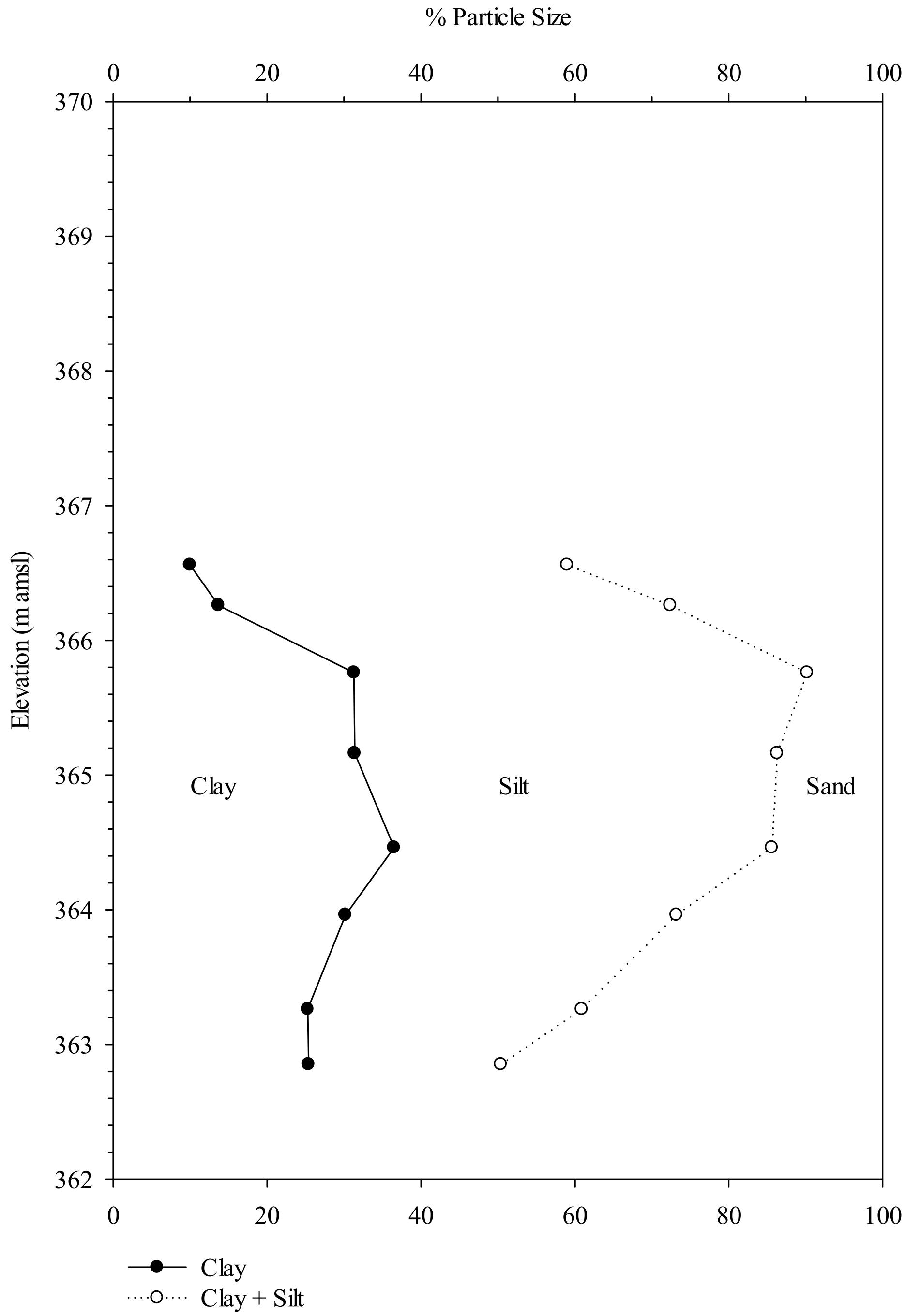
Directly above River (from Angeles, 2014)				
Depth (cm)	**Sand %**	**Silt %**	**Clay%**	**Texture**
	92.7	5.7	1.6	Fine Sand

