THESIS

PETER VILLAGE AND THE DELINEATION OF SPACE: NEW RESEARCH AT AN UNUSUAL ENCLOSURE IN CENTRAL KENTUCKY

Submitted by

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In partial fulfillment of the requirements

For the Degree of Master of Arts

Colorado State University

Fort Collins, Colorado

Fall 2021

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ABSTRACT

PETER VILLAGE AND THE DELINEATION OF SPACE: NEW RESEARCH AT AN UNUSUAL ENCLSOURE IN CENTRAL KENTUCKY

After over a century of research, archaeologists still identify one of the most important characteristics of the Early and Middle Woodland Period in the Middle Ohio Valley region as the construction, maintenance, and use of small geometric ditch-and-embankment earthen enclosures. However, the Peter Village site (15Fa166), located in Fayette County, Kentucky, is a ditch-and-embankment earthen enclosure that is both non-geometric and unusually large. Past archaeological summaries of Peter Village have classified it as an example of a non-mortuary site in the region, though its exact purpose remains unknown. Recent archaeological research I conducted on this atypical enclosure includes analyses of LiDAR-derived topographic visualizations, subsurface geophysical surveys, soil cores, and the construction of a new radiocarbon chronology that employs Bayesian statistical modeling. The result of my work provides new insights into the delineation of space at Peter Village. My data indicate that a second, previously undefined, embankment likely exists exterior to the ditch. There is also evidence from my geophysical imagery that shows the enclosure’s entrance and associated linear features in the southern, interior portion of the site. Finally, new radiocarbon data suggests that Peter Village is potentially one of the earliest examples of a ditch-and-embankment enclosure in the Middle Ohio Valley region. Using these new diverse datasets collected via multiple geoarchaeological methods, I argue that enclosure features like those present at Peter Village require us to reconsider their early monumental nature. Moreover, the identification of multiple

embankments forces us to reconsider changes in the delineation of space at the site. Peter Village serves as an important example of how a multi-scalar archaeological investigation can expand upon previous archaeological research.

ACKNOWLEDGEMENTS

I would first like to thank my advisor, Dr. Edward Henry. Without his professional guidance, care and awareness, and dedication to helping me learn and develop as a scholar, my completion of this thesis would not have been possible. I would also like to thank my committee members, Dr. Mary Van Buren, Dr. Scott Carman, and Jane Choi, for their advice and feedback on this thesis. A big thank you to Dr. George Crothers, from the William S. Webb Museum of Anthropology. Without his active support and willingness to assist in finding and selecting samples to radiocarbon date, I would have not been able to include a temporal analysis in this thesis. A special thank you to Dr. Rinita Dalan & Dr. George Holley who introduced me to the world of archaeology and fostered my profound love for the subject. Thank you to Grace Ellis, my colleague and good friend, for our thoughtful conversations and long days spent at coffee shops. To Clara Mosso, for our long walks and ice cream vent sessions. To Brendon Anthony, for being my resident graduate school confidant, advice giver, and role model. To William Kane, for being my first friend in Fort Collins and one of my biggest supporters throughout my time in graduate school. To Keri Canada, for giving me the strength and confidence to believe in myself as a scholar. And to Mike Betsinger, Crissy Lidenberg, and Emily Hartwig, my forever colleagues; we began our archaeological journey together, and it is one we continue to take together scattered throughout the country. Lastly, I would like to thank my family, particularly my parents, Jackie and Mark DeSanto, my sister, Kristen DeSanto, my grandparents, Cathryn and George Kovacs, and my Aunt Pat for always supporting and believing in me throughout all the endeavors I have undertaken in life, particularly my decision to pursue a career in archaeology.

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Chapter 1: Introduction

Monumental landscapes composed of earthen monuments are an important subject within the subfield of landscape archaeology as they are found in a variety of spatiotemporal contexts. In Eastern North America, people constructed earthen monuments as early as 3500 BC, evidenced by the Watson Brake site in modern-day Louisiana (Saunders et al. 2005). The construction of earthen monuments was particularly important during the Early and Middle Woodland periods in the Ohio Valley, as their construction and use are markers of increasing social complexity within the region (Abrams and Freter 2005; Applegate et al. 2005; Dancey 2002; Henry et al. 2019; Lepper 2016; Lynott 2015; Wright 1990).

Earthen monuments, both burial mounds and earthen enclosures, featured prominently across the pre-Contact landscape in the Middle Ohio River Valley, a subregion within the Ohio River Valley that includes the lower portions of Ohio, southwest corner of Pennsylvania, and much of Kentucky and West Virginia (Applegate 2005). This is due to the extensive spread of Adena societies in this region. Adena is the term for a cultural unit constructed by archaeologists to describe societies living from about 500 BC to AD 250 who shared a common identity as expressed in cultural materials produced from shared social practices (Clay 1985, 1988, 1998) The construction and subsequent interaction with earthen monuments is one of the defining shared social practices of Adena groups (Clay 1987; Henry 2018; Henry et al. 2019). Earthen monuments were closely linked with increasing social complexity at the time as their performance served the function of bringing dispersed people together to interact. During these interactions, common social identities were created and maintained through participation in ritual events, communal construction events, and feasting. Mortuary rituals were of particular importance throughout many of these ritual interaction spheres (Clay 1987, 1998; Hays 2010; Henry 2017, 2018; Pollack and Schlarb 2013).

Because of the prominence of mortuary rituals within the Adena, this aspect has been an important focus of archaeological research regarding Adena earthen monuments, and sites in general. However, during the 1970's, and continuing into contemporary research, archaeologists have begun to actively explore Adena sites outside of mortuary contexts (Black 1979; Clay 1998:13; Clay and Niquette 1992; Grantz 1986). Contributing to this research are recent technological developments within the field of archaeology, such as geophysical and geoarchaeological techniques, which enable researchers to collect new types of data relating to earthen monuments quickly. With the application of these new methods, it has been discovered that even without the presence of mortuary rituals, it was still possible for communal events such as construction to take place, expanding the notion of possible interactions resulting in the maintenance of social identities.

Therefore, the study of these earthen monuments is important to understanding Adena societies in the Middle Ohio Valley, more generally. Earthen enclosures, specifically, were prominent in this region and most are very uniform, small, and geometric in shape. However, there were earthen enclosures that did not fit this description. One example of an unusual earthworks is the Peter Village enclosure, located in Fayette County, Kentucky, which is both irregular in shape and abnormally large for the area (Clay 1985, 1988). This site was long misunderstood as an Adena "village," but Clay (1985, 1988) instead describes Peter Village as a potential "specialized" site for the production of tools and ritual goods. Peter Village is delineated by an enclosure, originally thought to be composed of a ditch and an embankment but remained largely unexplored again until Dr. Edward Henry conducted archaeogeophysical surveys at the site in 2013 and 2014, followed by soil coring in 2015.

After I analyzed these newly collected data alongside LiDAR visualizations of the site that I produced, I began to reevaluate the relationship between the ditch and embankment. My new analyses and consideration of these datasets suggest the potential for an additional, newly rediscovered, embankment situated outside of the ditch. This builds upon the previous identification of a possible "dual embankment" made by Clay (1985:10). Drawing on new datasets, diverse in their scales and forms, I explore the following research question: How did Adena societies delineate space at Peter Village?

Chapter 2 is a literature review describing the theoretical framework I apply to my research. The chapter outlines the notion of landscape and the field of landscape archaeology as a useful subfield that allows for the incorporation of new methodologies and perspectives. The chapter moves into a background of monumental landscapes and their two essential components: monuments themselves, specifically earthen monuments, and their perceived monumentality. Finally, there is a discussion of the Middle Ohio Valley region and the importance of my research regarding the Peter Village site. Chapter 3 focuses on the soil, geological, and environmental context of the site, as well as a culture history outlining the cultural context of the site. In Chapter 4, there is an overview of the field and laboratory methodologies used to explore the nature of Peter Village's built environment. These include aerial and terrestrial remote sensing methods such as the analysis of LiDAR-derived visualizations, magnetometry, electromagnetic induction (EMI), and ground-penetrating radar (GPR). In addition, I examined several solid soil cores of which I observed their soil characteristics, magnetic susceptibility, and sequential loss-on-ignition (LOI). I also produced a Bayesian analysis of legacy radiocarbon dates, in addition to three AMS ^{14}C dates run as part of this project. In Chapter 5, results of my methods implemented during this project are presented. Chapter 6 contextualizes my results within the creation of the site and the delineation of space at Peter Village. Here, I use the new understanding of Peter Village to explore the enclosure's qualities. Potential future research questions and fieldwork strategies are also presented. Chapter 7 then concludes with a summary of my research, as well as a discussion of the importance of Peter Village as an example of the increasing social complexity in the Middle Ohio Valley.

Research at the Peter Village site has the potential to contribute new research regarding early interactions between people and earthen monuments in the Middle Ohio Valley due to its abnormal size and shape. This is important because the occupation of the Peter Village site took place at a time when the construction and interaction with earthen monuments was on the rise, a hallmark of increasing social complexity. Therefore, because of the unusual nature of the enclosure at Peter Village, this site can serve as an important example of how people interacted with and experienced enclosures alternative to the social norm of small, geometric enclosures popular among Adena societies. Evaluating monumentality further within the context of Peter Village can aid in understanding how people used these monuments to facilitate important social happenings that reflect increasing social complexity.

Chapter 2: Social Space & the Built Environment in Small Scale Societies

Understanding how people created landscapes throughout history provides a perspective of the past that allows for a more dynamic understanding of time and space. A landscape is more than its physical components, consisting also of cultural and social elements. Landscapes enable archaeologists to consider how people of the past created, and subsequently used, built environments as social spaces. Such research is equally important when applied to large-scale societies as it is when considering small-scale societies, as their interaction with their surroundings was just as impactful and meaningful. Small-scale societies relied on common social landscapes to create and maintain common social identities and memories, allowing cultural patterns and trends to emerge throughout various regions.

Landscape

The word "landscape" derives from the ambiguous German term "landschaft" and was first used in the 16th century when the Dutch began to create early forms of landscape painting (David and Thomas 2016:27). Since then, landscape has become a popular concept discussed between, and studied across, many disciplines. However, no separate field of "landscape studies" ever formed as a standalone academic subject; historians, geographers, botanists, ecologists, geologists, architects, artists, anthropologists, and writers all engage with the concept of landscape in ways that suit their different subjects. With multiple perspectives contributing to the development of the concept of landscape, the term is dynamic and adaptable to its context. Nevertheless, with the inclusion of many voices and perspectives there remains significant debate about how the term should be interpreted and used (Muir 1999).

Some scholars take a literal approach to landscape, quoting dictionary definitions, such as "all the visible features of an area of countryside or land, often considered in terms of their aesthetic appeal," (The Oxford Dictionary 2010). Other approaches utilize a modified, more general reference such as a "restrictive piece of land" (Olwig 1996 [Hartsthorne 1939:150]). These simple definitions often involve a perception of landscape with definitive physical boundaries, boarders, and/or edges. Such perspectives developed because of the long-standing tradition of people associating landscape with "natural scenery" (Olwig 1996:631), which early landscape artists perpetuated through the use of rural settings as the subject of their work (Mitchell 1994).