Core 1

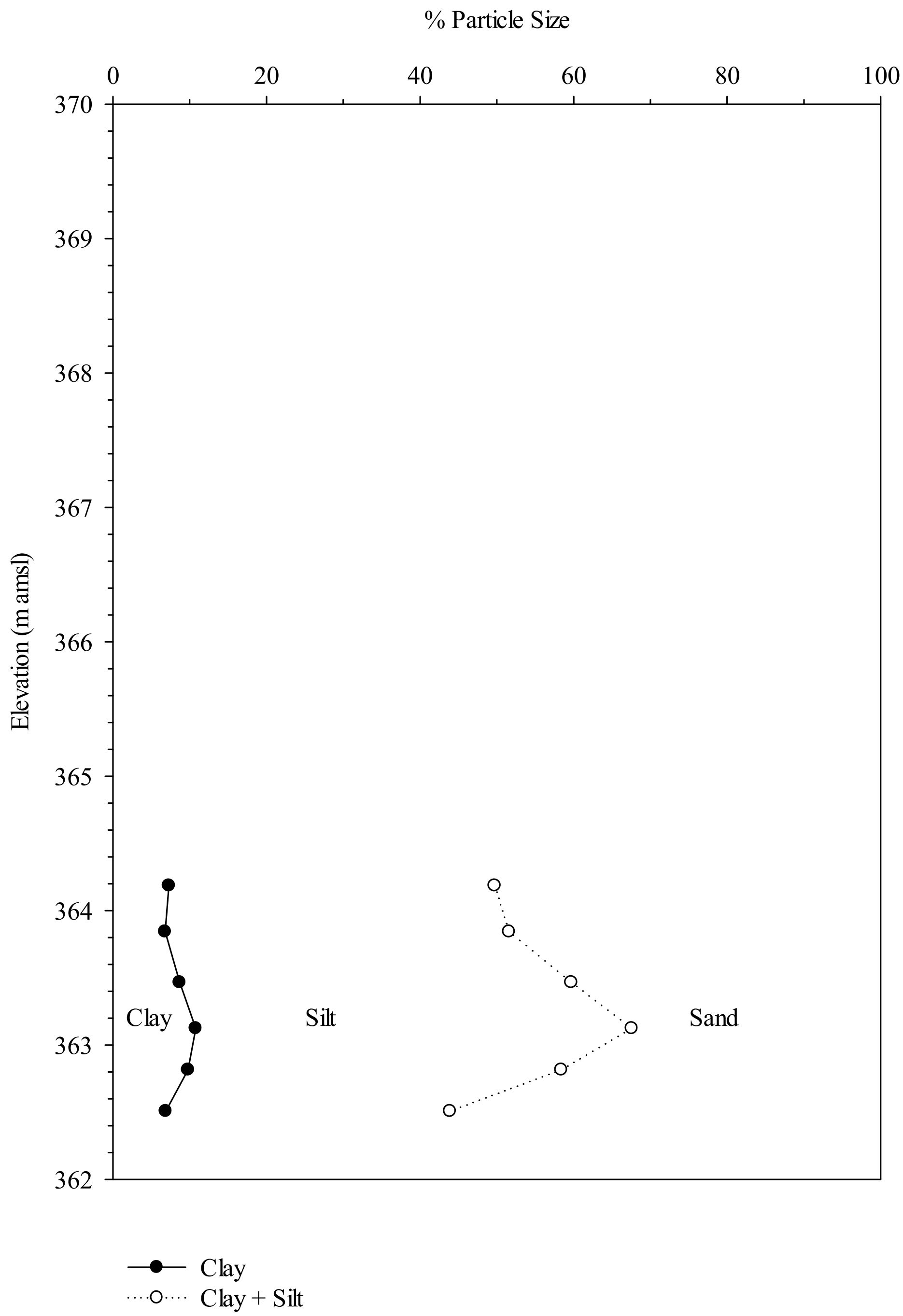


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

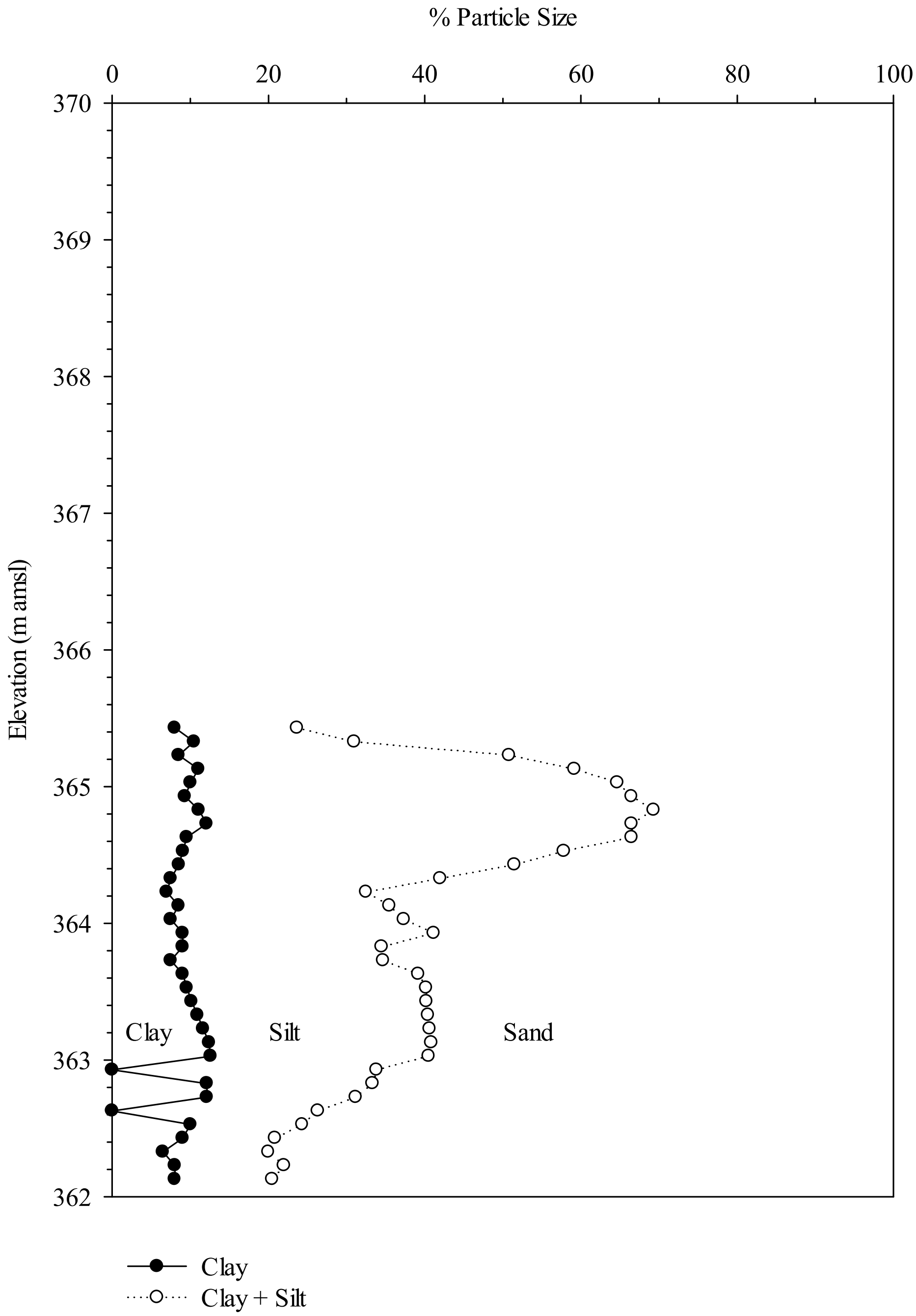
Core 2


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

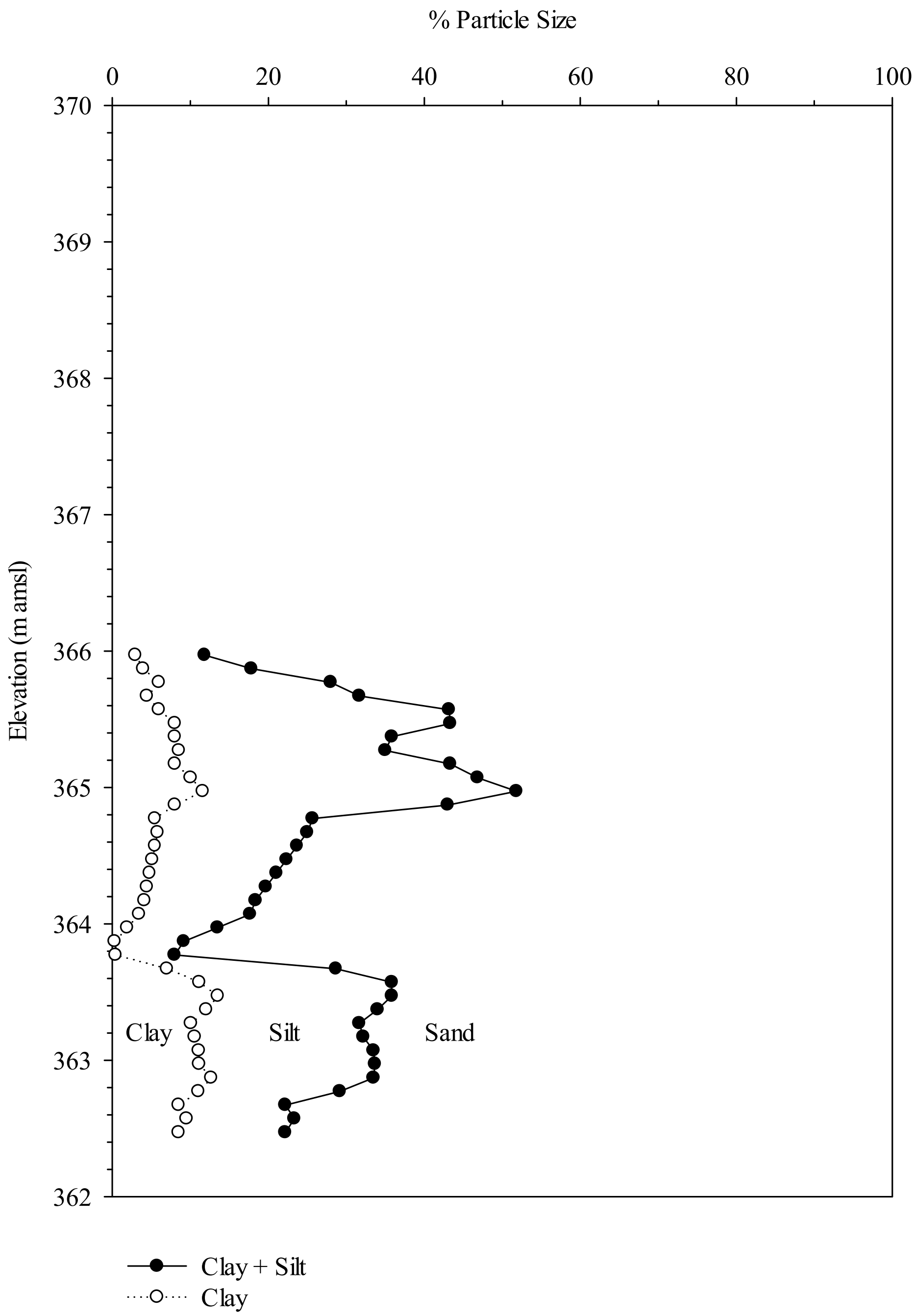
Core 3


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 4

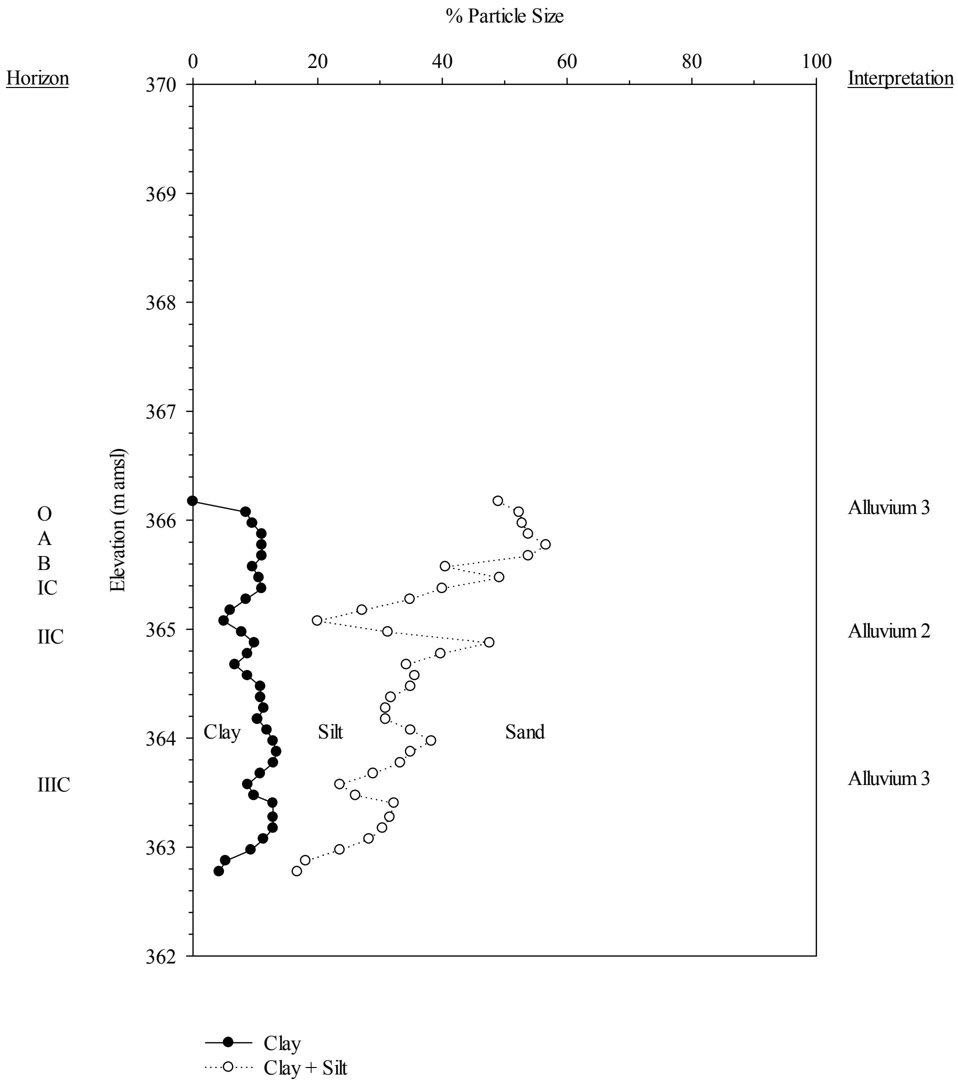

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 5

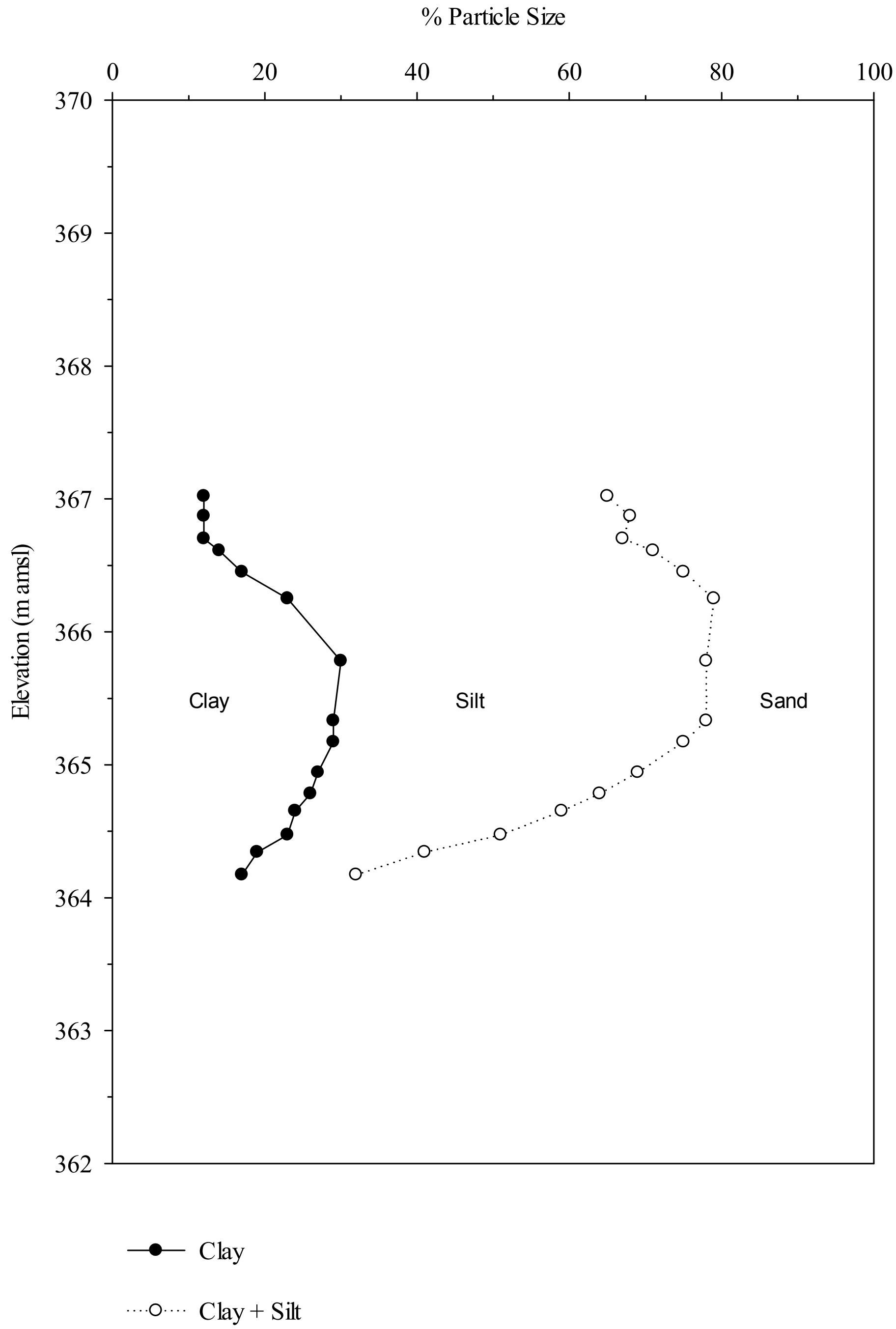


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay + Silt
Clay

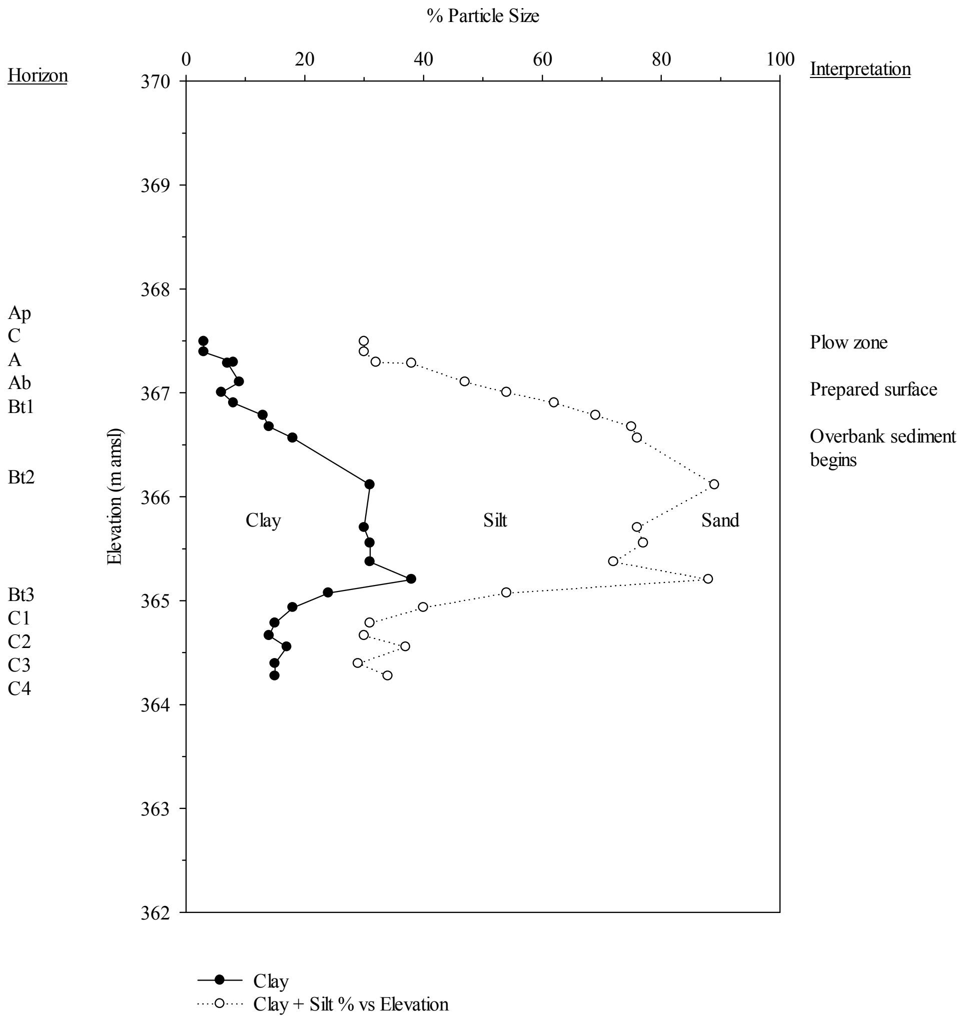
Core 6


% Particle Size
0
20
40
60
80
100
Horizon
Interpretation
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
O
A
B
IC
IIC
IIIC
Alluvium 3
Alluvium 2
Alluvium 3
Clay
Silt
Sand
Clay
Clay + Silt

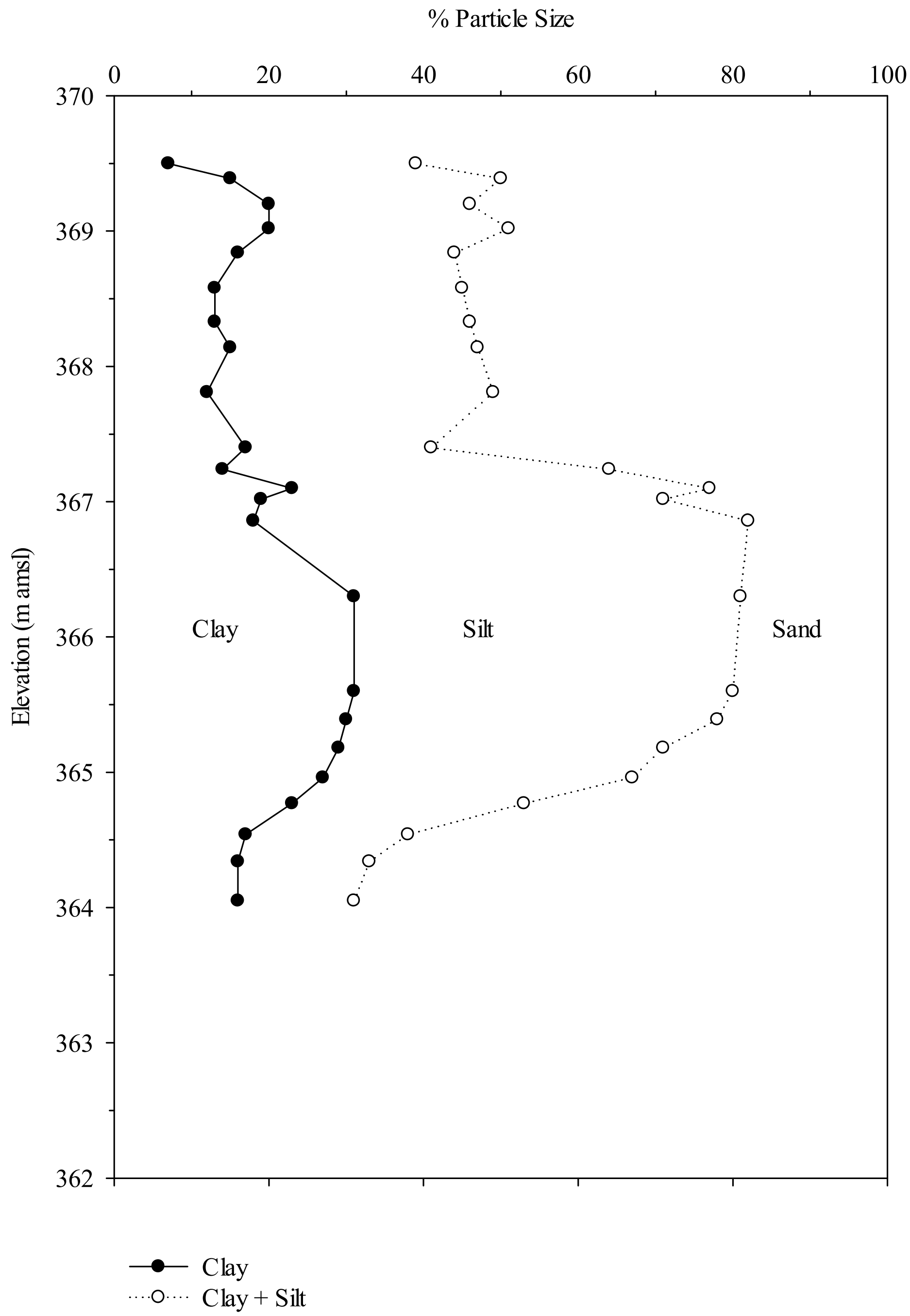
Core 7


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

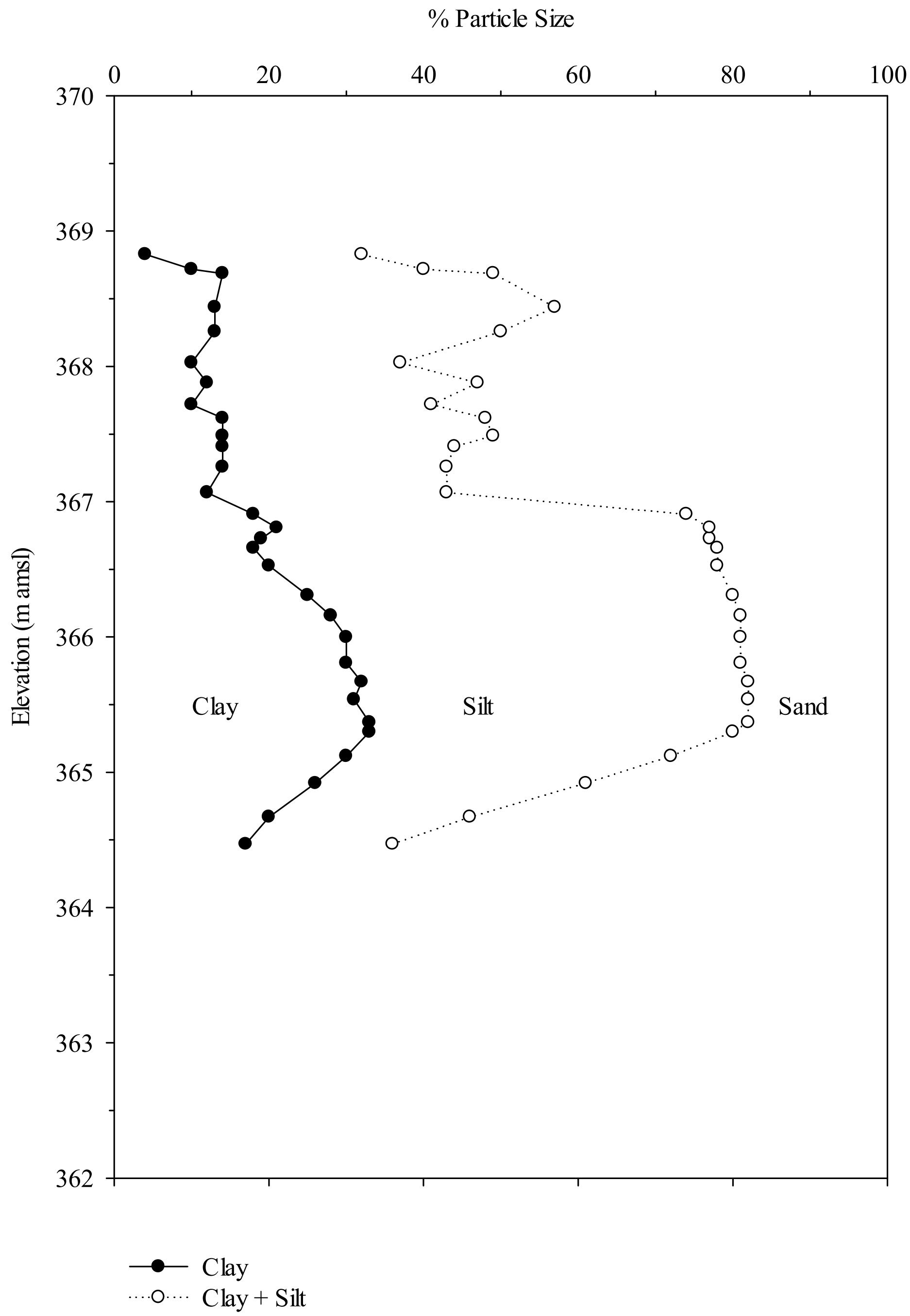
Core 8


% Particle Size
0
20
40
60
80
100
Horizon
Interpretation
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Ap
C
A
Ab
Bt1
Bt2
Bt3
C1
C2
C3
C4
Plow zone
Prepared surface
Overbank sediment
begins
Clay
Silt
Sand
Clay
Clay + Silt % vs Elevation

Core 9

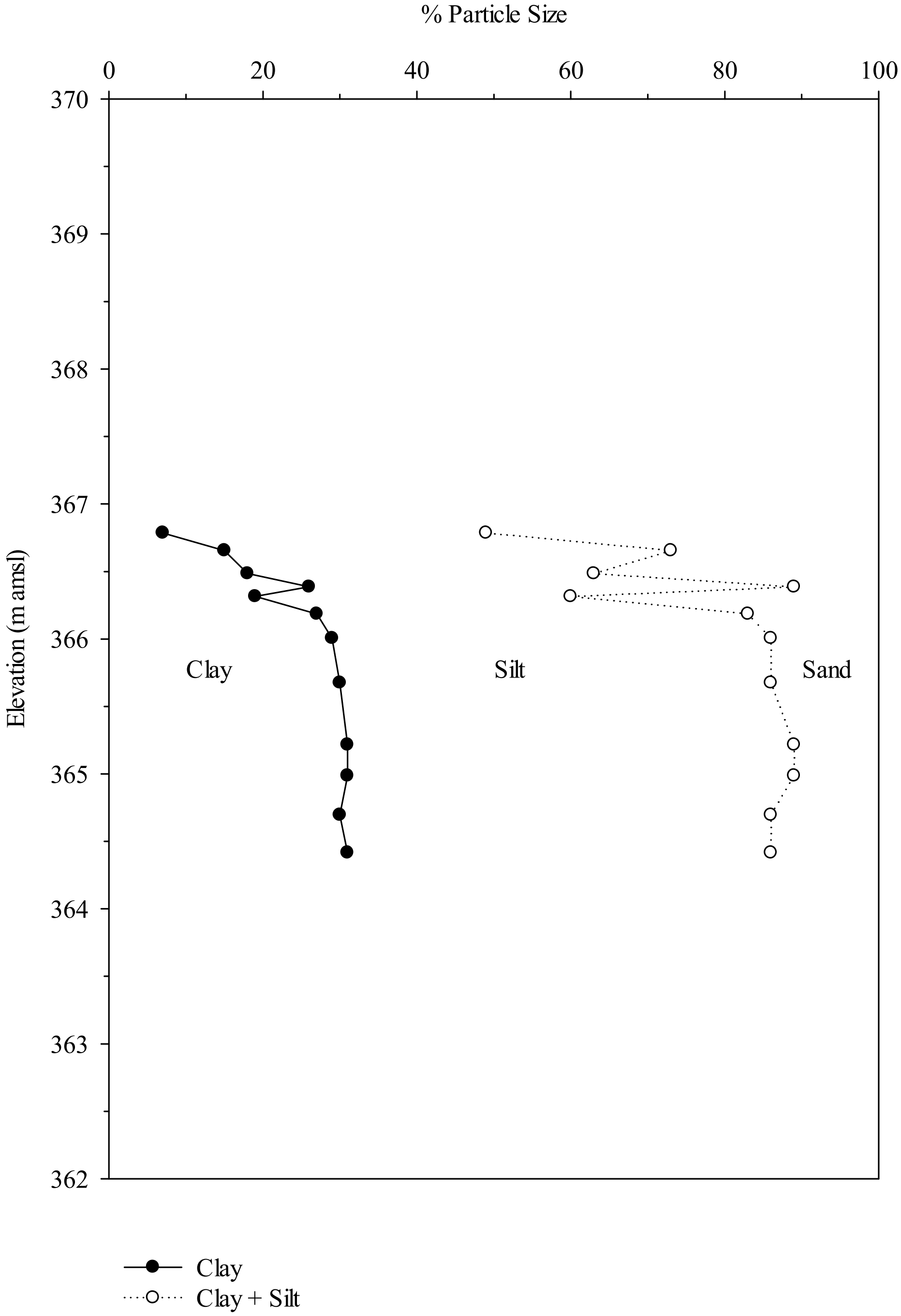

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 10



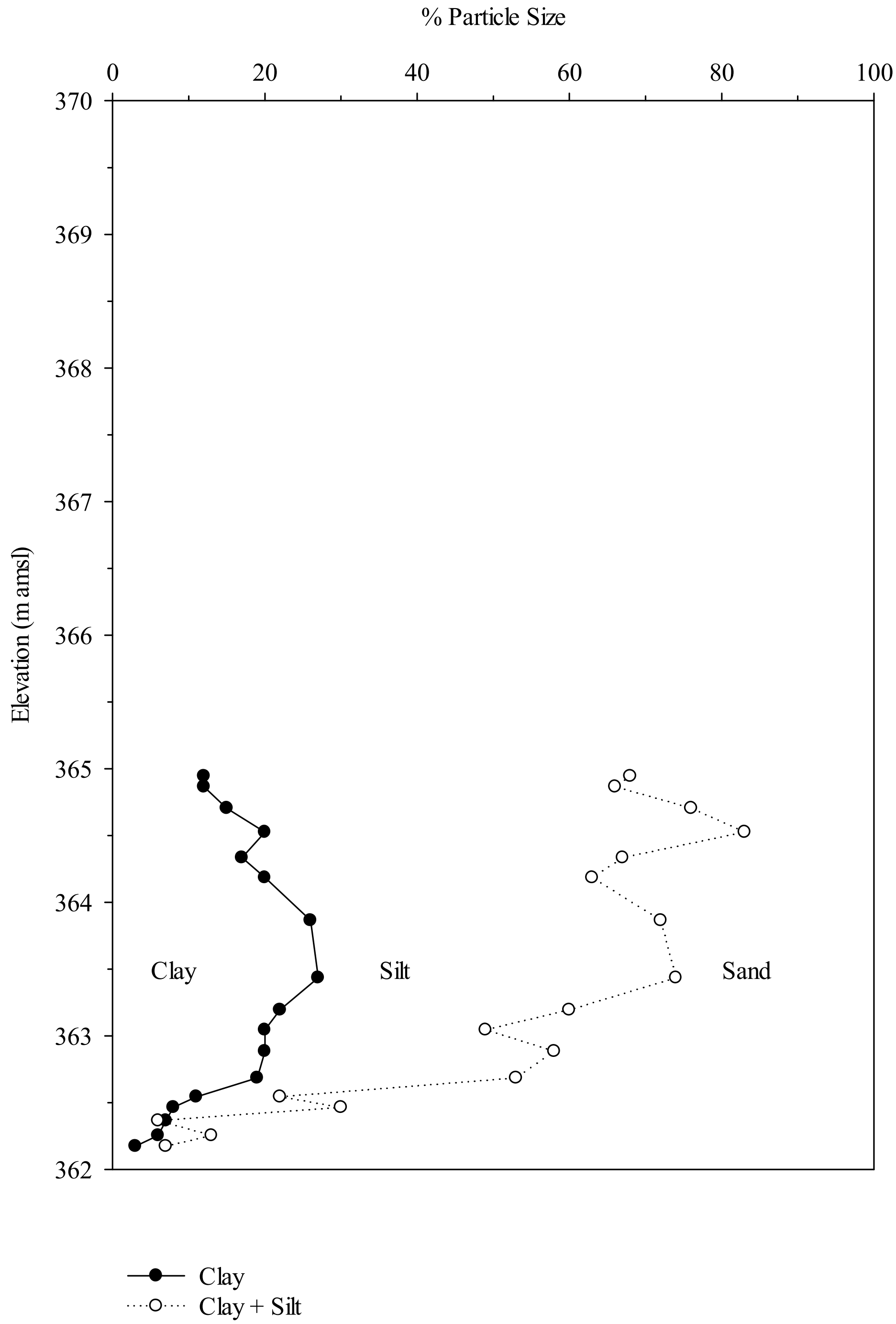
% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 11