In more recent years, approaches to landscape have significantly expanded beyond such restrictive understandings. Some researchers identify landscape as a "way of seeing the world" (Cosgrove 1998:13), which borrows ideas influenced by phenomenology to discuss this complicated term. New perspectives look to rid landscape of preconceived notions regarding definitive physical boundaries, broadening the concept to include more dynamic possibilities. For example, more recent definitions of landscape often take into consideration personal and societal perspectives (Muir 1999:4; Taylor 2008; Tuan 1979:89). Bender (2002:1) argues that "landscapes are created out of people's understanding and engagement with the world around them," acknowledging the different experiences landscape can provide a person and/or group of people. From this perspective, landscape is something that is culturally situated, dynamic, and a product of society; landscape is "shaped and reshaped" (Bender 2002; Muir 1999) by the people interacting with it. It is materialized by, and helps to materialize, certain aspects of society such as social identity and memory (Lowenthal 1975; Marschall 2009; Taylor 2008; Van Dyke 2008; Van Dyke and Alcock 2003).

The temporality of landscapes is equally as important as its spatial context (Bender 2002; Ingold 1993; Lowenthal 1975; Thomas 2001; Virilio et al. 2000). Ingold (1993) writes "to perceive landscape is therefore to carry out an act of remembrance and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perceptually with an environment that is itself pregnant with the past," (153-154). Scholars have approached the temporality of landscape in many different ways. Some scholars perceive landscape as a physical manifestation of a "record" or "story" (Ingold 1993:152). This perspective encourages a view of landscape which promotes the idea that the landscape present today is a result of the past; it contains the influences of the past in its present form (Hoskins 1955). Other scholars choose a perspective of landscape more closely resembling an "on-going recording," with the assertion that "record" has too stagnant a connotation; landscapes are both a result of the past, as well a representation of the present (Bender 2002).

To conclude, landscape has as much to do with environmental, ecological, and physical elements as it does with social norms, institutionalized knowledge, and culture (David and Thomas 2016:38). Landscapes are dynamic, as they are constantly contested, in both social and political spheres and are ever evolving across diverse temporal and spatial contexts. Depending on an individual's role in society, their experience will change in the landscape: where they can go, what they can do, who they can be, the people and things they can associate with, and their overall embodied experience (David and Thomas 2016:39).

Landscape Archaeology

The term "landscape archaeology" did not appear in archaeological writings until the mid-1980s (David and Thomas 2016:27). Therefore, the field of landscape archaeology is not an old discipline. However, there were scholars who came before the explicit development of the term "landscape archaeology" who laid the foundation for what would one day develop into a subdiscipline. An important, seminal piece written early on is Willey (1953), which describes archaeological research centered on understanding settlement patterns in Peru's Virú Valley. Willey uses an approach with a perspective heavily focused on how people *distributed* themselves across the *landscape* (Willey 1953:XVII–XIX). Early studies by those writing and researching within the field of landscape archaeology often did so similarly to those using an environmental archaeology approach, with a focus on how humans interacted with their *physical* surroundings. Popular topics during this early developmental stage of landscape and environmental archaeology included economics, environmental studies, settlement systems, and ecology (David and Thomas 2016:28, 30, 39).

As new archaeological methods began to develop and expand such as geoarchaeology, taphonomy, predictive modeling, bioarchaeology, and paleoecology, the field of landscape archaeology began to separate from environmental archaeology (David and Thomas 2016:28). With the expansion of landscape archaeology came new research perspectives, such as "siteless" archaeology which places less focus on establishing hard site boundaries and more focus on observing the spatial distribution of artifacts and environmental patterning throughout a landscape (see Dunnell and Dancey 1983 for an early example). This new focus on spatial patterning gave rise to archaeologists studying these patterns and relating them to expressions of social identity and cultural practices. An example of this is Smith (2003) which provides an archaeological understanding of past authority through the study of artifact distributions and the built environment to tease out the political dimensions of landscapes.

Landscape archaeology began to include the study of socially and culturally constructed landscapes through topical focuses on subjects such as material sourcing, style, cultural heritage and public outreach, and the inclusion of indigenous perspectives (David and Thomas 2016:31–32). Today, the field of landscape archaeology has greatly expanded from its earlier foci.

Archaeologists now use landscape archaeology to observe the spiritual, cosmological, and ontological elements of landscape, just as much as the physical elements (David and Thomas 2016:32). In an edited volume regarding landscape archaeology in the southeastern United States, Wright and Henry (2013) employ a notion of landscape archaeology to evaluate new perspectives of past landscapes. Research in this volume takes into consideration the way people of the past participated in varying interaction spheres within and/or across landscapes at different scales (Wright and Henry 2013:14–15). This approach allows for consideration of topics such as memorialization (Clay 2013), patterns in occupation (Wright 2013), and the interconnectedness of different regions (Keith 2013), all within the context of landscape archaeology in the same region.

In expanding notions of landscape in archaeology, researchers have moved away from the past environmental and physical centered perspective of landscape towards a more dynamic, culturally situated point of view. Landscape archaeology is now a "conceptual framework" which can aid in a more holistic understandings of people from the past and the meaningfully situated contexts of which they constructed and operated in (David and Thomas 2016:32–33). With this viewpoint, landscape archaeology can "locate human existence [...] in all its lived dimensions: experiential, social, ontological, epistemological, emotional, as place and emplacement concern social identity, as much as they concern the economic and environmental aspects of life," (David and Thomas 2016:38). Therefore, landscape archaeology provides insight into how people visualized their surroundings, engaged with one another through networks, chose to alter their surroundings, and experienced the circumstances of their local lives (David and Thomas 2016:37–38). This insight allows for the expansion of various topics in the field of archaeology to transcend past research perspectives. For example, in this research, I use landscape archaeology as a framework to understand past cultural aspects of an earthen enclosure within the context of the monumental landscape it is a part of. With a better understanding of the important elements of a monumental landscape, researchers can connect the physical elements of such landscapes with a better understanding of the sociocultural workings of the past.

Monumental Landscapes

The construction and formation of monumental landscapes has great time depth and from a global perspective can be traced back to between 8,000 and 10,000 BC to Gobleki Tepe's megaliths, which consist of large carved stones placed in a circle (Schmidt 2010). Around 5,000 BC, in Northern Arabia there were "mustatils," which were "fence-like structures" made from piles of rocks (Groucutt et al. 2020). A millennium later megaliths were being erected across Neolithic Europe (Bradley 1998). By 3,500 BC the first earthen monuments were being constructed at Watson Brake in present-day Louisiana, making them among the first earthen monuments constructed in what is now the United States (Saunders et al. 2005). The creation of monumental landscapes is a phenomenon that continues today, with contemporary societies still erecting new monuments (e.g., Ground Zero, former Civil War battle grounds, the Gateway Arch in Saint Louis, Missouri). To better understand how societies form monumental landscapes, an understanding of monumentality and how this concept helps to create a landscape which has monumental status is essential. Then, it is important to understand the possible forms monuments can take, as well as the role they serve in society.

<u>Monumentality</u>

An important concept that scholars have recently engaged with more is monumentality, which aids in an understanding of the relationship that people develop with monuments within a monumental landscape (Burger and Rosenswig 2012; Elliott 1964; Hildebrand 2013; Kassabaum et al. 2011; Osborne 2014; Scarre 2011; Wright 2014a; Wright 2014b). Osborne (2014) defines monumentality as “an ongoing, constantly renegotiated relationship between thing and person, between monument/s and person/s experiencing the monument,” (3). Definitions such as this one are appropriate as new research suggests that monumentality is extremely variable and relies on the societal context of the monument and community experiencing the monument (Hildebrand 2013; Osborne 2014; Wright 2014).

There are some characteristics outlined by various scholars associated with monumentality across different spatiotemporal contexts. Moore (1996) identifies common characteristics of monuments that influence their perceived monumentality as ‘permanence,’ ‘centrality,’ ‘ubiquity,’ and ‘visibility’ (139–165). Both material traits of monuments, such as ‘colossallity,’ ‘elaboration,’ ‘uniqueness,’ ‘surplus,’ and ‘durability,’ as well as non-material traits such as ‘surplus of meaning,’ ‘direction towards a collective,’ and ‘intentionality’ are often important in understanding monumentality (Furholt 2011:116; Müller and Furholt 2011:16–17). Scholars use these traits across literature when discussing monumentality (e.g., Hildebrand 2013). However, it is important to understand that not all, or exclusively, these properties must be present for monumentality to manifest within a community.

A monumental landscape contains monuments central to people’s lives, both ritualist and otherwise, as well as strong notions of monumentality between people and the present monument(s). Though monumental landscapes are present throughout history, scholars only recently have acknowledged and engaged extensively with the idea that small-scale and “low-density” societies contributed to the construction of monumental landscapes. Studying how people of the past constructed and developed these monumental landscapes is imperative for archaeologists to continue to develop their perspectives of monuments, as well as the use of social space by small scale societies for ritual and ceremonial practices to create and maintain community identities.

<u>Monuments</u>

The word “monument” can be traced back to the 17th century when it was first used to describe a built structure meant to commemorate a person or event. Over time, the word became more widely used among the general public, and the meaning shifted to be associated with something of impressive size (Scarre 2011:9). Therefore, a traditional understanding of the word “monument” attributes considerable meaning to the size and elaboration of a structure: something that was built to last and impress (Elliott 1964:52; Watts 2018:379). Monuments have also been viewed as structures which require cooperation between multiple households to participate in labor events (Adler and Wilshusen 1990) and are constructed in a way that exceeds practical use (Trigger 1990). These qualifying characteristics have led some scholars, such as Trigger (1990), to equate the energy spent on the size and elaboration of a monument with the overall “complexity” of a society (Trigger 1990:120). This came to be known as the *thermodynamic* approach to monuments (Trigger 1990). However, this theory has come under critique in recent years due to its over-simplified notion of the development of social complexity. Many scholars look to expand what can be considered a monument with the inclusion of different perspectives, which goes beyond size and elaboration.

Though supra-household cooperation and excessive display are often attributes of monuments, scholars today look to expand these qualifiers (e.g., Hildebrand 2013; Osborne 2014, 2017; Watts 2018). An example of new perspectives about monuments includes that of the phenomenological approach. This framework reorients research to emphasize the importance of the personal experience of monuments rather than developing one overarching narrative (Hildebrand 2013:158–159; Rowlands and Tilley 2006; Tilley 1997). A phenomenological approach moves scholars beyond that of a universal, and often traditionally Western, definition of monuments; it enables scholars to look at big-picture social practices related to people of the past's experiences of their landscape (Johnson 2012). Therefore, phenomenology focuses on experience and perspective as important components to the social meaning of a monument. An example is how the physical characteristics of a monument (form, appearance, location) relate to memory practices related to the creation and maintenance of identity (Johnson 2012 [Jones 2007]).

Across the literature there are characteristics of monuments that many scholars do cite across different spatiotemporal contexts. Monuments are the result of culturally-situated, human-orchestrated labor initiatives (Bradley 1998:70–72; Kidder and Sherwood 2017; Knapp 2009:47–48; Scarre 2011:16; Wright 2014b:88), the accessibility of materials (Knapp 2009:49; Osborne 2014:5; Scarre 2011:14), and specialized construction knowledge (Knapp 2009:48; Pauketat and Alt 2003:157–158; Sherwood and Kidder 2011). Originally, monuments were thought to be associated exclusively with stratified societies (e.g., Childe 1950; Renfrew 1973). However, many scholars today agree that monuments have been built in societies that span the spectrum of "social complexity" (Hildebrand 2013; Kassabaum 2019; Kassabaum et al. 2014; Sara-Lafosse 2007; Wright 2014a).