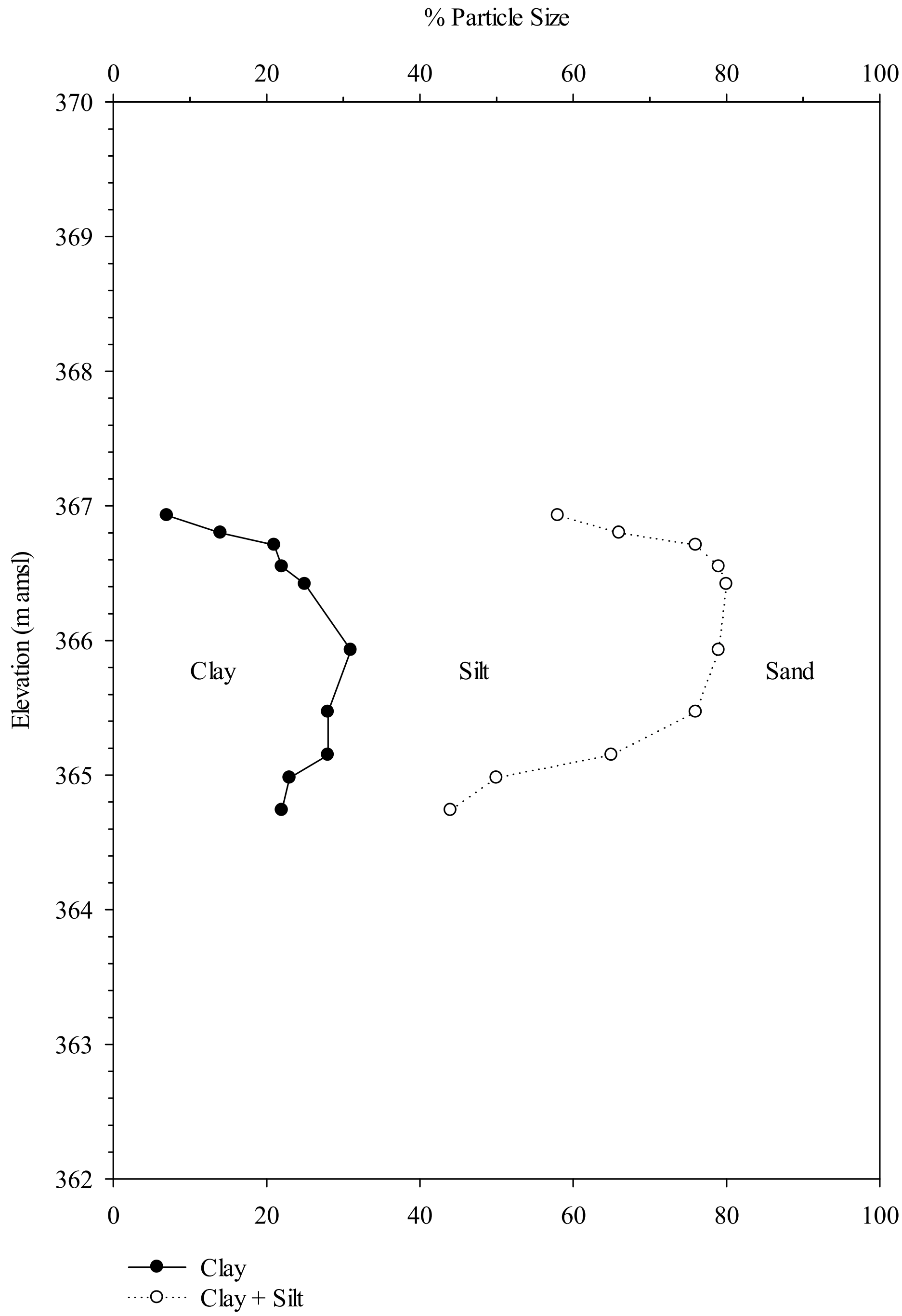


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 12

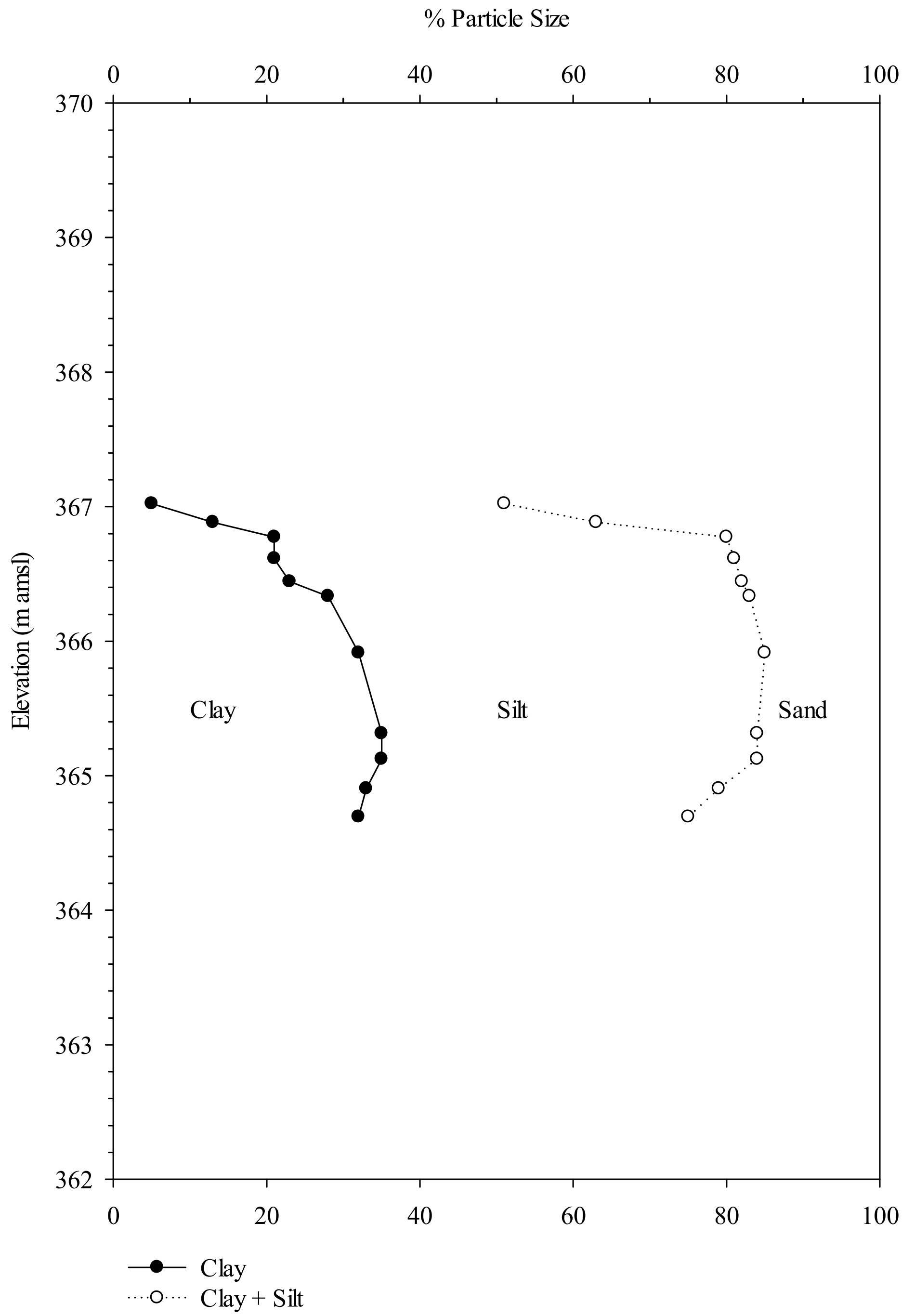

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 13

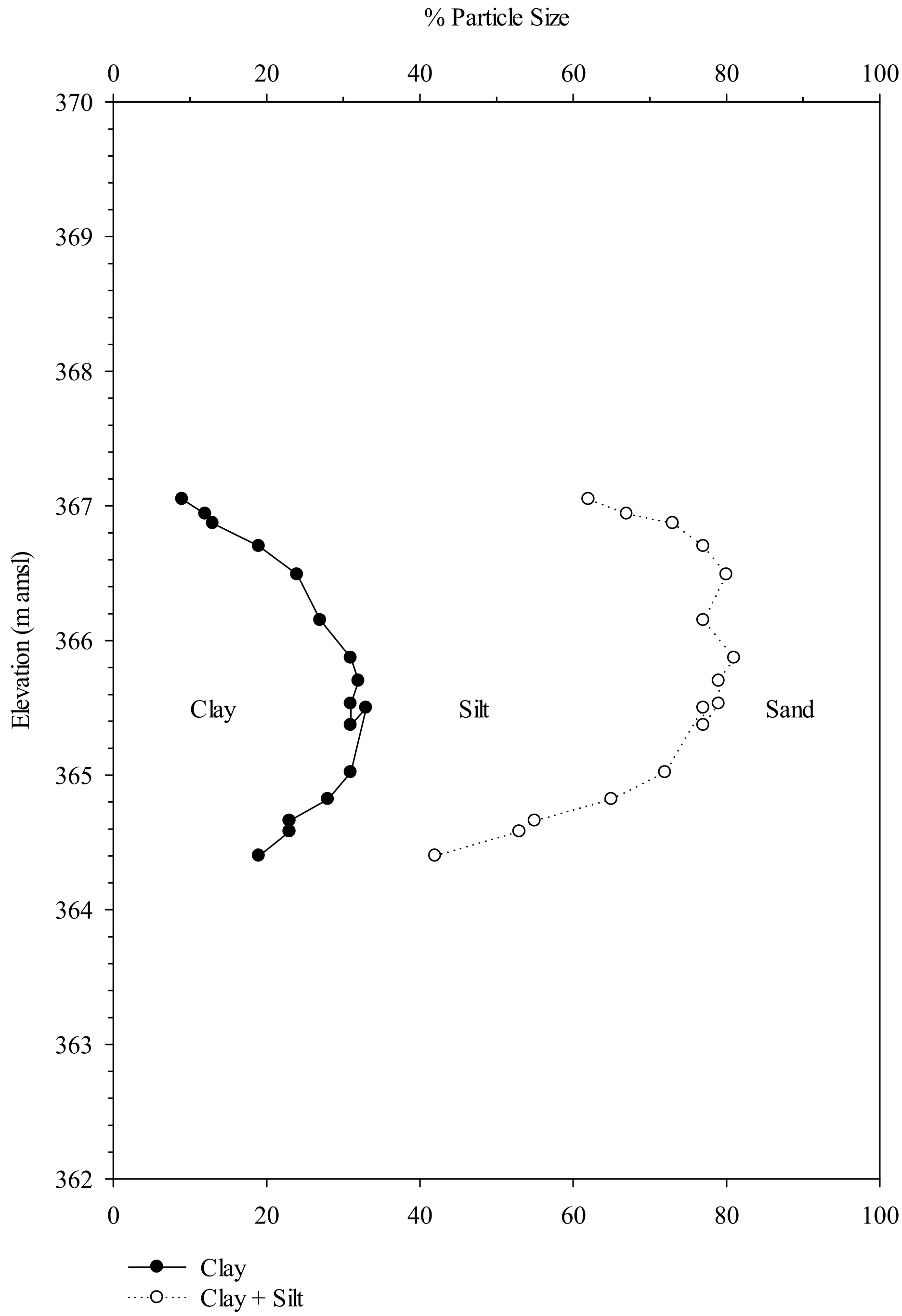


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 14

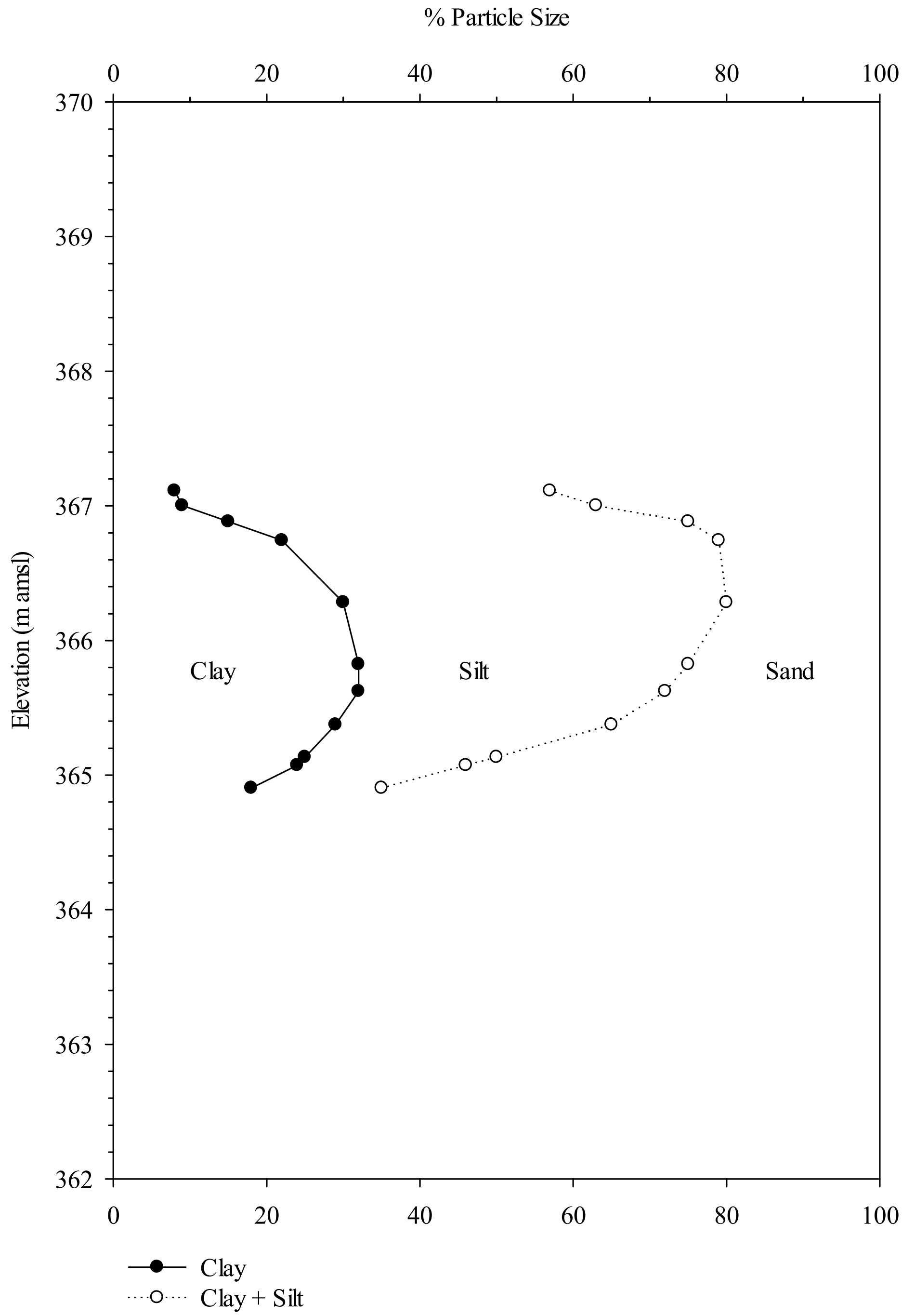

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 15

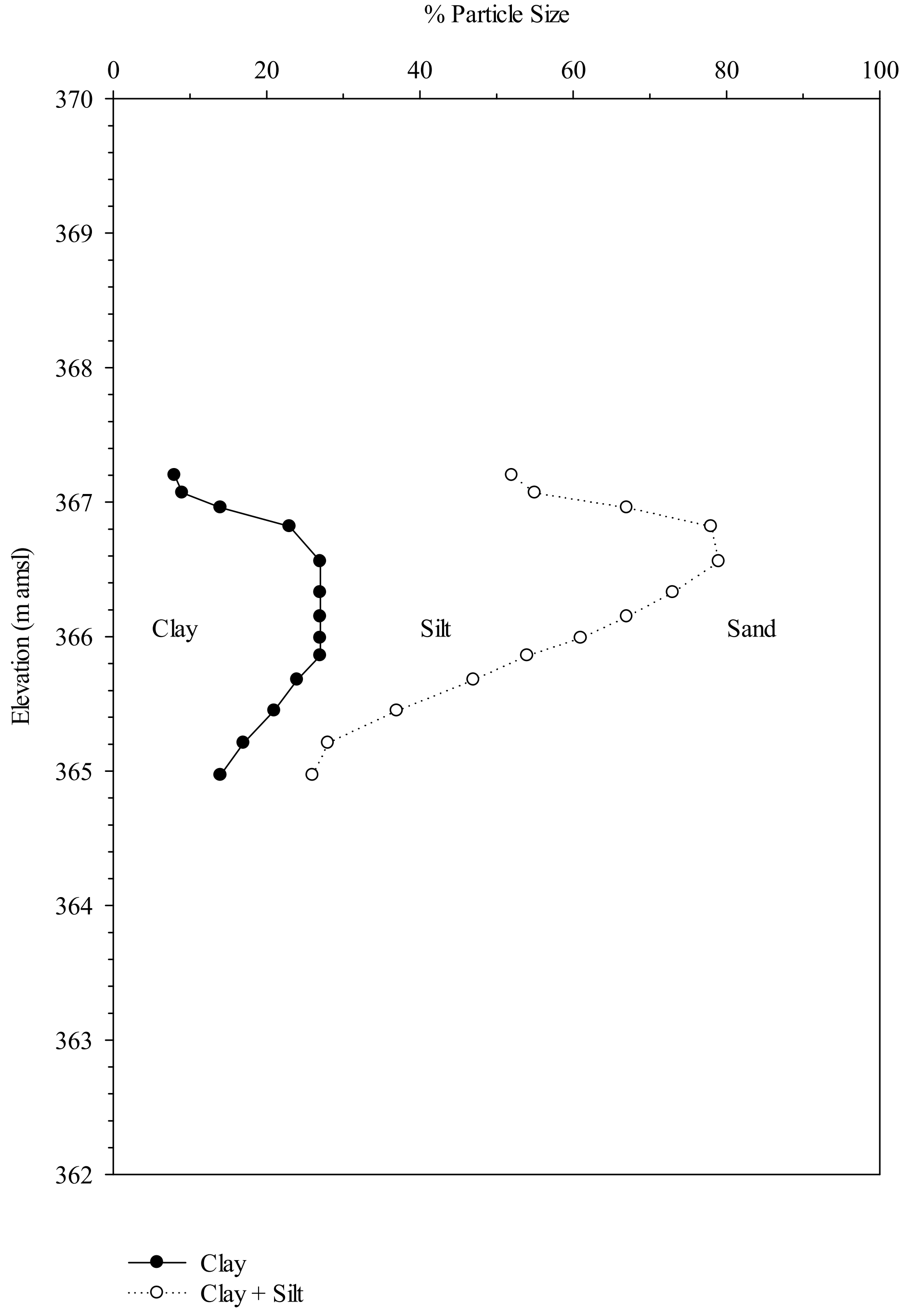


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

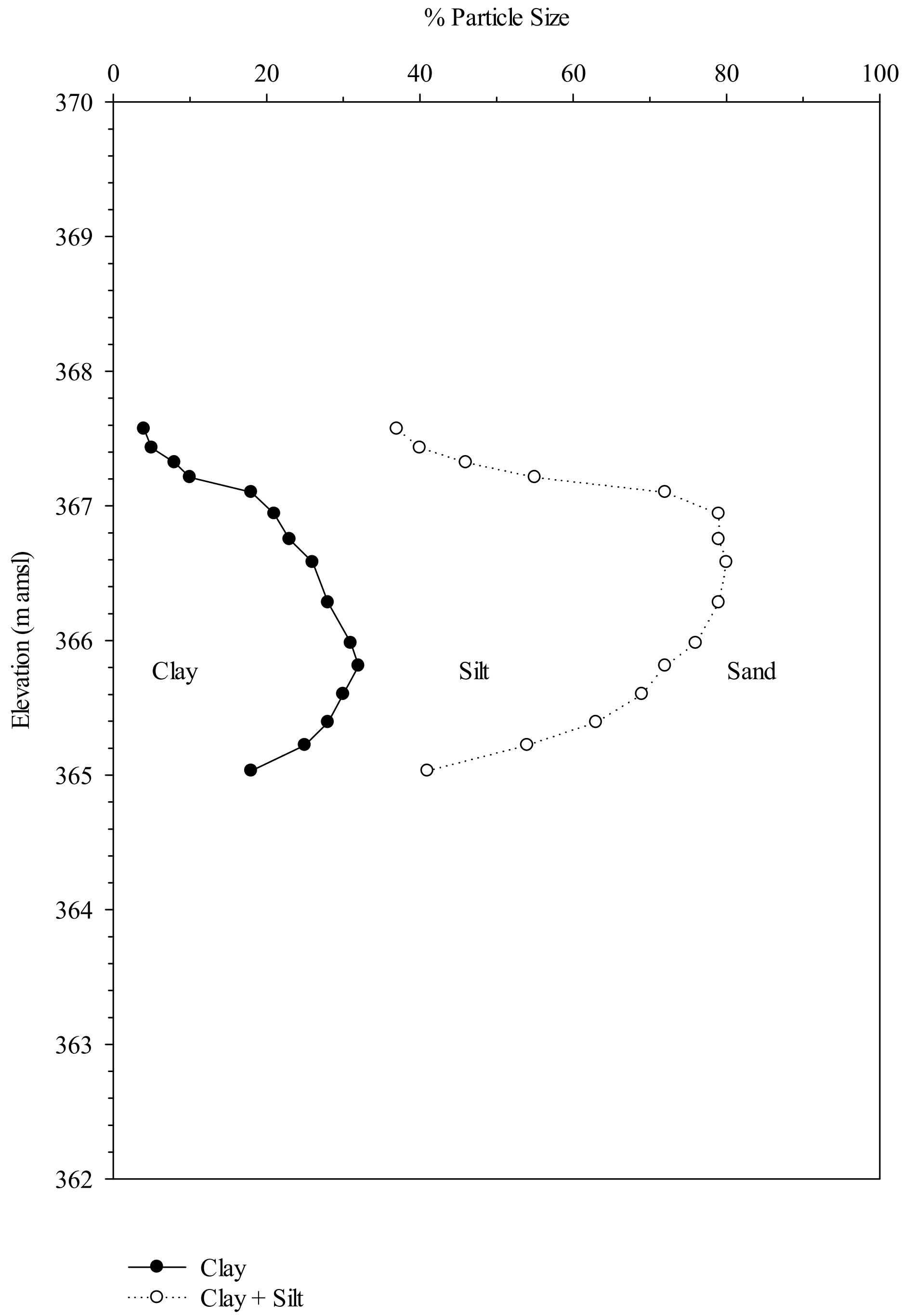
Core 16


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 17

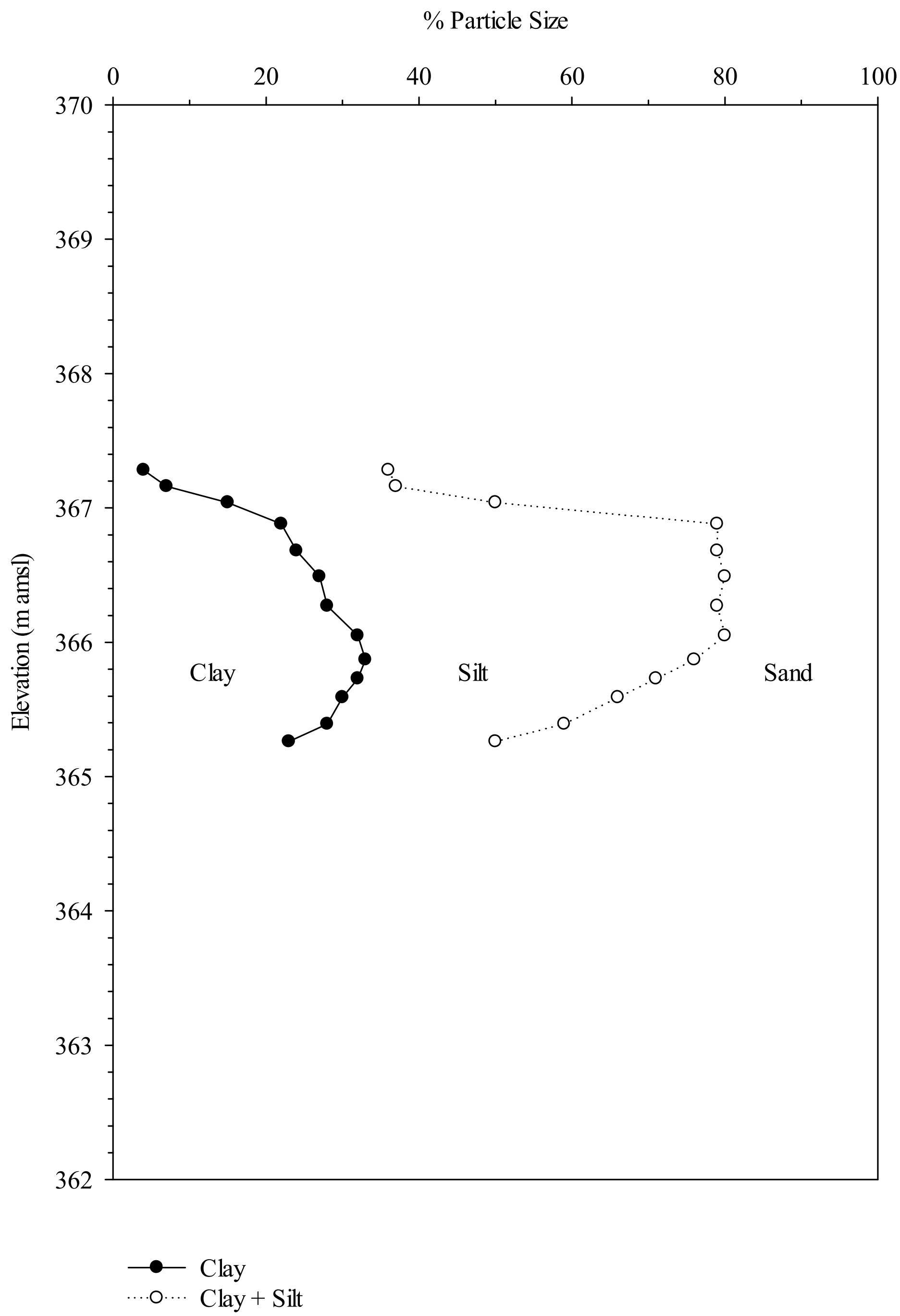

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 18

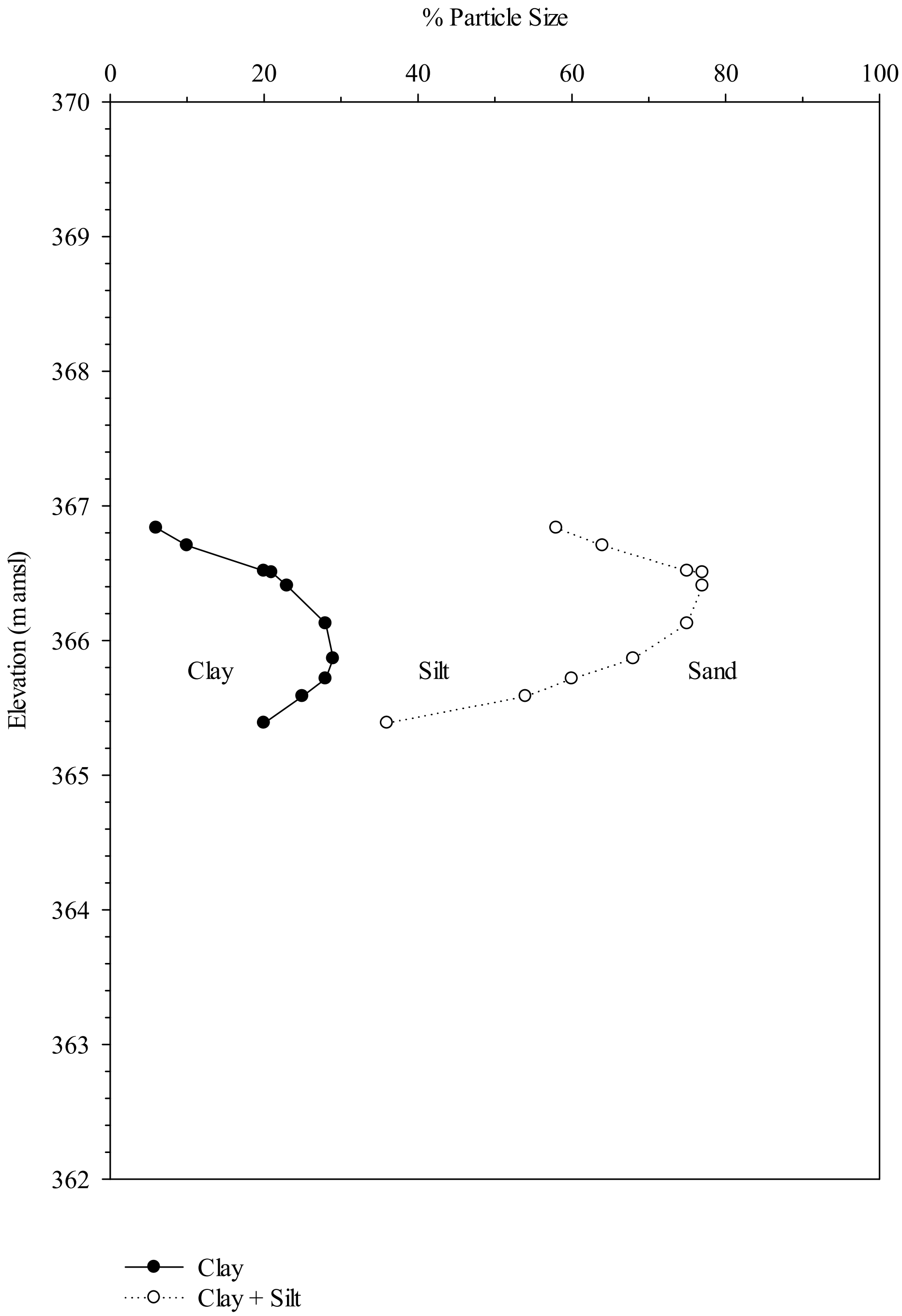


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

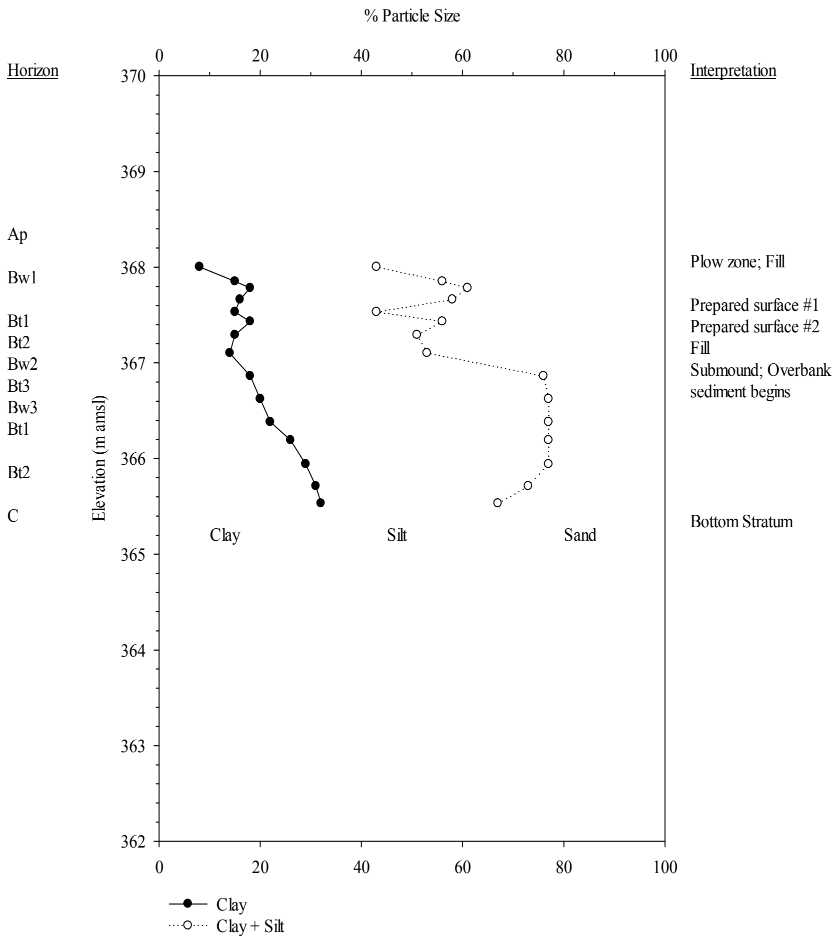
Core 19


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

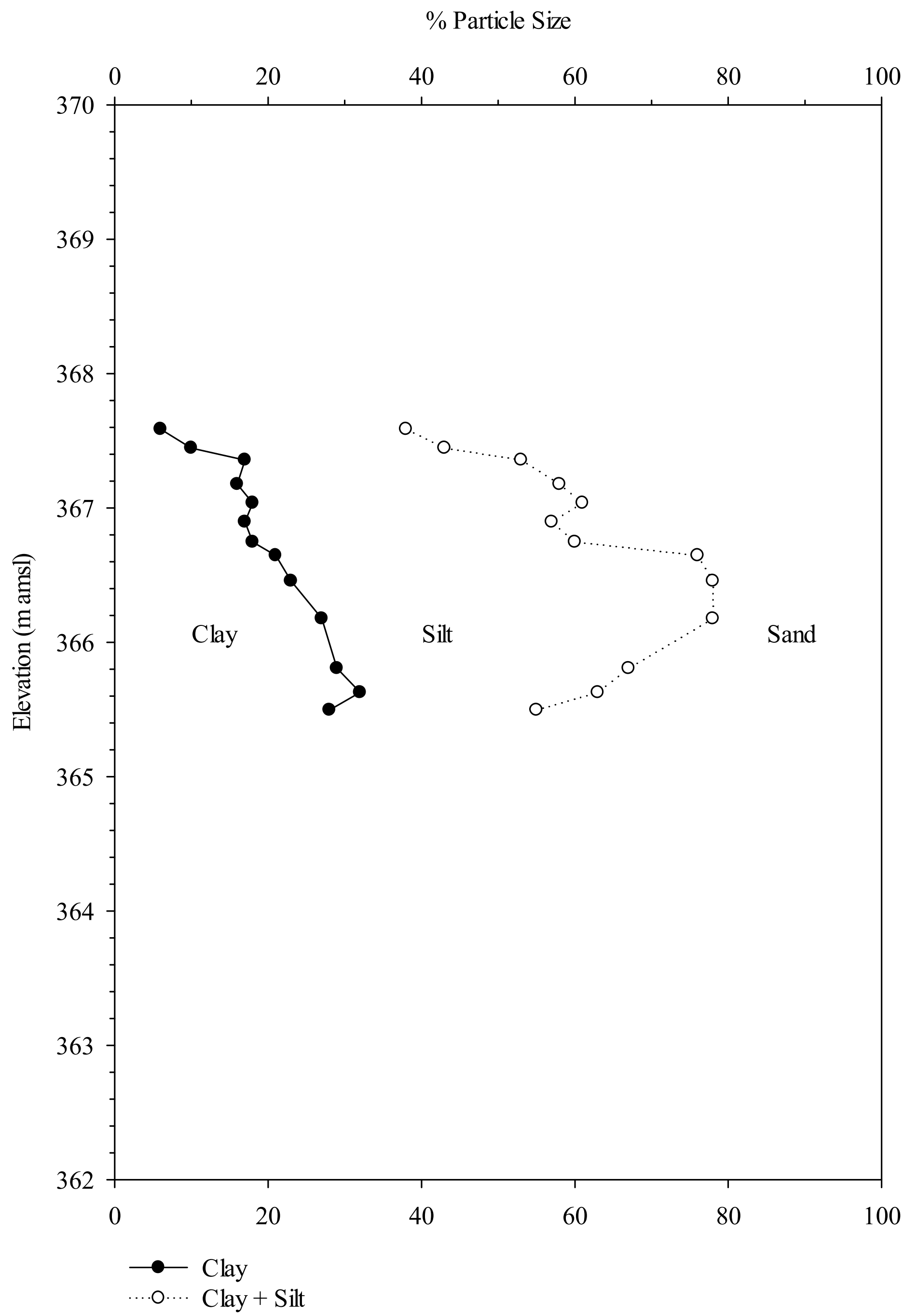
Core 20


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

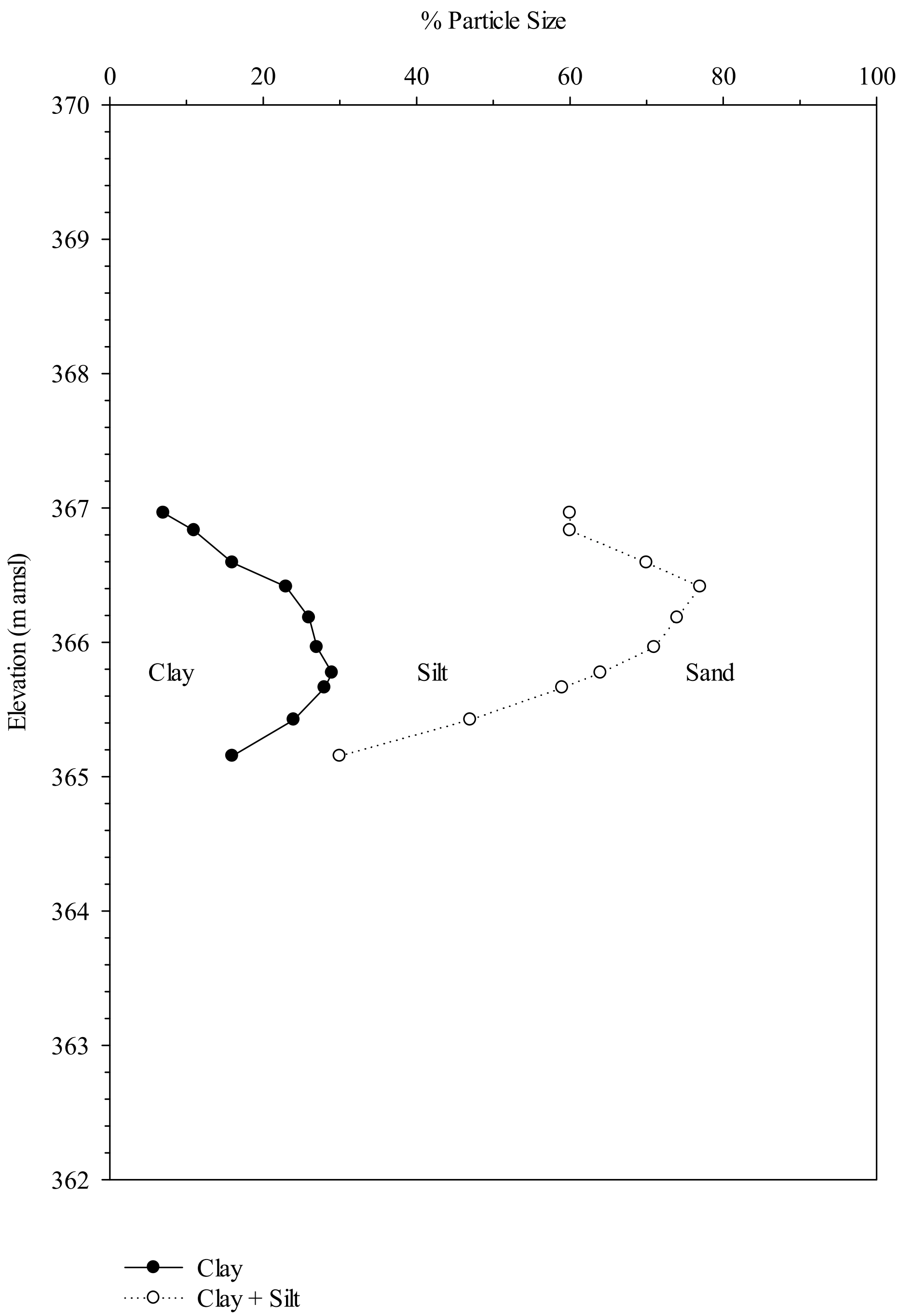
Core 21


% Particle Size
Horizon
Ap
Bw1
Bt1
Bt2
Bw2
Bt3
Bw3
Bt1
Bt2
C
Elevation (m amsl)
Clay
Silt
Sand
Interpretation