Possible purposes of monuments include their use as the location of ceremonial and ritual gatherings to create and maintain common social identities (Bradley 1998:71; Elliott 1964; Hildebrand 2013; Howey 2012:23; Kassabaum et al. 2011; Knapp 2009:2009; Sherwood and Kidder 2011; Wright 2014a), a reflection of community ideologies (Forest and Johnson 2002;

Knapp 2009:47), and to act as mnemonic devices (Bradley 1998:146; Henry 2017; Knapp 2009; Osborne 2014:11, 2017; Pauketat and Alt 2003; Scarre 2011; Watts 2018:380; Wright 2014b:9–11; Young 1992). Monuments can be places for interactions between and within communities (Henry 2017; Henry et al. 2014, 2019; Howey 2012:194; Kassabaum et al. 2014; Wright 2014a), the site of burial ceremonies and practices (Grinsell 2014; Mytum 2004), and the location for integration activities, such as intermarriage (Carr 2006). Therefore, monuments are dynamic features that serve various purposes depending on their situation.

Over time, monuments can physically change through various transformations, such as deconstruction, reconstruction, or modification (Bradley 1998:69–72; Henry et al. 2021; Knapp 2009:48; Watts 2018). An example of this occurred in the time shortly after the collapse of the USSR, when Russian political elites selectively removed or modified monuments within their surroundings; they were changing the monumental landscape to refocus Russian memory and identity to reaffirm the status of political elites (Forest and Johnson 2002). This case study also highlights the ties that the physical appearance of a monument has to ideology, as mentioned previously. Returning to the notion that monuments are *dynamic*, this example demonstrates that as the needs, views, and power structures of a society changes, monuments within that society may be altered to refocus the ideology reflected in the monumental landscape.

Some monumental forms appear across regions and throughout history. However, it is important to understand that the presence of a similar physical form of a monument in multiple societies does not mean that it has served the same purpose or had the same meaning within these communities, largely due to their varying monumentality. Therefore, spatiotemporal context is important when considering how a group of people perceived a monument. Evidence of this comes from platform mounds in the Southeastern United States. In this case, an increase in the use of platform mounds occurred in the Middle Woodland period (cal 200 BC to AD 600) (Kimball et al. 2010; Knight 2001; Pluckhahn 1996, 2003; Pluckhahn et al. 2006) prior to their popular use during the Mississippian period (AD 1000 to 1600) (e.g., Blitz 2010; Blitz and Livingood 2004; Lindauer and Blitz 1997). During the Middle Woodland period, these structures brought communities together with evidence suggesting the likelihood of "situational" and heterarchical forms of leadership to organize and oversee labor initiatives and feasting (Henry and Barrier 2016; Wright 2017:57). However, in the Mississippian period, the activities involving platform mounds correlated with demonstrations of hierarchical leadership (e.g., Beck 2003; Blitz 1999; Blitz and Livingood 2004; Lindauer and Blitz 1997; Schilling 2013). Feasts on mounds were held by elites as a demonstration of wealth during the Mississippian period, whereas in the Middle Woodland period, feasting was a way to build a common social identity (Sherwood and Kidder 2011; Wright 2014a:9, 2014b:288–289). Though overlap exists, this example highlights the importance of not conflating form with function, which is an important consideration across different spatiotemporal contexts in North America.

Monumental Landscapes in the Middle Ohio Valley

A prominent regional example of the construction of monumental landscapes is the Middle Ohio Valley, a subregion of the larger Ohio Valley (Abrams and Freter 2005; Applegate et al. 2005; Dancey 2002; Henry et al. 2019; Lepper 2016; Lynott 2015; Wright 1990). The Middle Ohio Valley consists of the lower portions of Ohio, corner of Pennsylvania, and much of Kentucky and West Virginia (Applegate et al. 2005). During the Early and Middle Woodland periods, earthen enclosures and burial mounds were frequently constructed and became a regional hallmark for increasing social complexity (Applegate et al. 2005; Clay 1988; Connolly 1997; Henry et al. 2019; Parkinson 2002; Wright 1990). In this research, I specifically focus on expanding an understanding of earthen enclosures in the Middle Ohio Valley by providing an example of an anomalous enclosure to provide an alternative example of enclosed space during this regional time period. To explore the importance of anomalous enclosed space, a discussion of earthen enclosures must be had for a better understanding of the importance of enclosures at this time.

Earthen Enclosures

Earthen enclosures, or "earthworks," found across the Eastern Woodlands are a hallmark of the Early and Middle Woodland Periods in the Middle Ohio Valley (Burks 2014; Burks and Cook 2011; Connolly 1997; Henry 2018; Henry et al. 2019). These structures, and other earthen structures across the United States, required large labor inputs and specialized engineering knowledge which included an understanding of how to mix excavated soils into sediment fills to construct long-lasting monumental forms (Henry et al. 2020; Henry et al. 2021; Lynott and Mandel 2009; Riordan 1995). Therefore, these types of built structures required specialized knowledge, specific skillsets, and engineering (Kidder et al. 2021).

Long term planning was required for the construction and subsequent ritual events for maintenance and use of these earthen enclosures. Studies in the Mississippi River Basin have highlighted the meaningful construction of earthen monuments as an important part of the formation of community identities over a broad temporal scale (Kidder and Sherwood 2017; Sherwood and Kidder 2011). Some enclosures are built in one building event, common with the small, geometric enclosures in Kentucky (Clay 2001, 2014; Henry et al. 2020). There are other, larger enclosures which were built over longer periods of time in construction phases, as well, as seen in Ohio (Lynott 2009). Often an enclosure is built in a way that dictates people's entrance, subsequent movement, and even actions within the enclosure (Thunen 1998). Because enclosures are an example of “enclosed space,” there has been discussion about what it means to physically “enclose” space and the power such an act can have. When space is enclosed, those ritually situated on the inside are juxtaposed to those not involved on the outside (Spielmann 2008).

Middle Ohio Valley earthen enclosures that delineate space are often compared to the earthen enclosures found in Europe known as “hengiforms.” A hengiform is an earthen monument constructed first with a surrounding ditch and then the removed fill is used to create an earthen embankment on either the inside or the outside of the ditch (Henry et al. 2021; Warner 2000). The distinction between the difference in where the earth forms an embankment has led some researchers to theorize about what embanked earth on the inside versus the outside of a ditch could mean. Warner (2000) discusses how when there is an embankment on the inside of a ditch, there is some force that is trying to be kept out. However, if the embankment is on the outside of the ditch, then there is some force that is trying to be kept in the sacred space of the enclosure. These notions of enclosed space are important when thinking about the earthen enclosures of the Middle Ohio Valley because they are constructed through a similar process. This notion is brought into the Middle Ohio Valley by Henry et al. (2021) for the Winchester Farm enclosure, an enclosure very close in proximity to Peter Village.

Research at Winchester Farm, only 1,500 feet from Peter Village, suggests changes in space occurred, from a ceremonial gathering place with no built structure, to a place that then enclosed space with the addition of an earthen enclosure. The enclosure at Winchester Farm both “*defined* a new space on the landscape” as well as “*confined* the material remnants of past social gatherings” (Henry et al. 2021:19). This example highlights that the construction of an enclosure can be both an acknowledgement of the past, but also a transformation of space for new cultural purposes. Like burial and platform mounds, these structures are a result of labor, histories, and situations resulting in their construction (Everheart 2020; Henry et al. 2020; Thunen 1998:11). Therefore, thinking about the physical form of Peter Village is an important component to this research.

Earthen enclosures in the Middle Ohio Valley were places where rituals often occurred and were sometimes constructed in alignment with certain astronomical events (Brown 1997; Henry et al. 2020; Hively and Horn 2013; Redmond 2016; Romain 2015). Earthen enclosures come in a diverse range of forms around the United States, ranging in both size and shape, including geometric (Wright 2014), hilltop (Riordan 1995), environment-conforming (Thunen 1998), nearly geometric (Jones and Kuttruff 1998), or the "squircle" (Burks 2015; Henry 2018; Jefferies et al. 2013; Wright 2014), though the most common earthen enclosure found in the Middle Ohio Valley are geometric enclosures. There is often an entrance/exit causeway present to access the internal area of the enclosure (Clay 1987:46), which consisted of either an open platform, a burial mound, or a wooden post enclosure (Henry 2018; Henry et al. 2021). Though there is not typically much material found inside enclosures, archaeologists sometimes find exotic craft items that would have been used in ceremonies related to offerings or ritual practices. Other common material remains include animal bones from feasting, as well, found at sites such as Winchester Farm (Henry et al. 2021).

Peter Village provides an interesting case study of an earthen enclosure situated within the Middle Ohio Valley as it is irregular in both shape and size. Even with such unusual characteristics, this site remains understudied, with no new research conducted at the site until 2013, when Dr. Edward Henry began collecting new geophysical datasets. Using these datasets, my research explores the abnormal expression of monumental form present at the Peter Village site. The multiscalar data presented in this research allows for an interrogation of the expression of monumentality at Peter Village, including newfound evidence of an entrance with associated linear features, as well as support for the presence of a dual embankment on either side of the ditch. Research regarding Peter Village helps to expand the possible forms monumentality can take within Adena societies, and when. The study of this monument also contributes to current notions of how small-scale societies interacted with their built environment, and the increasing social complexity expressed in some of these interactions.

Chapter 3: Environmental, Cultural, and Site Background

Environmental Background

The Peter Village site (15Fa166) is located in Fayette County, Kentucky, in the Inner Bluegrass physiographic region (McGrain 1983:38). This region is situated between the Ohio River valley (northern constraint) and the Knobs and Kentucky River (southern constraint), an area with the oldest exposed rocks in the state of Kentucky (Figure 1). It is underlain by Bluegrass-Maury soils (United States Department of Agriculture 2019). The modern-day climate in this region began around 1000 BC, which led to the area becoming forested with a variety of tree species and diverse range of animals (Wharton and Barbour 1991).