Plow zone; Fill
Prepared surface #1
Prepared surface #2
Fill
Submound; Overbank sediment begins
Bottom Stratum
Clay
Clay + Silt

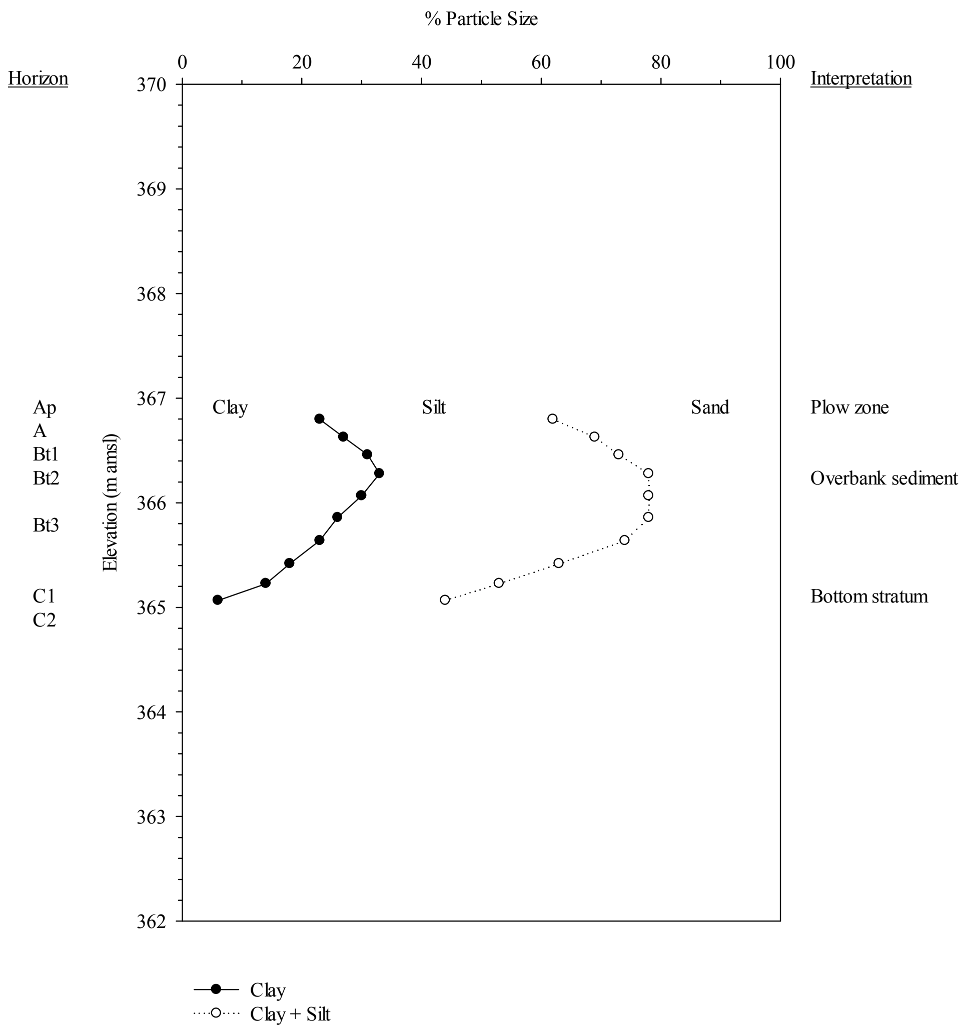
Core 22


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 23

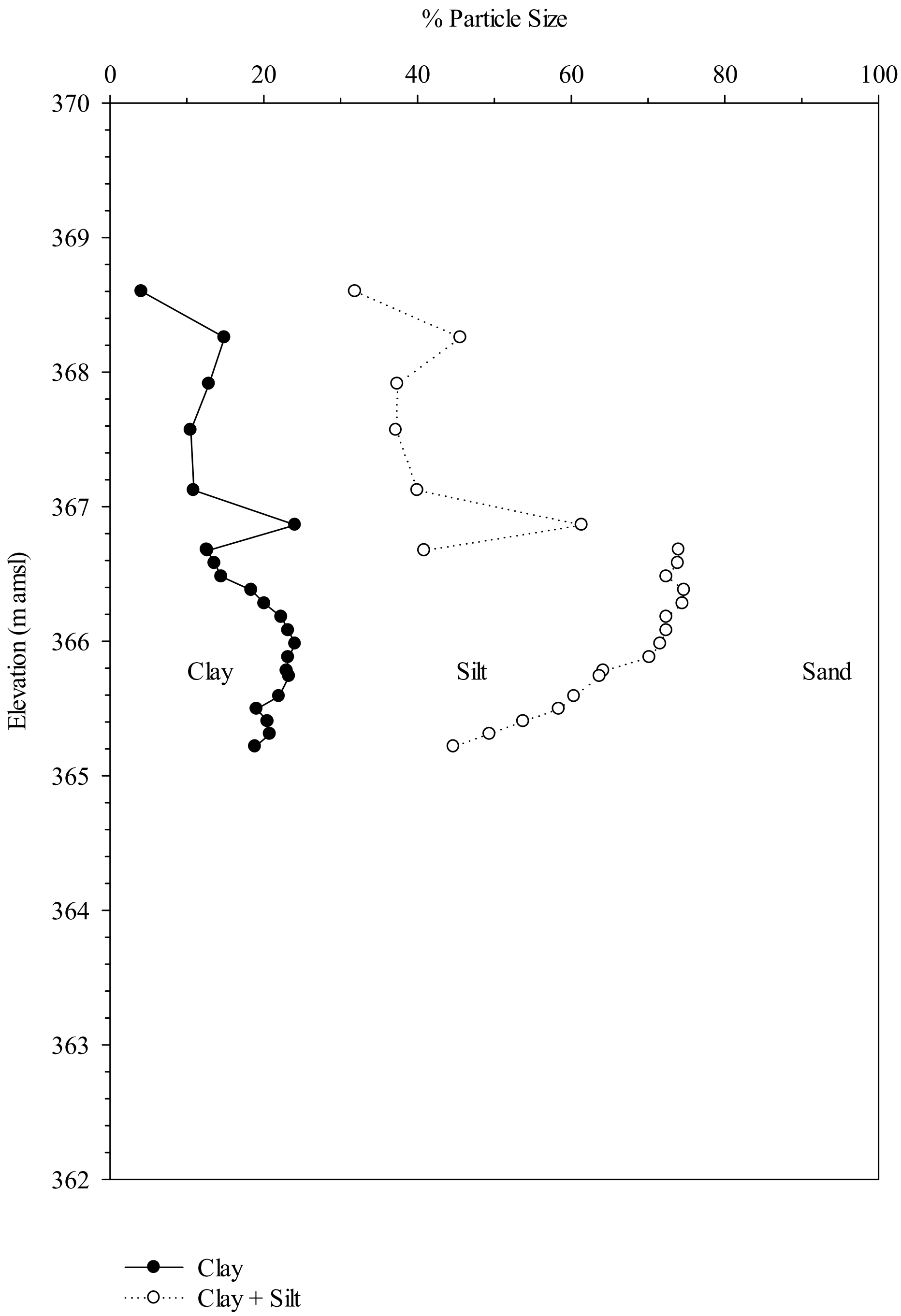

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 24

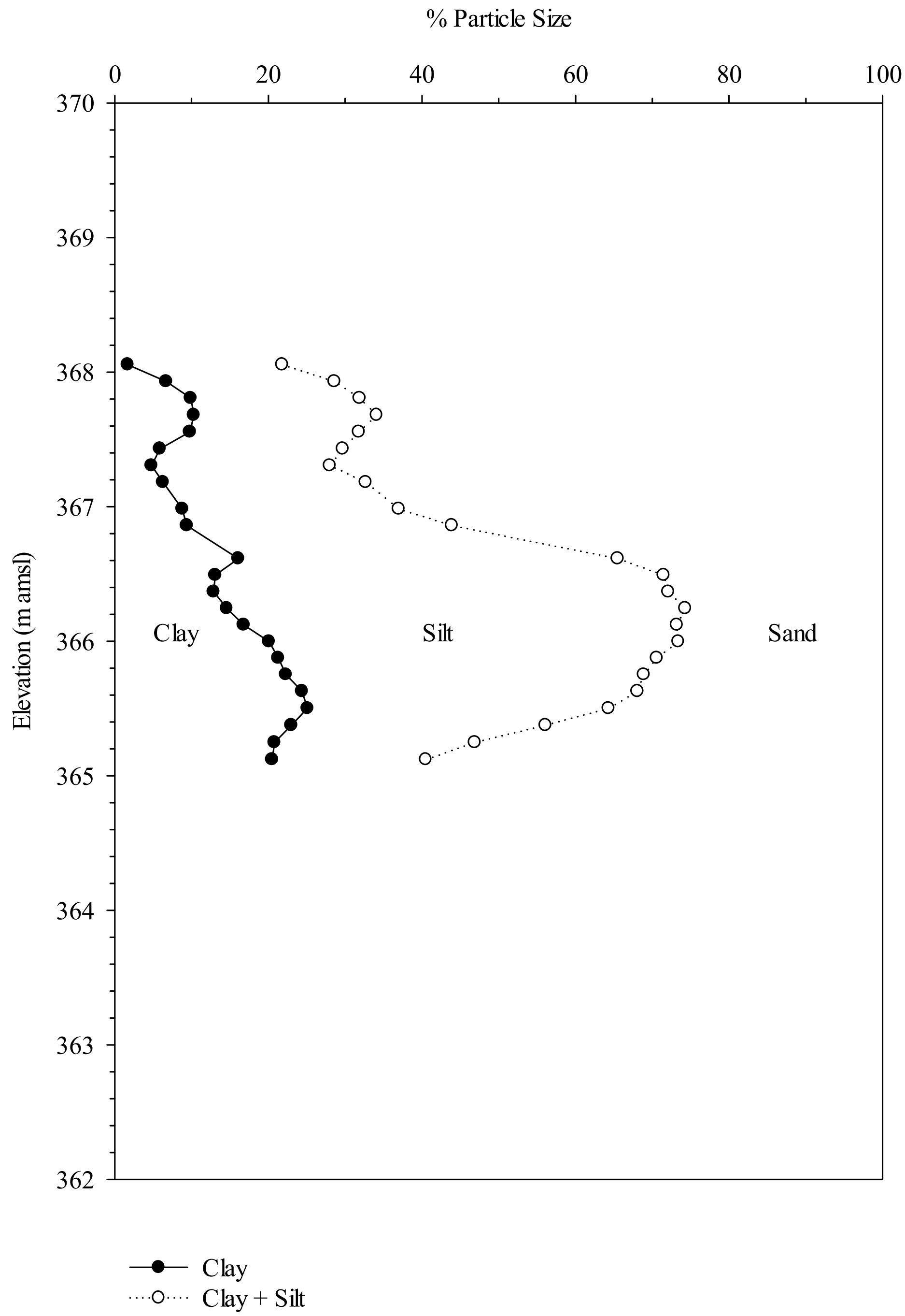


% Particle Size
0
20
40
60
80
100
Horizon
Interpretation
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Ap
A
Bt1
Bt2
Bt3
C1
C2
Clay
Silt
Sand
Plow zone
Overbank sediment
Bottom stratum
Clay
Clay + Silt