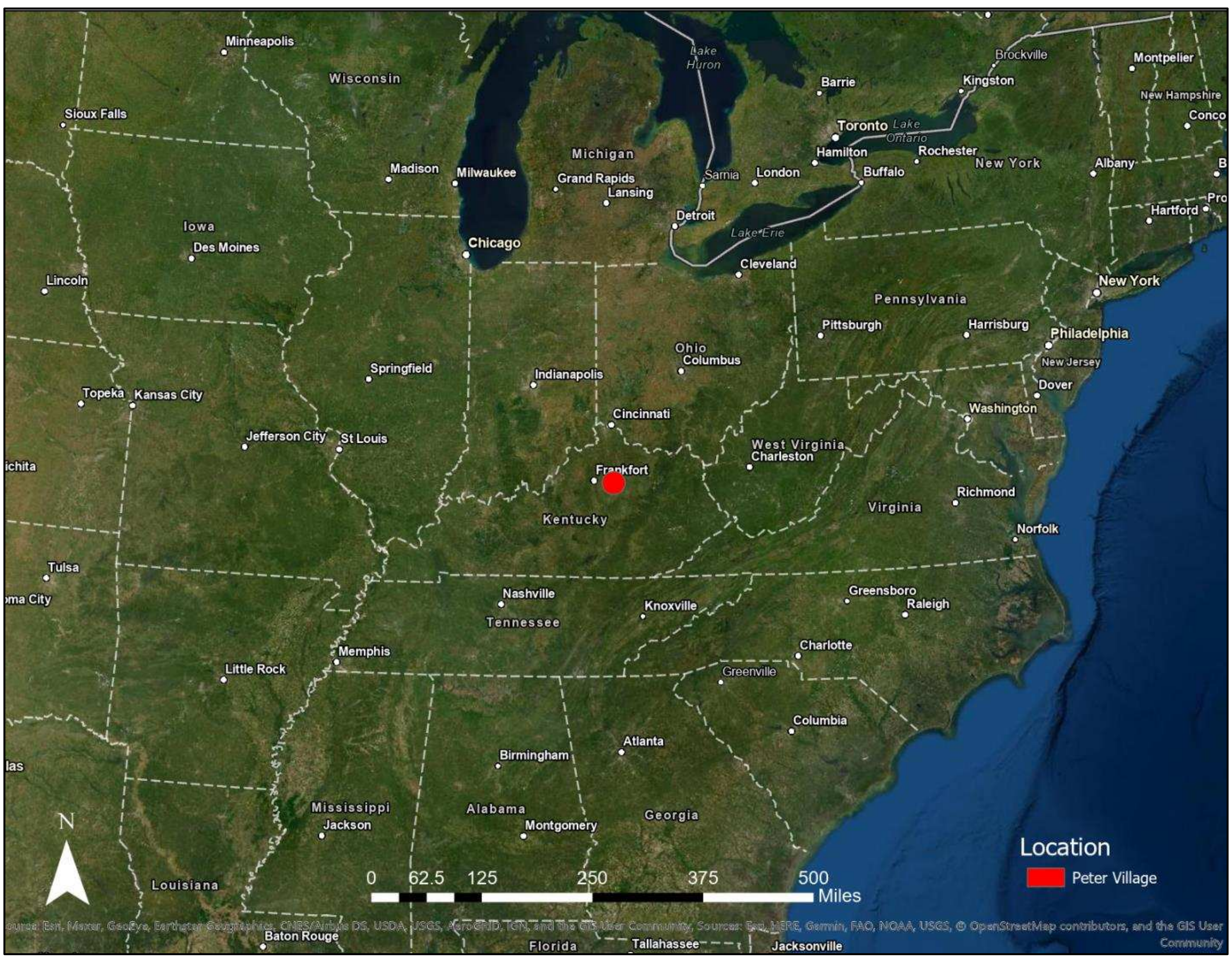

Figure 1. Location of Peter Village.

Soils

Peter Village is situated in Bluegrass-Maury silt loam soils, with "2 to 6 percent slopes." The "Bluegrass" designation recently developed in 2008. The Bluegrass-Maury soil is comprised of 50% Bluegrass Series and similar soils, 40% Maury Series and similar soils, and 10% minor components. It has a profile staring with a top layer of silt loam that can extend up to 30 cmbs, which is underlain by a silty clay loam that becomes more clay-like at just over 210 cmbs. The last 30 cm of the profile before bedrock is typically a clay (United States Department of Agriculture 2019).

Due to the deep, dark top layer, it is suggested that, unlike some of the other surrounding soil series, Bluegrass-Maury soils may not have developed under a forested environmental context, but instead under grass, canebrakes, or both. The parent material this series formed from is a phosphatic limestone, therefore these soils are high in phosphate. Maury series soils also formed in a slight mantle of silt and are suitable for growing crops, especially burley tobacco, corn, small grains, and alfalfa (United States Department of Agriculture 2019).

Geology

The Inner Bluegrass is approximately 2,400 mi^2 and contains the oldest exposed rocks in the entire state of Kentucky, which are "thick-bedded limestones" formed during the Middle Ordovician age (McGrain 1983:38; Wharton and Barbour 1991:5). The geomorphic relief in the Inner Bluegrass region is not typically more than 100 ft, often described as "gently rolling." The exception to this are areas within a close vicinity of the Kentucky River which can be cut as deep as 300-400 ft from surrounding topography (McGrain 1983:39; McGrain and Currens 1978:27). There is also limited karst activity throughout this region, which has resulted in sinkholes and some sinking streams and springs (McGrain 1983:38; Wharton and Barbour 1991:15–16).

The fertility in this region resulted from the weathering of the phosphatic limestone strata. These limestone strata are from the Cynthiana Formation (limestone with thin layers of "calcareous shale"), Lexington Formation (most widely distributed in the area, phosphatic, thin-bedded, and shaly limestone), and High Bridge Formation (follows the Kentucky River gorge and has "massive" limestone that makes up Kentucky's oldest exposed rock) (Wharton and Barbour 1991:8).

The Inner Bluegrass is mostly an "old eroded peneplain" which has several fault systems. Where there are now deep narrow valleys with steep crested ridges, there were weaker exposed rocks which were more susceptible to weathering. Inner Bluegrass surface water largely drains into the Kentucky River. Formations on the edges of the Inner Bluegrass region become younger as they move outward (Wharton and Barbour 1991:11–12).

Climate

Around 1,000 BC, the climate in this region became more temperate, resembling modern climate trends of this region. A diverse range of plant and animal life was, and continued to be, encouraged by the temperature, rainfall, and humidity. Rainfall is fairly distributed throughout the year, resulting in a lack of distinctive "Wet" or "Dry" seasons, with moderately cool winters and warm summers. The growing seasons range from about 190 to 200 days a year, with high moisture and humidity consistent throughout the year.

Flora and Fauna

Vegetation present in the Inner Bluegrass when settlers first explored this region were oaks, ash, black walnut, black and honey locust, Kentucky coffee tree, "sugar tree," black cherry, hickory, mulberry, ironwood, sycamore, and elm (Wharton and Barbour 1991:22–25), as well as grasses, clovers, and canes. Unfortunately, in historical records people often use different names for the same species, making these accounts inconsistent. Early accounts of the area often describe the vegetation as consisting of non-dense, open canopy forests, underlain by smaller vegetation like grasses and clovers (Wharton and Barbour 1991:23). Evidence of bur oak, a savannah tree species, is a testament to the earlier climate conditions of the area (Wharton and Barbour 1991:30–33).

Based on archaeological evidence from prehistoric middens dated after the climate became similar to modern day temperatures, there was a diverse range of animal species at the time. Mammals found in the region ranged from medium to large such as deer, bear, and elk, to smaller mammals including skunk, muskrat, squirrel, meadow vole, woodchuck, raccoon, otter, beaver, and dogs. Birds identified from middens included wild turkey, great horned owl, and trumpeter swan (Wharton and Barbour 1991:34).

Culture History Background

In this region, there is ambiguity about the exact chronology for occupation and construction of Peter Village. This is because there is archaeological evidence that calls into question the timeline of the site's occupation versus construction. The chronological understanding of certain ceramic types in this region (e.g., Adena Plain vs. Fayette Thick) and the extent of their use make this situation more ambiguous. These two pottery types are found in the same context within a pit, though Fayette Thick is typically thought of as one of the earliest pottery types in this region, with Adena Plain coming much later. However, it is likely that the main occupation of the site that involved interaction with the enclosure would have been between the Early and Middle Woodland Periods. Below is a discussion of the Early and Middle Woodland periods as they are understood in the regional context of Kentucky.

Early and Middle Woodland Period in Kentucky (1250 BC to AD 500)

The Early and Middle Woodland periods in the Middle Ohio Valley in Kentucky spans from as early as 1250 BC, the earliest known evidence of pottery in the region, to AD 500, with the emergence of ceramic cord-marked, subconoidal and subglobular jars (Applegate 2008, 2013:19–20). The projectile points in the beginning of the Early Woodland were largely notched and stemmed and fastened onto spear or dart forms. During the Middle Woodland, projectile points expanded into more stemmed varieties, as well as shallow side-notched points (Applegate 2008:343–344, 346; Railey 1996:81–83, 90).

Subsistence strategies during the Early and Middle Woodland periods can be characterized as hunting, gathering, gardening, and even farming, with evidence for a number of domesticated plants (Applegate 2008:346; Mueller 2018). Popular food sources included small mammals and some medium-sized mammals like white-tailed deer, fish, birds, and box turtles (Applegate 2008:344; Railey 1996:84). Nuts were a popular food to be foraged and squash, gourds, sunflower, goosefoot, knotweed, and maygrass were popular cultivated foods (Applegate 2008:344; Watson 2007). There were at least nine regularly cultivated plants by the Middle Woodland period including "squash, gourd, maize, sunflower, maygrass, erect knotweed, little barley, certain varieties of goosefoot, and sumpweed," though maize has not been found in Middle Woodland sites in Kentucky (Railey 1996:90). Also, the use of maize during this regional time period remains a debated topic; recent research suggests it was likely of very minor importance in diets, if at all, until the end of the Late Woodland Period (Simon et al. 2021).

Settlement patterns for the Early and Middle Woodland periods were typically singular, short term uses of sites (Applegate 2013:20). Possible short term domestic structures included "circular and rectangular enclosed houses, open ramadas or sunscreens, and open cabanas, windbreaks, or lean-tos," (Applegate 2013:20). However, there were instances of long term, or seasonally used, sites. About 20% of the domestic sites found in the Middle Ohio Valley have evidence of long-term occupation with some structures having two to three construction episodes (Applegate 2013:32). An example of a structure found at a long-term site would be a roofed rectangular house (Applegate 2013:20). The layout of domestic sites during the Early and Middle Woodland had no clear or common repeating patterns in the layout, unlike the later circular villages of the Late Woodland (Applegate 2013:35). Earthen monuments began to be built closer to domestic settlements specifically in Central and Eastern Kentucky (Railey 1996:90–91). There was a notable increase in floodplain settlements during this time period, as well (Applegate 2008:246).

Leadership at the time has been characterized as heterarchical, or a "situational" style of leadership in which people rise to the occasion of leadership temporarily. This does not mean that the political organization at the time resembled that of an egalitarian society, but rather a "decentralized" social structure (Henry 2013:220; Henry and Barrier 2016). Individuals would have been able to obtain some achieved status through their actions within the community and likely would have been influenced by their kin. There could also be multiple leaders with similar status and power at the same time (Henry 2013; Henry and Barrier 2016:230–233). There are also some scholars who believe that the political organization of the time could have also taken the form of chiefs (Shryock 1987).

During the Early and Middle Woodland period in Kentucky, as well as the larger Middle Ohio Valley, evidence of the Adena and Hopewell societies is seen throughout the region (Carr and Case 2005; Clay 1998; Greber 1991; Henry 2018; Henry et al. 2019; Lynott 2015; Pollack and Schlarb 2013; Seeman 1979). These terms are cultural units developed by archaeologists to describe two different groups of people spread out over a common regional landscape that shared common social identities, cultural practices, and material remains. Adena is often considered to be the earlier of the two, having started around 500 BC and lasting until roughly AD 250. Therefore, Adena had a significant presence in the Early Woodland period and did not last the entirety of the Middle Woodland Period, though it is only a few hundred years short. Hopewell, on the other hand, began in the late Early Woodland around 200-100 BC, and lasted until approximately AD 500, with the end of Middle Woodland ceremonialism being one of the markers of the end of the time period.