Core 25

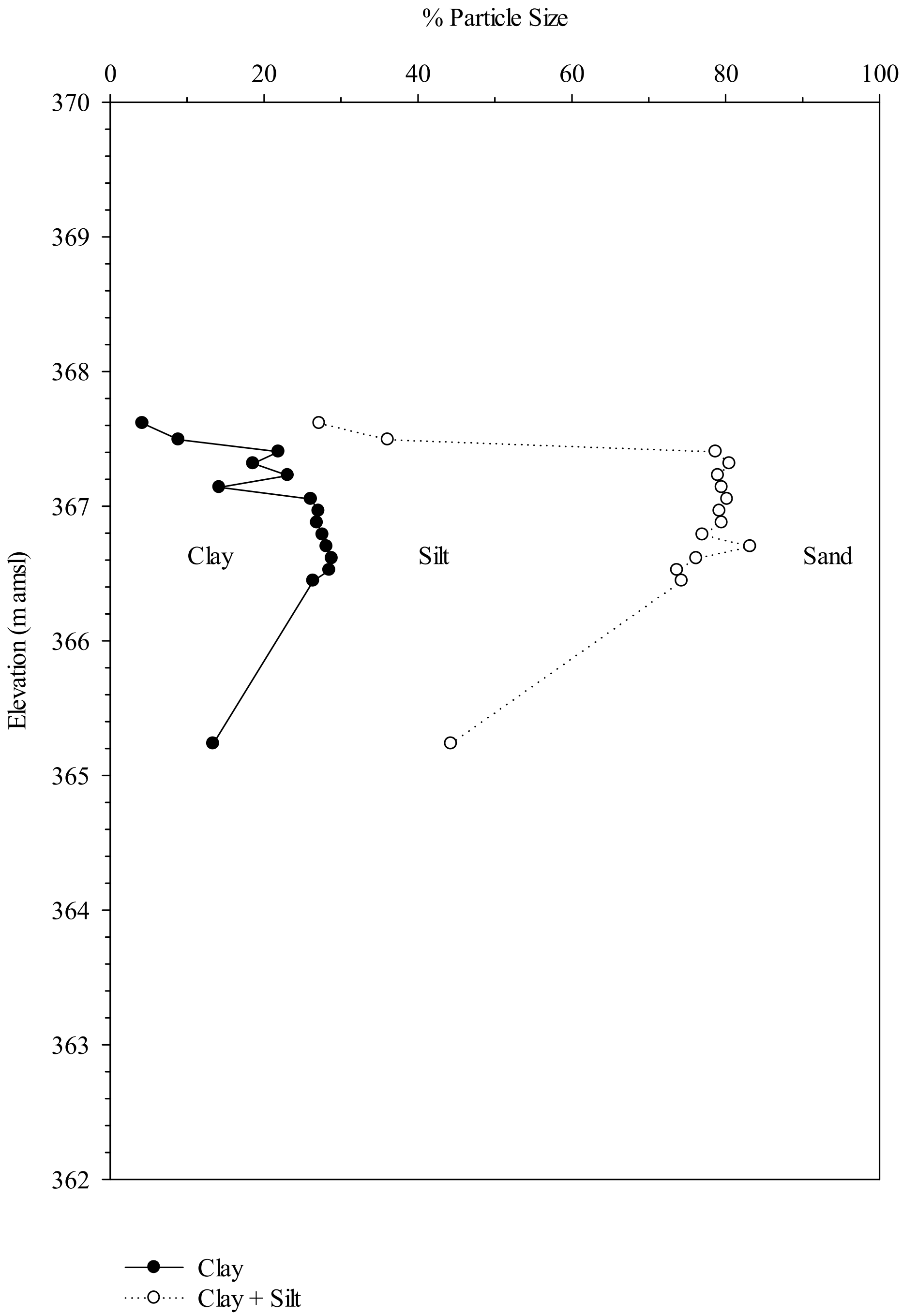

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 26

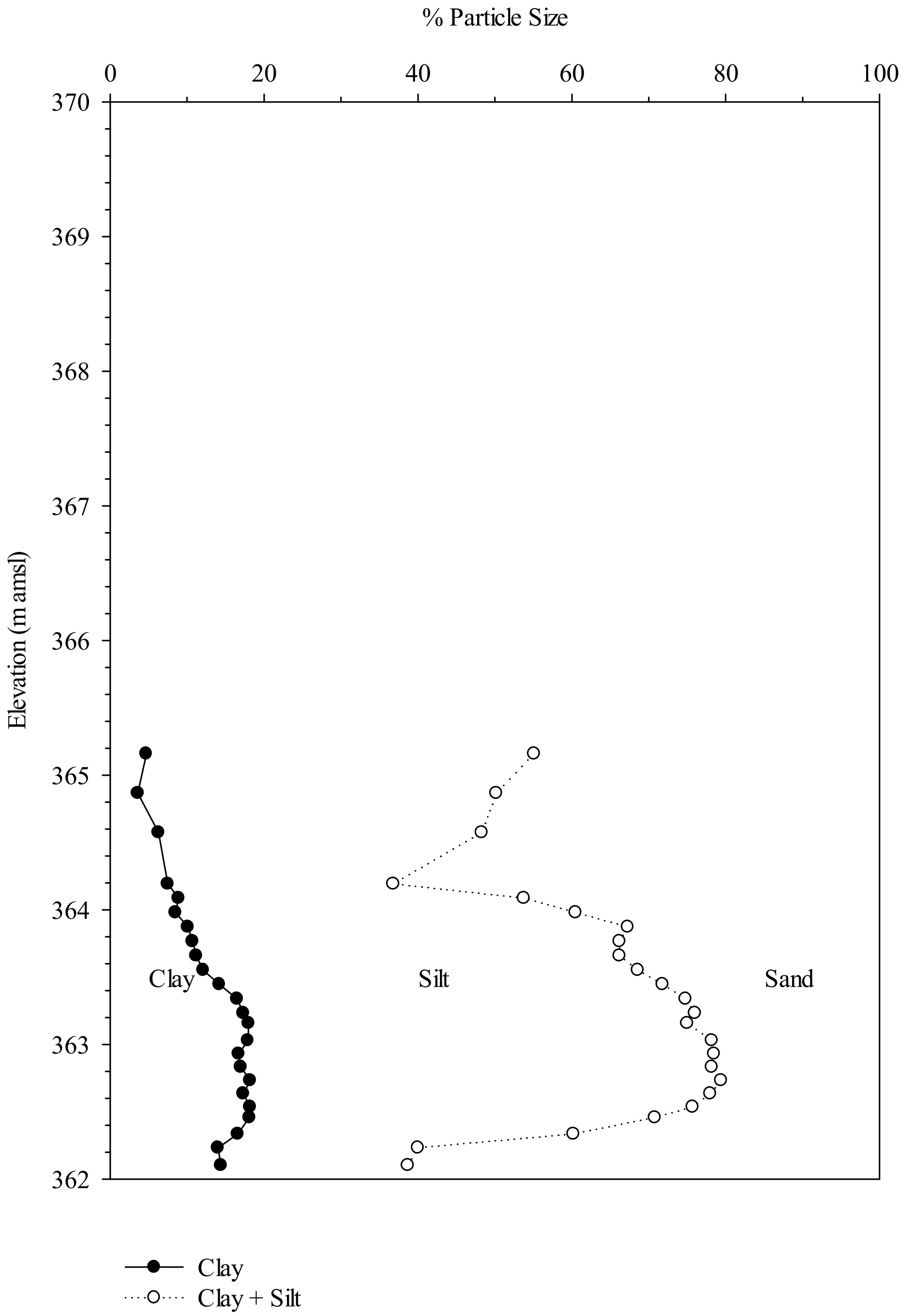


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 27


% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Core 28



% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Clay
Silt
Sand
Clay
Clay + Silt

Appendix F: Percentages and graphs for sand fraction for Cores 2 and 20 – 24 on the North – South Transect.

Core 2			
Depth (cm)	**Coarse, Coarse, Medium**	**Fine**	**Very Fine**
0-10	19.07	39.62	41.32
30-40	15.03	36.79	48.18
80-90	15.06	28.48	56.46
140-150	18.75	23.09	58.16
210-220	13.65	42.47	43.88
260-270	24.99	41.26	33.75
330-340	9.88	50.18	39.94
370-382	14.79	50.21	35.00

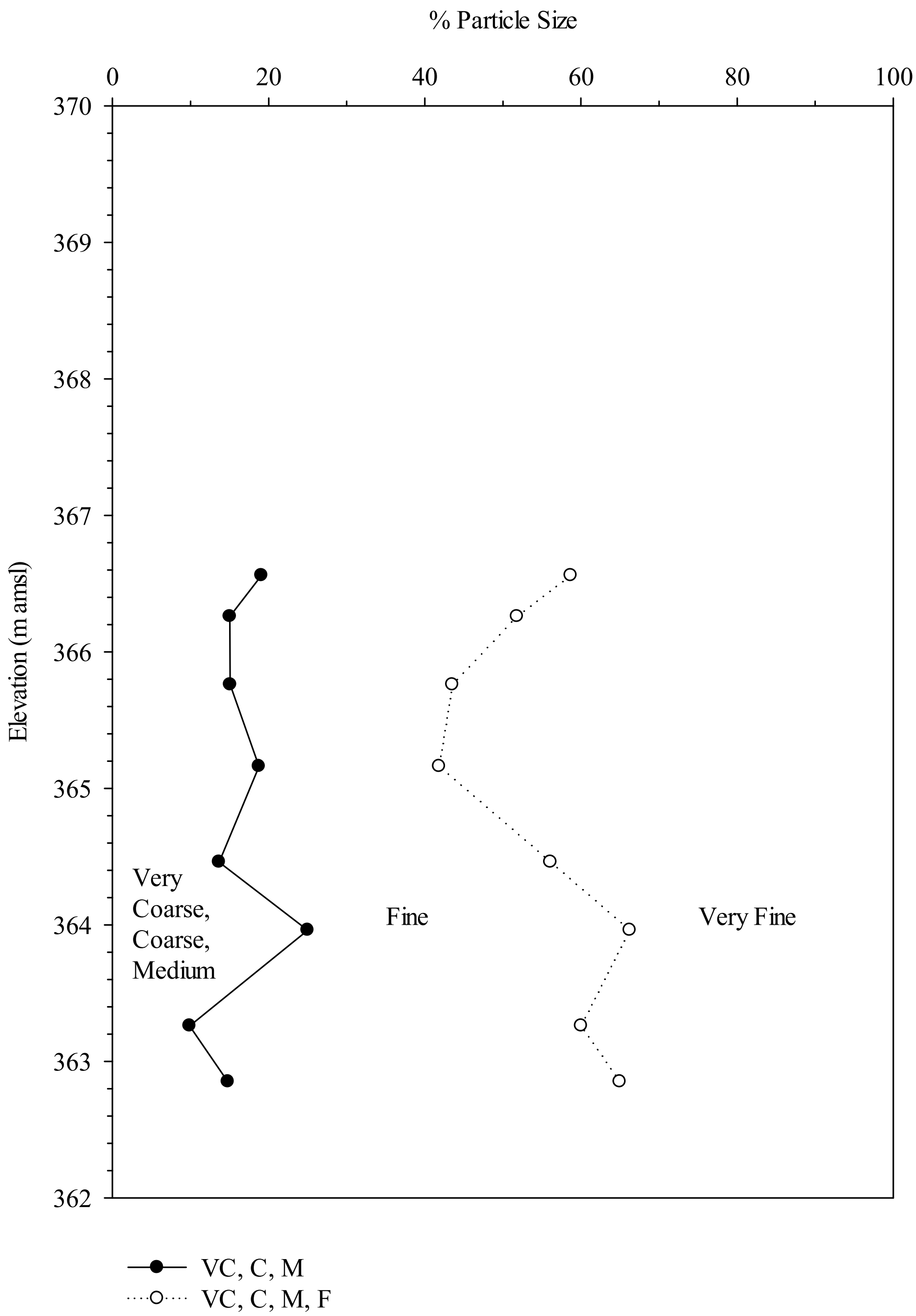
Core 20			
Depth (cm)	**Very Coarse, Coarse, Medium**	**Fine**	**Very Fine**
0-3	26.64	40.69	32.68
8-18	20.00	41.67	38.33
28-36	17.62	41.11	41.27
39-47	17.51	35.16	47.33
49-56	18.95	37.02	44.02
66-77	22.06	38.85	39.09
93-101	30.34	28.21	41.45
107-117	30.84	45.44	23.72
121-130	35.89	44.00	20.11
139-148	51.46	34.30	14.23

Core 21			
Depth (cm)	Very Coarse, Coarse, Medium	Fine	Very Fine
0-10	26.12	45.80	28.08
17-22	24.65	41.58	33.77
22-31	24.16	42.73	33.11
34-43	18.47	50.06	31.48
48-56	50.35	35.39	14.26
58-65	23.99	42.59	33.42
71-81	24.44	46.78	28.78
94-104	24.86	46.04	29.10
114-123	23.78	32.90	43.33
138-148	26.78	30.83	42.39
162-172	29.15	30.95	39.90
181-191	28.13	30.13	41.75
206-216	37.20	32.04	30.76
229-239	48.10	32.16	19.73
247-257	54.27	30.92	14.81

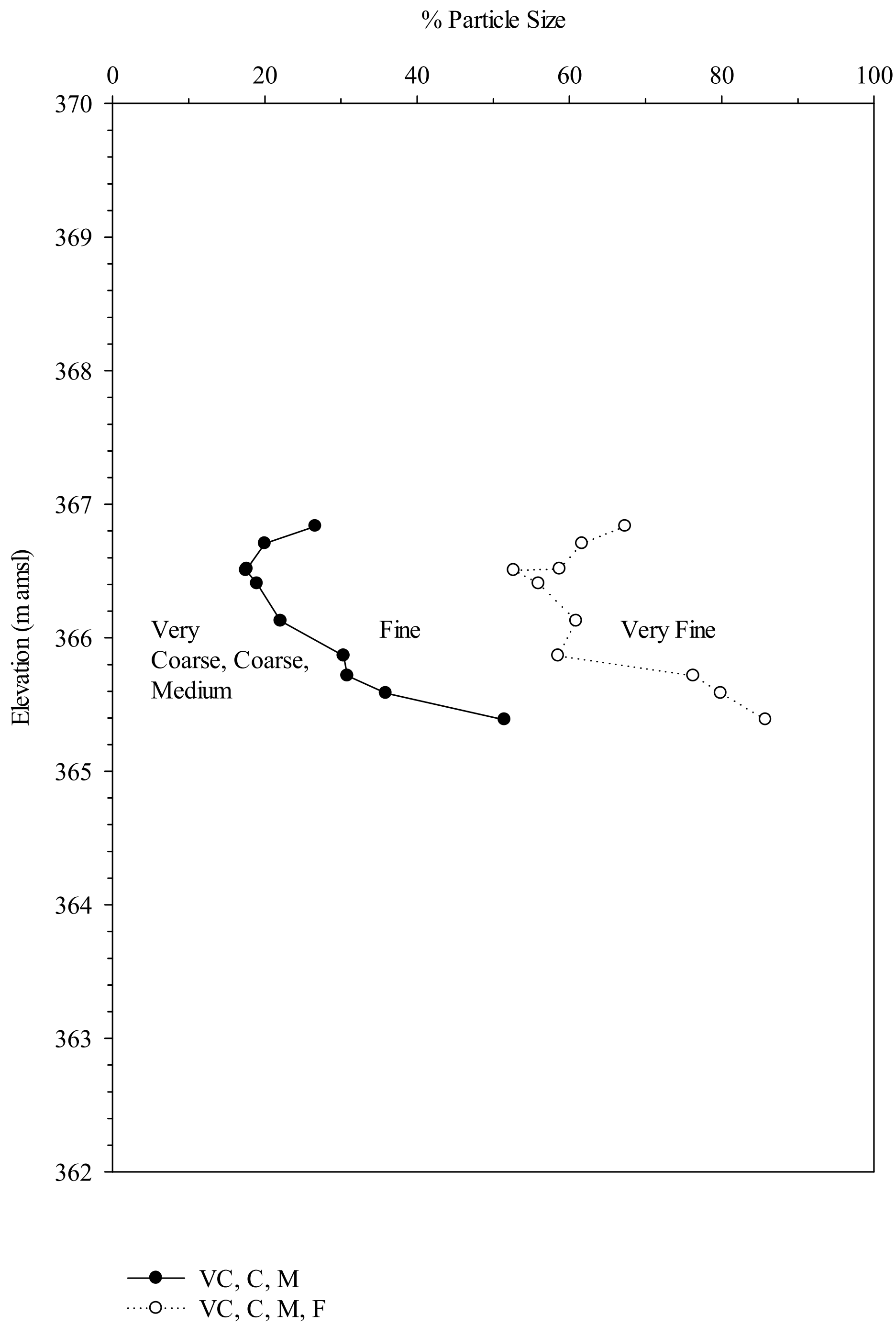
Core 22			
Depth (cm)	Very Coarse, Coarse, Medium	Fine	Very Fine
0-10	26.89	43.52	29.59
15-23	32.59	42.33	25.08
23-32	27.85	43.76	28.38
41-50	26.27	43.37	30.37
55-64	19.04	44.04	36.93
70-77	25.57	42.41	32.02
84-94	36.63	39.45	23.92
94-103	30.64	32.36	37.00
113-123	30.57	32.54	36.90
142-150	31.90	32.06	36.04
179-187	49.30	33.86	16.83
196-206	52.01	35.03	12.97
209-219	60.22	30.21	9.57

Core 23			
Depth (cm)	Very Coarse, Coarse, Medium	Fine	Very Fine
0-7	14.87	40.47	44.66
12-22	20.29	43.56	36.15
36-46	18.09	43.50	38.41
55-63	19.75	37.13	43.12
77-87	22.18	40.23	37.59
100-108	27.76	43.16	29.08
118-128	34.43	45.65	19.92
128-140	33.26	46.53	20.22
153-164	38.00	43.63	18.36
179-190	48.31	38.77	12.92

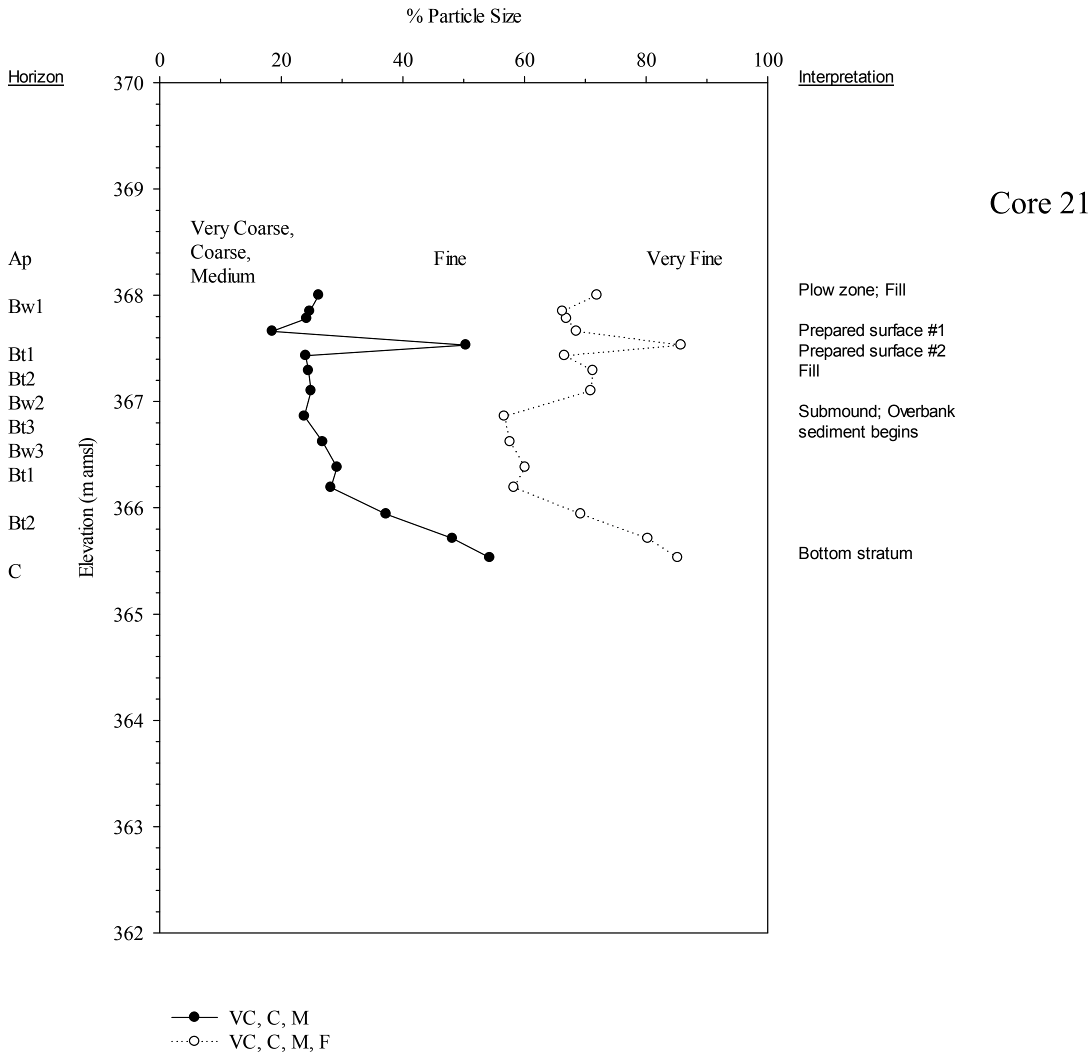
Core 24			
Depth (cm)	Very Coarse	Fine	Very Fine
0-10	11.71	40.51	47.78
17-28	17.77	41.56	40.67
35-43	18.51	39.49	42.00
52-62	18.15	35.89	45.96
73-84	19.36	34.91	45.72
94-104	27.10	39.86	33.04
116-126	32.08	42.93	24.99
138-148	35.14	43.87	20.99
157-166	36.58	43.70	19.72
173-183	36.70	43.48	19.81

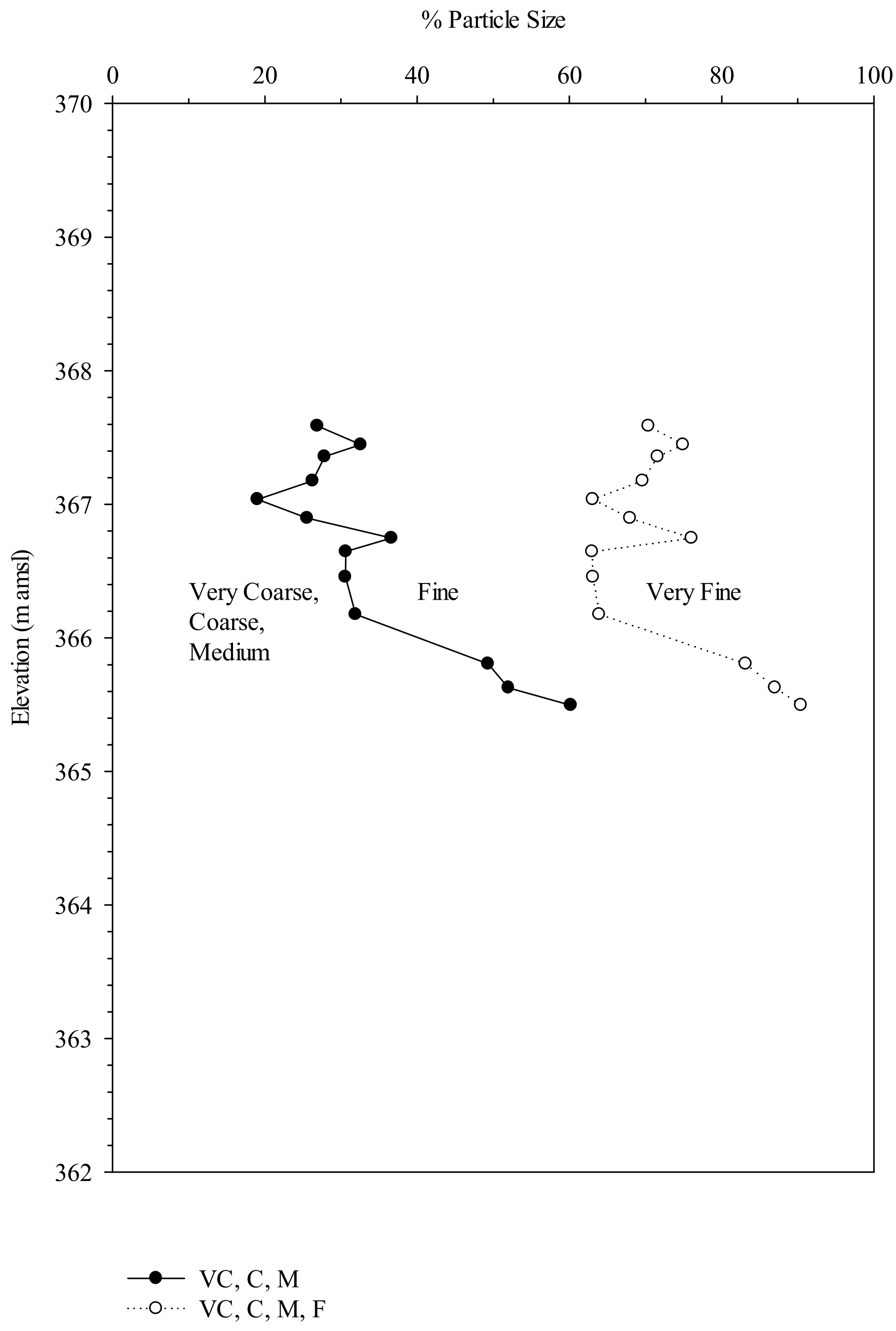

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Very Coarse, Coarse, Medium
Fine
Very Fine
VC, C, M
VC, C, M, F

Core 2

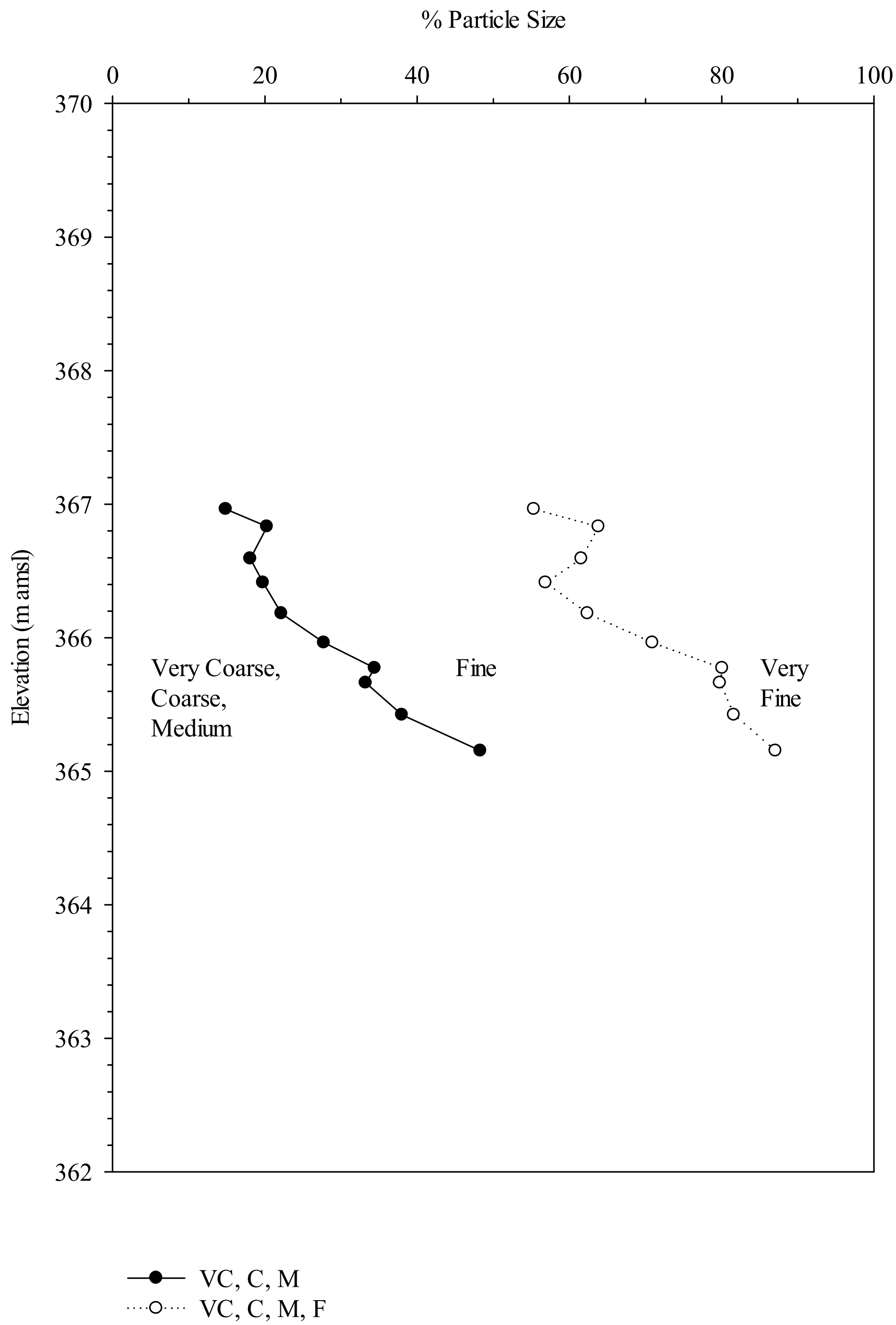

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Very
Coarse, Coarse,
Medium
Fine
Very Fine
VC, C, M
VC, C, M, F

Core 20


% Particle Size
0
20
40
60
80
100
Horizon
Interpretation
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Core 21
Very Coarse, Coarse, Medium
Fine
Very Fine
Ap
Bw1
Bt1
Bt2
Bw2
Bt3
Bw3
Bt1
Bt2
C
Plow zone; Fill
Prepared surface #1
Prepared surface #2
Fill
Submound; Overbank sediment begins
Bottom stratum
VC, C, M
VC, C, M, F

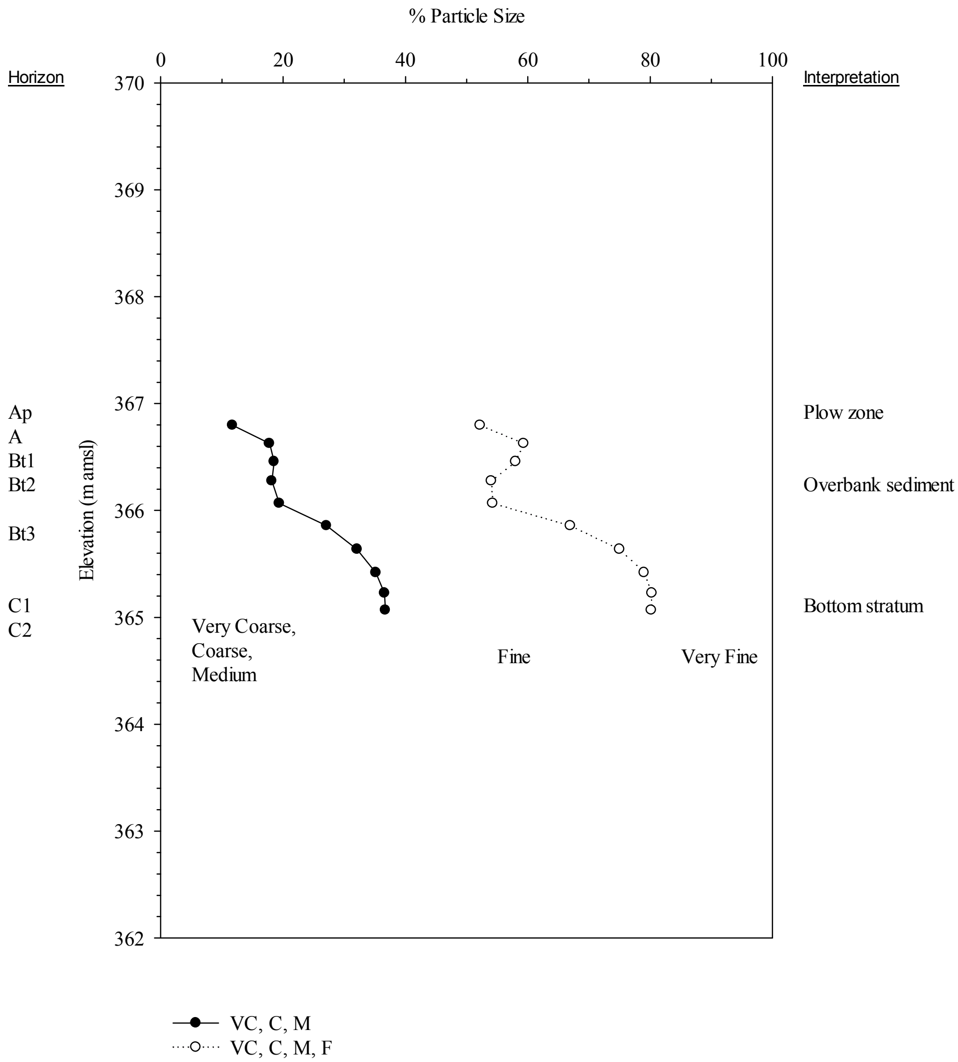

% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Very Coarse,
Coarse,
Medium
Fine
Very Fine
VC, C, M
VC, C, M, F

Core 22



% Particle Size
0
20
40
60
80
100
370
369
368
367
366
365
364
363
362
Elevation (m amsl)
Very Coarse,
Coarse,
Medium
Fine
Very
Fine
VC, C, M
VC, C, M, F

Core 23


% Particle Size
0
20
40
60
80
100
Horizon
370
369
368
367
366
365
364
363
362
Interpretation
Ap
A
Bt1
Bt2
Bt3
C1
C2
Elevation (m amsl)
Plow zone
Overbank sediment
Bottom stratum
Very Coarse,
Coarse,
Medium
Fine
Very Fine
VC, C, M
VC, C, M, F

Core 24