In the past, the perspective persisted that the earlier Adena culture laid the foundation for the development of the later, more complex Hopewellian culture (Carr 2006; Clay 1987; Dancey 2002; Webb and Snow 2001). However, recently some scholars have called this clear distinction into question, exploring further possibilities of the relationship between the two. Recently, scholars have incorporated better supported assertions when discussing the division of Adena and Hopewell. Everhart (2020) has brought attention to the importance of considering the local timeline of the two groups, something done in his study region of the Central Scioto Valley early on by Dr. N'omi Greber (1991). This is especially important when the site under investigation falls within the time periods when the two cultures most likely overlapped within a region (Everhart 2020:131–133). He proposes to not only take into consideration local context, but in instances when the temporal relationship between the two has not yet been determined, to use a hybrid term such as "Adena-Hopewell" (Henry 2017; Henry and Barrier 2016).

Because of this contentious debate, it is important to observe the characteristics of the Peter Village enclosure that could suggest the presence of either the Adena or Hopewell, and/or an observation that does not look at the two as separate phenomena. Peter Village does embody characteristics of both the Adena and Hopewell. The enclosure is large, as is seen in Ohio where the Hopewell featured prominently during the Middle Woodland Period. It also does not conform to the expected geometric shape seen in Adena enclosures. However, the early date of the Peter Village enclosure, determined by its accompanying ceramic assemblage and radiocarbon dates (as I discuss further in this research), suggests that the occupation of the enclosure would have more likely been an early expression of Adena earth moving. With this evidence, as well as material culture previously found at the site, I interpret the Peter Village enclosure as associated with Adena societies.

Peter Village: Previous Research and Site Background

The Peter Village site (15Fa166) is located in present-day Fayette County, Kentucky, approximately 12 km north of Lexington. Peter Village is an irregularly shaped earthen enclosure which Clay (1985, 1988) describes as delineated by a ditch with an interior embankment (Clay 1985, 1988). Enclosing 9.2 ha., it is one of the largest, and potentially among the earliest, ditch and embankment monuments in the Middle Ohio Valley. Constantine Rafinesque, a French antiquarian and professor at nearby Transylvania College who mapped many archaeological sites in Kentucky, was the first to draw and describe the site in 1820 (Clay 1985:1, 1988:19; Rafinesque 1820). The first published description of the site came in 1847 from Lewis Collins, who based his description of the site on the imprecise notes of landowner Dr. Robert Peter. Based on modern observations of the site, Constantine Rafinesque's description of the enclosure (size, shape, interior, etc.) was the most accurate of the earliest published descriptions. The site gained recognition from Squire and Davis' (1848) publication, *Ancient Monuments of the Mississippi Valley*, where a description and map of the site, based on Rafinesque's drawing, was published. However, archaeologists have later noted that the description and map did not match the original work done by Rafinesque (Clay 1985:2–3; Clay 1988:19-21).

Webb and Funkhouser first began archaeological investigations near Peter Village in 1939. They initially gave attention to a small circular enclosure called the Mount Horeb Earthwork, but while doing this work, they also became aware of Peter Village, a small burial mound named Fisher Mound, and other sites in the region. Together, these sites form what is now known as the Mount Horeb Complex (see Figure 2 and Figure 3). Today, the Mount Horeb Complex is referred to as a ritual landscape composed of geometric enclosures and conical burial mounds that include Grimes Village (15Fa14), Fisher Mound (15Fa160), the Mount Horeb Circle (15Fa1), Tarleton Mound (15Fa15), Winchester Farm (15FA153), and Peter Village (15Fa166) (Figure 2 and Figure 3) (Clay 1985:3–6, 1988:21). After further investigations, Grimes Village was identified as a non-built, unique landform along Elkhorn Creek with a high surface density of artifacts, possibly used due to the natural landform resembling an earthen enclosure. However, the others all are confirmed as built earthen features.

In 1942, Webb began research at the Peter Village site, during which he also became interested in the nearby Grimes Village area. At no point during these early archaeological excavations were any interpretations of the site developed beyond the suggestion that Peter Village was a “village” type site for the Adena culture (Clay 1985:6, 1988:21), hence the name of the site. Webb applied a domestic interpretation to Peter Village because it was unlike any other enclosure discovered before. During this time, there were also few examples of village sites related to the Adena culture. There was also no evidence of mortuary practices at the site, making Peter Village one of the few examples of a “non-mortuary” Adena site at the time. One last line of evidence Webb used was that the enclosure appeared to have once had a “stockade”

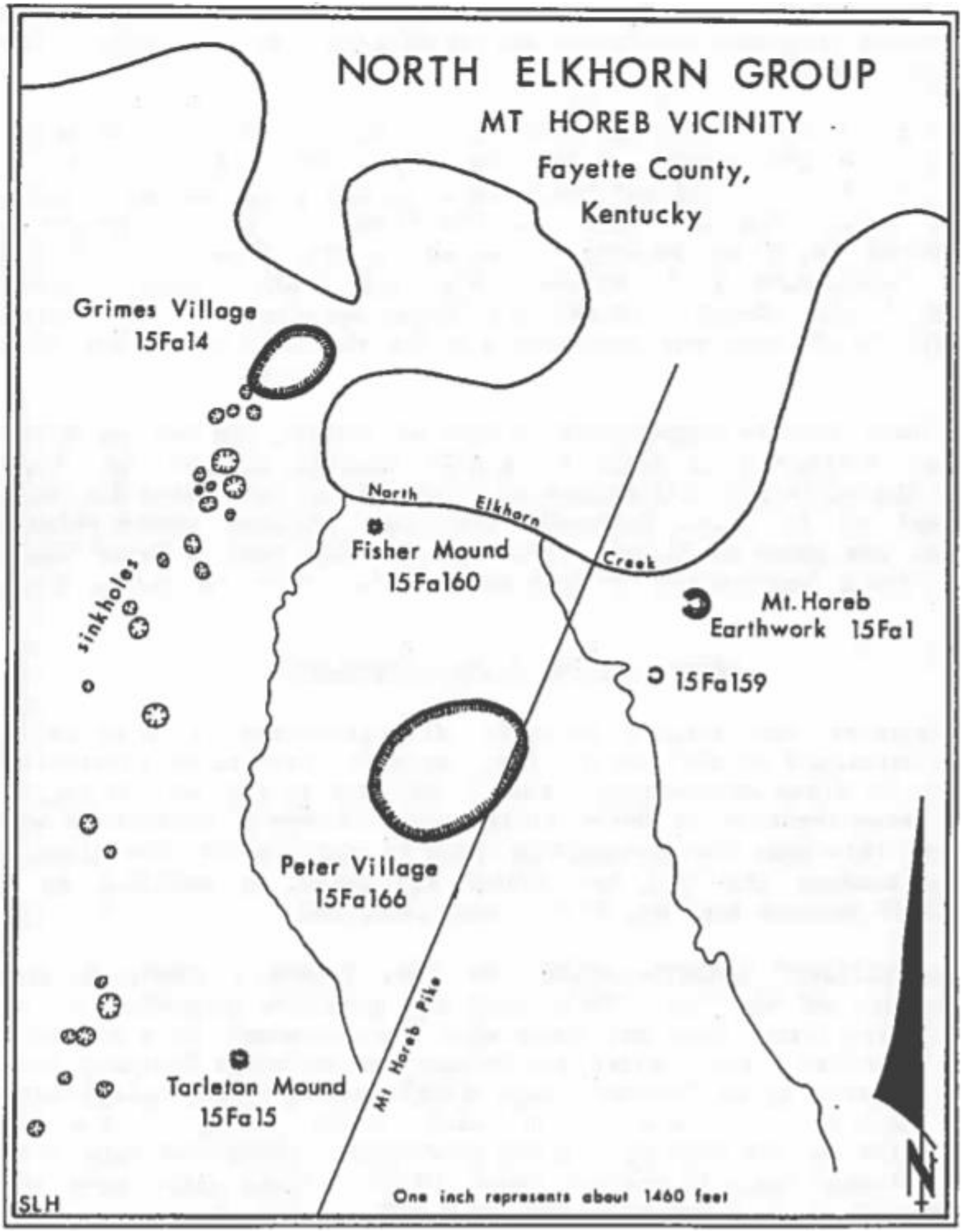

Figure 2. Mt. Horeb Complex (Clay 1985:3, Figure 5).

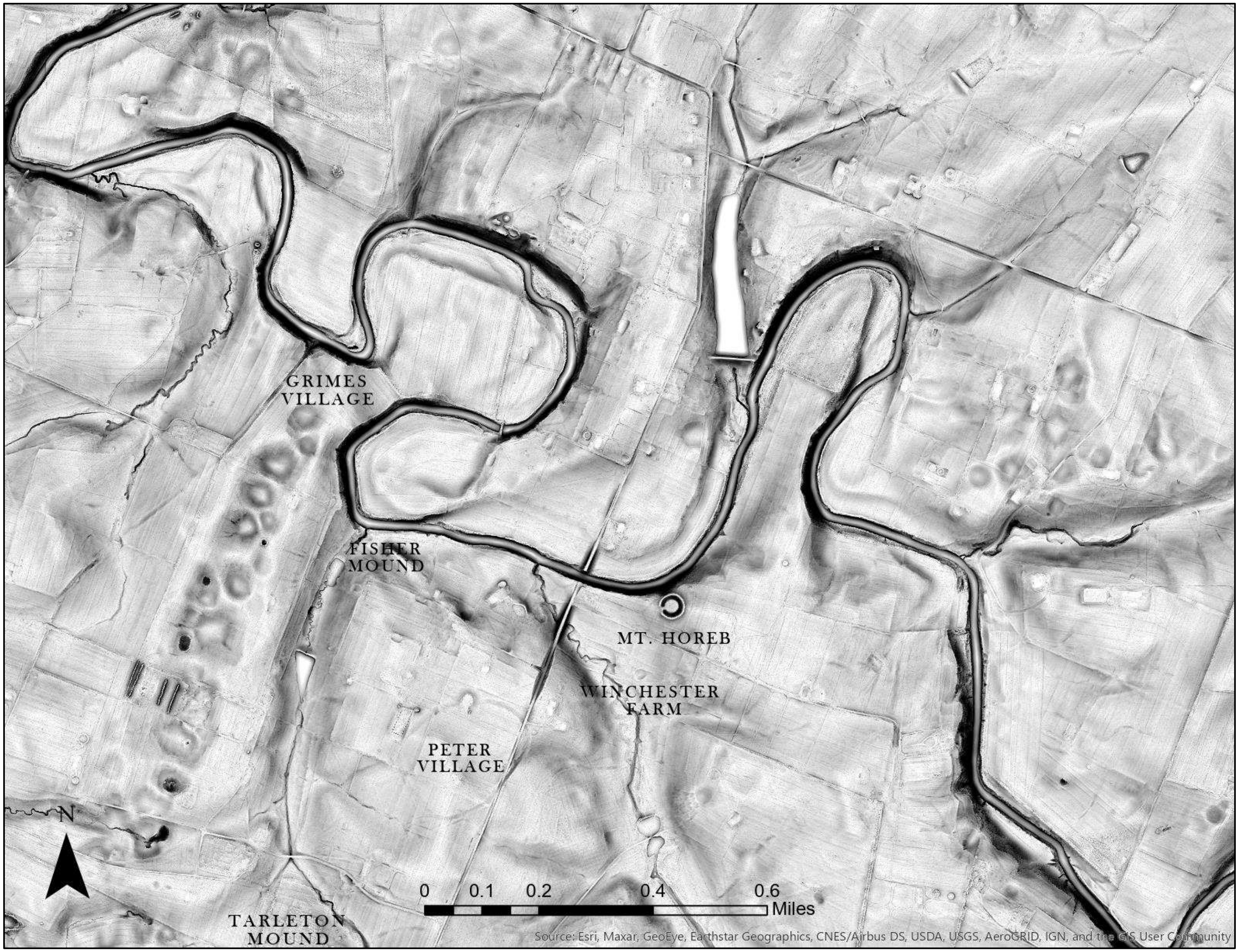

Figure 3. LiDAR visualization of the Mt. Horeb Complex.

fortifying the area. However, this is unlikely as similar post-styled enclosures have been found at other sites in the region, and little evidence exists for them to have been “fortifications” (Clay 1985:6–7; Henry et al. 2021; Webb 1941).

It was not until Dr. Berle Clay initiated excavations in 1983 and 1984 that Peter Village was more intensively studied (Clay 1985, 1988). The focus of Clay’s new research was on the temporal nature and boundary of the site. The methodology used for this archaeological research included aerial photography, resistivity survey, soil coring, excavation, and radiocarbon dating. Evidence from these investigations suggested that though historical documents placed an embankment on the inside of the ditch of the enclosure that there remains ambiguity about the actual placement of the embankment. This is because the resistivity data Clay collected showed high readings on either side of the ditch (Clay 1985). Clay identified these readings as potential for a “dual bank,” or the possibility of an embankment on either side of the ditch (Clay 1985:10). However, Clay did not investigate this notion any further.

Other data Clay collected during his two field seasons was the location of the ditch and suggested the depth to be about 2 m using soil coring (Clay 1985:10). With excavations, Clay identified seven different features: two pits, three limestone piles, a ditch, and the post structure (identified by Clay as a “stockade”) (Table 1). Artifacts found within the 88 m^2 area excavated at the site included bone, pottery, and lithics. These excavations were done primarily over areas where Clay had located the ditch with resistivity.

A majority of the ceramics found at the site were Fayette Thick and Adena Plain (Clay 1985:22), all with local limestone grit tempering (Clay 1985:24). Most of the Fayette Thick ceramics were cord marked. It is uncommon, if at all present, for these two ceramic types to be found at the same site. Traditionally, researchers viewed Fayette Thick as much earlier than

Adena Plain, but the discovery of them in the same context raises further questions about the temporal relationship between the two types. Based on the ceramic evidence found at Peter Village, it is possible that Adena Plain was used longer than Fayette Thick and that there was overlap in use. There is also evidence for overlapping, but different, uses of the ceramic types. It is possible that Peter Village was one of the first locations to adopt Adena Plain either to replace Fayette Thick, or possibly to expand the types of pots they used.

Table 1. Features found by Clay (1985, 1988) at Peter Village.

Feature #	Feature	Description
1	Limestone pile	Clustered heat-modified rocks. Associated small white charcoal flecks. Briefly used. Base of plowzone. Fayette Thick sherds, Adena Stemmed point base, and small human cranium fragments (maybe skull cap bowl) found in association with pile.
2	Pit	More Fayette Thick than Adena Plain pottery. Other materials found include faunal remains and chert debitage. Near the stockade.
3	Limestone pile	Clustered heat-modified rocks. Associated small white charcoal flecks. Briefly used. Base of plowzone. Chert flakes, fired clay, Adena Plain and Fayette Thick sherds, deer bone, and non-limestone rock associated with pile.
4	Pit	More Adena Plain than Fayette Thick Pottery. Other materials found include decomposed limestone, chert debitage, and faunal remains.
5	Post Structure	21-22 post molds. Assumed to extend around whole perimeter, though only a small portion excavated.
6	Ditch	Three strata identified, no sharp contrasts in color/texture from normal Maury profile. Adena Plain and Fayette Thick pottery found in bottom. Some charcoal found throughout, with one main lens.
7	Limestone pile	Clustered heat-modified rocks arranged in circle approx. 1 m in diameter. Associated small white charcoal flecks. Briefly used. Across from Feature 2 (Pit). Fayette Thick sherds (6) from the same ceramic vessel, and an Adena stemmed point were associated.

The lithics recovered at Peter Village included bifaces and groundstone artifacts. The biface-type artifacts included a triangular biface, stemmed points, and biface fragments. Most of the stemmed points were “Adena Stemmed.” However, some of the lithics found at the site were of an earlier variety, as early as Late Archaic. Others were from much later, as late as Late Woodland (Clay 1985:31). Majority of these points were made with local Bluegrass Region cherts. The ground stone artifacts found were granite celts, worked barite, sandstone whetstones, and worked slate. Many of these artifacts are related to the production and working of barite artifacts.

With the various lines of evidence collected during Clay's field seasons, he explored the age of the site. Clay not only had access to temporal information regarding the site based on the ceramic assemblage, but he also collected radiocarbon samples (Table 2). Two of the dates are taken from posts, one from a singular post (Post 12) and the other from a combined two posts (Posts 3 and 4). Another date is taken from a charcoal layer found in the ditch between 165-185 cmbs. The final date Clay submitted was taken from a location described as "adjacent to and outside the stockade" (Clay 1988), and "between the ditch and stockade" (Clay 1985:15). All the radiocarbon dates are from unidentified wood charcoal. Based on both the ceramics and radiocarbon dates, Clay estimated occupation at the site in association with the earthen enclosure to have been around 300 to 200 BC, which spans the later, Early Woodland, and early, Middle Woodland periods. Clay's timeline suggested that the Peter Village enclosure one of the earliest enclosures in the Middle Ohio Valley region. However, there is still much to be learned about the temporal nature of Peter Village as some of the previous radiocarbon dates are unreliable. The date taken from wood samples combined from Posts 3 and 4 (Beta-7758) is a combination date, and therefore may not be accurate. Beta-7757, the date taken somewhere "between the ditch and stockade" is also unreliable due to its vague context which may or may not date use of the enclosure or site.

Table 2. Radiocarbon dates from Peter Village taken in 1984 field season.

Lab #	Material Dates	Date	Context Location
Beta-7758	Unidentified post wood charcoal	610 ± 90 B.C	Posts 3 and 4 (combined date)
Beta-7755	Unidentified post wood charcoal	310 ±60 B.C	Post 12
Beta-7756	Unidentified wood charcoal	190 ± 10 B.C	Charcoal layer in ditch (165-185 cmbs)
Beta-7757	Unidentified wood charcoal	270 ± 100 B.C.	"Adjacent to and outside the stockade" (Clay 1988) "Between the ditch and stockade" (Clay 1985:15).

Based on his research, Clay draws three conclusions about Peter Village. First, that the site was an Early and Middle Woodland site due to the site's ceramic assemblage, as well as the radiocarbon dates. Because researchers found both types of pottery within and/or associated with the enclosure, the enclosure was present during the existence of both ceramic types. Second, though the ditch and post-structure were only excavated along a small portion of the enclosure, it is likely they represent structures that delineate the entire site. And finally, based on the artifact assemblage, Peter Village was a specialized production site where people worked with barite artifacts made from locally sourced materials (Clay 1985, 1988).

Building on this previous work, my research looks to expand the general knowledge of the enclosure, including the placement of embankment(s). The primary question I address in my research is:

1. How did Adena societies delineate space at Peter Village?

Because of the unusual size and shape of the site, an important aspect of my research is understanding the construction and form of the enclosure. I observe how the ditch and embankment(s) delineate the boundary of the site, building off Clay's previous suggestion of a "dual-embankment" (Clay 1985:10). I also explore any anomalies that could suggest other previously unknown features (entrance, causeways, etc.) to see how people interacted with the space of the enclosure in relation to movement. Finally, I expand the investigation of the site's chronology. To observe these questions about the site, I use an array of geoarchaeological and geophysical methods, described in the subsequent chapter.

Peter Village has the potential to provide insight into early interactions between people and earthen monuments in the Middle Ohio Valley, a region where the appearance of earthen monuments is a hallmark of increasing social complexity for most of Eastern North America. As an irregular earthen enclosure, research at Peter Village can provide insight into alternative monument forms in this region. During this time period, earthen monuments and their associated components operated within broader belief systems and contributed to society by supporting the creation and maintenance of social identities for people typically spread out across a larger regional landscape. In drawing on several theoretical traditions, I seek to provide greater insight into the monumentality that comes with the delineation of space at Peter Village.

Chapter 4: Methods

In this section, I describe the archaeological methods used in my research to better understand the morphology and chronology of the Peter Village enclosure. They include aerial and terrestrial remote sensing methods, as well as the characterization and laboratory analyses of solid soil core samples collected from Peter Village. Dr. Edward Henry collected the geophysical data and soil cores in 2013, 2014, and 2015. I processed, analyzed, and interpreted all digital data; I characterized and analyzed all soil core samples. I also selected and prepared five ^{14}C samples from curated materials at the William S. Webb Museum of Anthropology at the University of Kentucky. All data were analyzed using instrumentation and software at the Center for Research in Archaeogeophysics and Geoarchaeology (CRAG) laboratory at Colorado State University. Together, these methods contribute to a holistic and multi-scalar geoarchaeological perspective of human-landscape relationships at Peter Village.

The Importance of Multiple Methods

The development of new technologies within archaeology enables researchers to apply a multi-scalar approach to their work. Using multiple methods allows archaeologists to create more robust inquiries into past human practices through the compiling and comparison of large and diverse datasets. A multiple method approach has especially become prevalent in archaeogeophysical and geoarchaeological research as accessibility and increased knowledge of various methods has become more prominent over time (Clay 2001; Goodman et al. 2009; Henry et al. 2019, 2021; Kvamme 2007; Milek and Roberts 2013; Storozum et al. 2020, 2017; Van Keuren and Roos 2013).

The archaeological methods I use contribute to my research in different ways depending not only on what each instrument measures, but also the scale at which it collects data. A good case study that demonstrates the strengths and weaknesses of different archaeogeophysical methods can be seen in Kvamme's (2006:255–256) survey at a historic church in Arkansas. This project was comprised of electrical resistivity, GPR, and magnetometry surveys. Only with all the datasets Kvamme collected could the outline of architectural foundations, individual rooms, and features within individual rooms all be observed. Another example of a multiple method approach is Henry et al. (2020), which focuses on the Johnston site, a Middle Woodland site located in Tennessee. The methods employed were LiDAR, aerial photography, gradiometry, magnetic susceptibility, and EMI surveys, which enabled researchers to have multi-scalar perspective of the entire landscape, including data of the entire site, as well as survey areas throughout the site in more detail. In both case studies, a multiple method approach provided a more holistic perspective of the site with the combination of data from a variety of scales, which would have been impossible using just one method.

In this research I began with an analysis of LiDAR data of the site, which provides a basic overview of the site's topography. Then, I processed and analyzed archaeogeophysical data (magnetometry, electromagnetic induction, and ground-penetrating radar) collected in survey areas throughout the site to compare with the LiDAR-derived visualizations of the enclosure. I then moved to conduct soil analyses of the eight soil cores collected on site, which were comprised of soil descriptions, sequential loss-on-ignition, and magnetic susceptibility to further inspect surface and subsurface variation identified using the remote sensing surveys in finer detail. Finally, radiocarbon samples, calibrated and modeled using Bayesian statistics, were processed to provide chronological information regarding the temporal use of the site. Together, these methods each contribute data to form a more holistic and multi-scalar dataset that can be analyzed and compared to address the presented research question.

LiDAR Visualizations (Relief Visualization Toolbox)

For this research, I use LiDAR data encompassing the entire Peter Village site. This data was downloaded as a digital terrain model (DTM) from the Kentucky State GIS server, and then used in conjunction with the “Relief Visualization Toolbox” (RVT). The RVT is a processing toolbox developed specifically for the archaeological interpretation of LiDAR through the creation of visualizations that help to emphasize “small-scale” landscape features which are more likely to be anthropogenic in nature (Kokalj et al. 2012; Kokalj and Somrak 2019). Currently, this software has ten different visualizations (Table 3) and the ability for mosaicking, blending, and different terrain settings (Kokalj et al. 2012). The available functions are important for the “visualization for archaeological topography (VAT)” tool, which uses a combination of either hill shading or hill shading from multiple directions with slope, sky-view factor, and positive-openness along with a combination of normal and very flat terrain calculations. Together, this combination of visualizations is meant to optimize data for archaeological conditions (Kokalj et al. 2012:8).

In this research, I project data in three visualizations: Sky View Factor, Positive-Openness, and Simple Local Relief Model. I also use the “visualization for archaeological topography” (VAT) visualization combination with a flat terrain setting to focus on any potential small-scale, archaeological features. These visualizations were then brought into ArcGIS Pro to be interpreted. First, all four datasets were analyzed at a site-level perspective, with visualizations projected of the entire site. Then, twenty elevation profiles were drawn on the Sky View Factor visualization. I analyzed these elevation profiles in five sections, with four profiles in each section.

Table 3. Visualizations present in the Relief Visualization Toolbox (Kokalj et al. 2012; Kokalj and Somrak 2019).

Visualization	Pros	Cons
Hill shading	Most common; works best on finding “light sources on flat areas”	Sometimes produces brightly lit areas or dark shading on data
hill shading from multiple directions	See above. Can be calculated in equally distributed, multiple directions	See above.
PCA of hill shading	Summarizes and removes repeating data	Different datasets produce different results (not consistent)
slope gradient	Accessible and easy to use/interpret, easy to compute and interpret; works on diverse terrains; pairs well in conjunction with hill shading	Need outside data to interpret, saturated areas remain on data
simple local relief model	Removes features like hills and valleys (large morphological features) from data, leaving “small-scale” features.	Excessive smoothing; sometimes creates false “features” in data
sky-view factor	clearly differentiates protruding vs depression features; helpful with complex features, "no saturations," intuitive	Flat terrain undergoes “washout effect” is too flat and low features
anisotropic sky-view factor	See above. Takes into consideration variable brightness of sky	See above. Need more data to input.
positive and negative openness	brings out convexities and concavities; no saturations, enhances complex features, removes general topography	same value can result of various slopes; interpretation for negative openness not intuitive
sky illumination	General topography preserved, considers viability of land for human activities	Difficult calculations; too many options, flat terrain “washed out”
local dominance	Works well with subtle positive relief features (e.g., eroded mounds), also depressions but also (e.g., mining traces, and hollow ways)	n/a

Magnetometry

Magnetometry is a passive geophysical technique that maps near-surface differences in the earth's magnetic field, measured in nanoteslas (nT) (Kvamme 2006:206). Magnetometry surveys look to detect magnetic variations different from the normal "background" of the matrix of a site, often resulting in the detection of various "geometric" shapes and patterns, irregular or regular in nature which can indicate a cultural feature (Kvamme 2006:205). Scholars use magnetometry to collect data regarding earthen enclosure monuments (Burks 2010, 2014; Burks and Cook 2011; Henry 2018; Henry et al. 2019; Horsley et al. 2014; Schurr et al. 2020). As per previous research, the ditch will likely have a high magnetic value due to backfilling with topsoil. Conversely, the embankment(s) should have low magnetic signatures due to the top soil having been removed, and subsoil added, during construction of the embankment (see Burks 2014:6–7).

Data were collected with a 4-sensor Foerster FEREX 4.032 gradiometer, with smaller overlapping areas collected using a Bartington Grad 601-2 gradiometer. The data density for the Foerster gradiometer was collected in 0.5 meter transects at a sampling rate of .10 m over 40 m-by-40 m grids (see Figure 4 for total survey area). The survey area was composed of three main areas: one irregularly shaped survey area to the south with a total area of 79,000 sq m, a survey to the east which was 40 by 200 m (area= 8000 sq m), and the northern section at 160 by 120 m (area=19200 sq m). The smaller Bartington survey was only 80 x 80 m but collected with 0.25 meter transects. I used the DAT38MK2 program to transform the raw N38 files to converted, M38 files.

I processed all magnetometry data using TerraSurveyor, created by DW Consultants. I applied processing functions such as 'destriping,' that applies a zero median or zero mean adjustment to the data, and ‘despiking,’ which gets rid of extreme values within the data. Another function available at this stage of processing is ‘destagger,’ which offsets the traverses to compensate for errors introduced during data collection. After I applied these functions across the three different survey areas, I then used a high or low-pass Gaussian filter with a 3 x 3, or 5 x 5 window size. This removes the low (or high if a high pass used) frequency aspects of the data. At the end of the processing, I interpolated the data collected with the Bartington and Foerster data to 0.10 m pixels, so that data resolution improves.

Figure 4. Magnetometry survey areas.

Electromagnetic Induction (Conductivity)

Electromagnetic induction (EMI), often associated with earth conductivity, measures "the ability of the soil to conduct an electrical current" (Clay 2006:79), in siemens. Researchers collect data using this instrument by producing an electromagnetic field, making this an "active" method (Clay 2006:79). Archaeologists often use EMI to find features that formed with redistribution of soils across a site, or those that are significantly different from the soil matrix and obtrude the produced electromagnetic field. Conductivity is particularly suited to study the "nature of earth moving," due to the ability for this technique to distinguish between different soil types. This is particularly helpful for this research as Peter Village has largely been erased from the landscape due to agriculture.

Embankments have been identified in certain case studies as both low conductivity (Henry et al. 2014:18), and high conductivity (Burks 2014; Burks and Cook 2011; Jefferies et al. 2013). However, it is important to acknowledge that low conductivity embankments typically are found when embanked earth is still present on the landscape, but when erased, they are typically detected as high conductivity features. The low conductivity from embanked earth is due to the ability for mounded earth to get rid of water quicker compared to its surroundings, and high conductivity a result of erosion which results in a concentration of enhanced magnetism (Burks 2014; Burks and Cook 2011; Henry et al. 2019; Jefferies et al. 2013). Conversely, ditches still visible at a site have good water retention, and therefore high conductivity and magnetic susceptibility (Henry et al. 2014:18). However, erased ditches have a low conductivity due to the eroded soil that fills them often having higher porosity (Clay 2006; Jefferies et al. 2013). Peter Village is an erased ditch-and-embankment enclosure; therefore, it is expected that the embankment(s) will have high conductivity, and the ditch, low conductivity.

An electromagnetic survey was conducted using a Geonics Ltd. EM38 MK-2 on a small portion of the total site: 80 x 40 m (area= 3200 m^2) (Figure 5), which was collected in the same area as the soil cores and over areas interior and exterior of the ditch. The 0.5 m and 1 m coils produced four datasets, one measuring in-phase (magnetic susceptibility) electromagnetic field induction at roughly 0.3 and 0.6 m below the surface and the other measuring quad-phase (conductivity) electromagnetic field induction at roughly 0.75 m and 1.5 m under the surface. In the results, I will discuss the conductivity and the magnetic susceptibility collected using the Geonics Ltd. EM38 MK-2 together.

I used the DAT38 mk2 program to transform the raw, N38 files to converted, M38 files. Then, I brought the data into TerraSurveyor to be processed for both the conductivity and the magnetic susceptibility. I processed each set of EMI, conductivity and magnetic susceptibility, data using a similar technique. Once in TerraSurveyor, I used several functions to enhance the data. 'Edge matching' was performed to match up the mean of an area to one edge of data. This creates a more continuous visualization of data. EMI also uses the 'despiking' function, like magnetometry, to get rid of the extreme values. Also similar to the magnetometry is the application of a Gaussian filter, either high or low pass, removing the high or low frequency aspects of the data, using a 3 x 3 or 5 x 5 window. In the last step of processing, I interpolated the data to a resolution of 0.25 m.

Ground Penetrating Radar (GPR)

Ground-penetrating radar (GPR) uses antennas on the ground surface to transmit a pulse of electromagnetic energy into the ground (Conyers 2013; Conyers and Goodman 1997). GPR contributes to this research as it can differentiate between cultural layers in stratigraphy, which can help to identify the ditch and embankment(s). At the Peter Village enclosure, GPR can aid in distinguishing the ditch and embankment(s) by reflecting back to the surface when it detects something underground, which could be compaction from either the embankment(s) or the ditch.

The data in this research was collected with a GSSI, Inc. SIR-3000 control unit with a 400 MHz center frequency shielded antenna, which can collect data from about 1 to 2 m below ground surface. The time window was set to 40 ns and the samples per scan was 512. The location of the GPR survey is the same 80 x 40 m (area=3200 m^2) as the electromagnetic survey in the northern portion of the site (Figure 5). To process the data into amplitude slice maps, I used the Geophysical Archaeometry Laboratory's GPR-Slice MT software program. Each slice map represents the surveyed area at an interval of depth which has been averaged (e.g., 0.2-0.4 m below surface). In GPR Slice I applied a time 0 correction and a bandpass filter, before migrating the radargrams. I then defined 15 slice ranges, correlating with 5 different depth ranges that span surface to 160 cmbs.

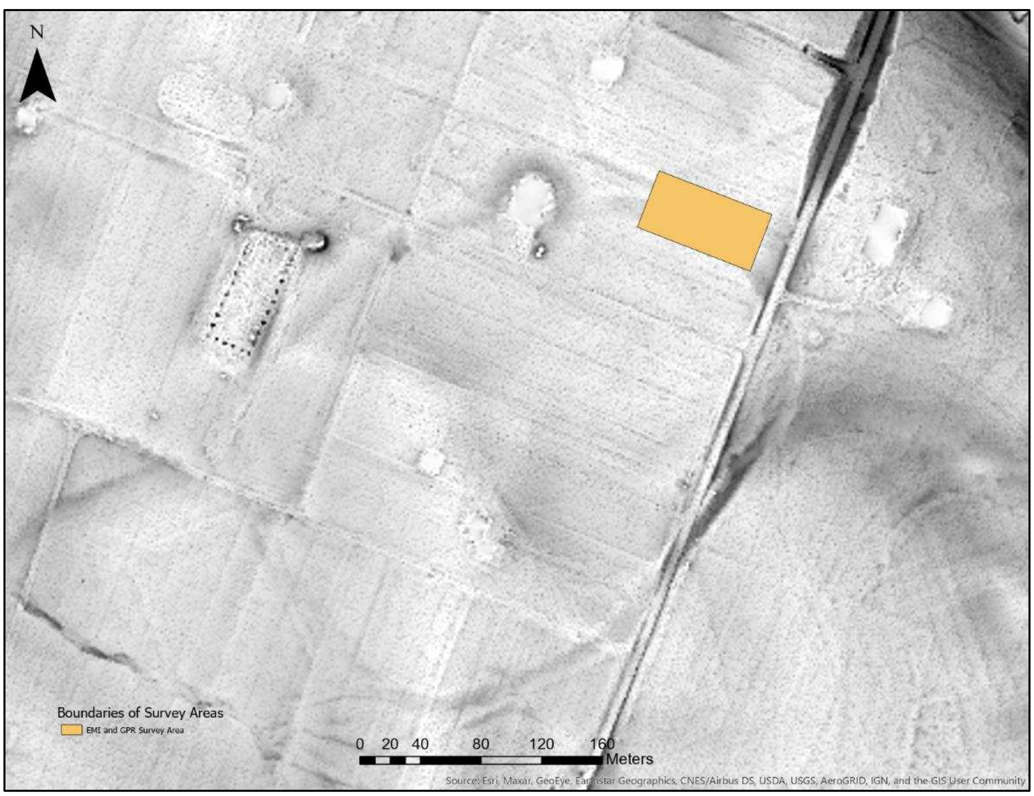

Figure 5. EMI & GPR survey area.

Soil Core Analysis

The analysis of soil cores is frequently employed in archaeology (Canti and Meddens 1998; Goldberg and Macphail 2005; Macphail and Goldberg 2018; Sherwood 2013; Stein 1986, 1991). Soil coring is useful for evaluating questions about past environmental contexts across broad spatial and depth scales of sites, while remaining relatively non-invasive. Solid soil cores collected from archaeological sites are often characterized from a survey site.

For this project, a bull auger was used to take eight cores, including a test core and cores both inside and on either side of the ditch (Figure 6). In this research, soil core analysis provides information which can help distinguish whether an area that a core represents is within the ditch, embankment(s), or outside/within the enclosure. Evidence of construction fills in the cores would result in soil texture and color to be different from the test core, with evidence for mixing such as mottled soils, consistent textures, and/or homogenized color profiles. This evidence could provide information regarding construction events at the site, such as evidence of fill, and what the main construction material would have been. The soil core analysis performed for this research involved the identification of soil color (wet and dry, using a Munsell color scale), texture (for every color change), and gradient (for every visible soil horizon) using both physical soil samples as well as photos taken of the cores (Appendix A).

Magnetic Susceptibility

Magnetic susceptibility is a measurement of “a material’s ability to be magnetized” (Dalan 2006:161). This property measures how something responds to a weak magnetic field. Magnetic susceptibility is an active method because it cannot be measured without a material being subjected to an artificial electromagnetic field. The ratio of the magnetization induced in a sample to the inducing (magnetizing) field is how researchers represent magnetic susceptibility (Dalan 2006:161–162).

Magnetic susceptibility is well-suited to contribute to this research due to its ability to detect erased features that still have a strong magnetic presence, which is common for earthen monuments. Though the Peter Village enclosure has some topographical evidence of the relationship of the ditch to the embankment(s), using magnetic susceptibility can help to identify different fills and features with varying magnetic signatures. High magnetic values can serve as a proxy for refilled ditches that contain eroded topsoil, whereas low magnetic values can serve as a proxy for embankments that have had topsoil stripped and subsoils added. Magnetic susceptibility was run on soil samples using the MS2B, a lab-based instrument, with the MS3 dual frequency sensor using Bartsoft software for PC v. 4.2.1.3. I packed and weighed every five-centimeter increment for each core into 10 cc non-magnetic cylindrical plastic boxes for the eight soil cores (Appendix A).

Loss-On-Ignition

Loss-on-ignition (LOI) is a process that can measure the amount of organic material and estimate the amount of calcium carbonate that is present in a soil sample by heating the samples and measuring the weight that changes after firing. Observing the loss of organic material provides insight into “soil development sequences” (Ayala et al. 2015:38). Measuring the reduction in calcium carbonate offers a better understanding of human interactions with soil formation (Li et al. 2019).

Loss-on-ignition has the potential to help differentiate different soils (fill versus natural, two different natural soils, etc.) and/or construction processes of the Peter Village enclosure through the measuring of the differences in organic material and calcium carbonate in the eight soil cores collected at Peter Village. High amounts of organic material or calcium carbonate can indicate that organic material was allowed to grow, therefore indicating multiple construction events with time in between the events. It can also indicate the mixing of topsoil into a homogenized matrix, possible in ditch or embankment fills. Like magnetic susceptibility, I measured LOI in 5 cm increments for all eight cores (Appendix A). After measuring the soil samples for magnetic susceptibility, I transferred the same sample material into ceramic crucibles for burning at 550° C for four hours to measure the amount of organic material present in the samples, and then again at 1000° C to estimate the amount of calcium carbonate.

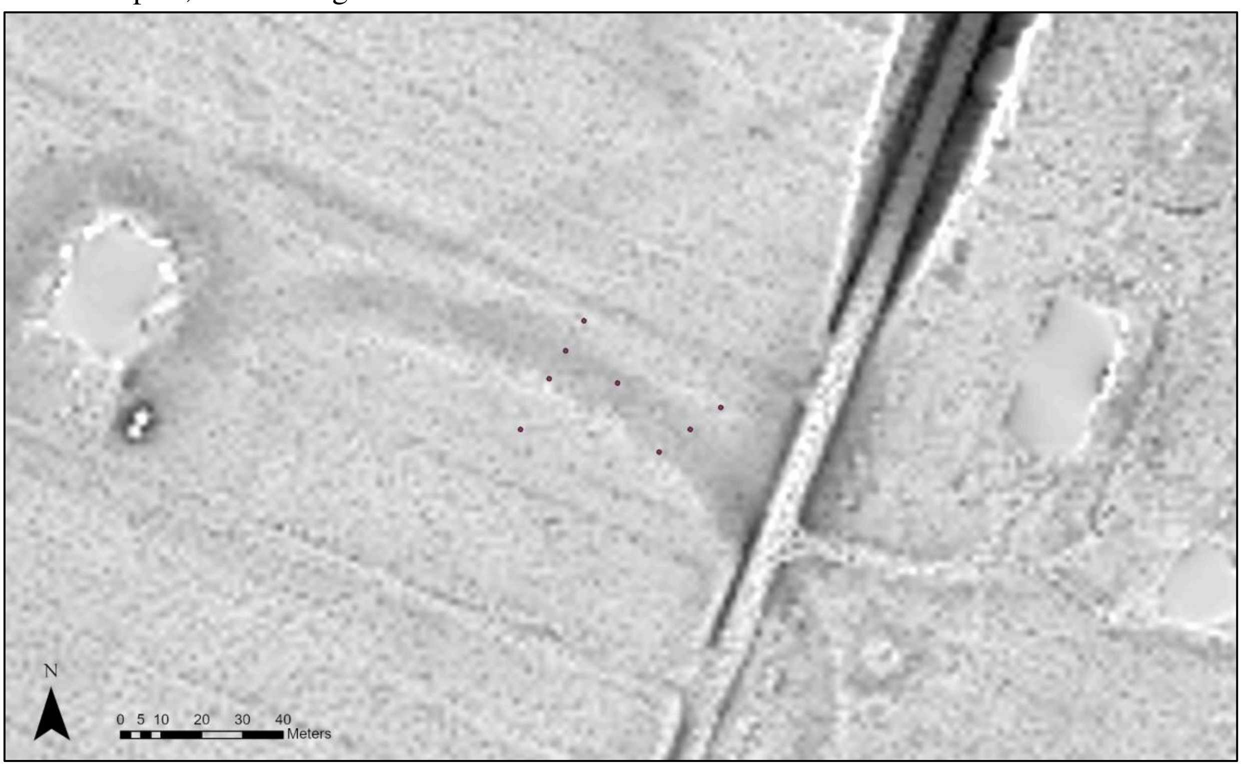

Figure 6. Locations of Cores 1-8 at Peter Village on a positive-openness LiDAR visualization. Cores used for soil core descriptions, magnetic susceptibility, and loss-on-ignition.

Radiocarbon Dating & Bayesian Modeling

For this thesis, I selected five new samples for radiocarbon dating with the help of Dr. George Crothers from the William S. Webb Museum of Anthropology Research and Collections Facility located in Lexington, Kentucky. This facility curates all materials previously recovered from Peter Village. Two of the five samples selected represent different depths within the ditch so that a better understanding of ditch refilling could be evaluated. I also chose a date from a post mold, as there remain questions surrounding the age of the post structure (whether it came before or after the enclosure, etc.). The last two dates chosen were bone from the bottom of Features 2 and 4. Unfortunately the bone did not have enough collagen and was unable to produce a date. My new dates were compared to existing dates from Clay's research in the 1980's. I found two of those dates to be unreliable because of poor context or their pooled nature (dated material comprised of charcoal from two features or sources). However, two of the dates, one taken from a charcoal lens within the ditch, and the other from a singular post, are included in my analyses and discussed in my results below.

The three new radiocarbon dates were then combined with the two old radiocarbon dates and analyzed using a Bayesian statistical approach. This approach allows for the inclusion of previous archaeological knowledge to be taken into consideration when structuring the model. Using OxCal v4.4.2, I modeled the dates as one phase, defined as the "occupation phase." Though there are dates from both the posts and the ditch, two different contexts, the contiguous phase is meant to estimate the occupation of the site and its termination as defined by the post structure, and the refilling of the ditch. The code for my model is located in Appendix B.

Chapter 5: Geoarchaeological and Archaeogeophysical Results

In this chapter I present and discuss the results produced from the methodologies described in Chapter 4. For LiDAR, I provide an overview of features identified within the study region using four visualizations created with the Relief Visualization Toolbox (RVT), as well as an evaluation of 20 elevation profiles made using the original Kentucky 5-foot DEM. I then divide the surface geophysical data into three sections, one for each method used: magnetometry, EMI (conductivity, magnetic susceptibility), and ground penetrating radar. In the soil core analysis section, I discuss soil core descriptions, magnetic susceptibility (performed in the lab), and LOI for each core individually. Lastly, I discuss the new radiocarbon dates, as well as a Bayesian statistical analysis which includes a discussion of the five new dates, as well as the four previously collected radiocarbon dates.

LiDAR

I downloaded the LiDAR data from the KY Raster server (http://kyraster.ky.gov/ArcGIS/rest/services/) (see Figure 7 for aerial imagery and LiDAR comparison). I exported a clipped portion of the 5ft DEM layer that was run through the Relief Visualization Toolbox (RVT) to create four LiDAR visualizations that include, Positive-Openness, Sky View Factor, Simple Local Relief Model, and the Visualization for Archaeological Topography (VAT). Also, I produced 20 elevation profiles using the DEM in GIS. In this section, I use the visualizations to describe “erased” features within the study region. Then, I consider and discuss the 20 elevation profiles created, divided into five groups of four profiles.

Figure 7. Aerial imagery (left) and Sky-View-Factor LiDAR visualization (right) of Peter Village site.

LiDAR Visualizations

The four visualizations used to evaluate the topography of the Peter Village enclosure include Positive-Openness (Figure 8), Sky View Factor (Figure 9), Simple Local Relief Model (Figure 10), and the Visualization for Archaeological Topography (VAT) tool, calculated using the general terrain setting (Figure 11). The VAT is a combination of several visualizations meant to specifically highlight archaeological features. In all the visualizations there are clear disruptions by modern features present, such as a road, buildings, plow scars, a farm, and horse paths (Figure 12).

Regardless of this modern "noise," the enclosure is visible in these visualizations of the site, particularly Positive-Openness and Sky View Factor (Figure 13). Both visualizations enhance the contrasts of subtle higher elevation and lower elevation throughout the LiDAR, which works particularly well in the data possible because of the high-low-high contrast. The ditch and embankments are only moderately visible in the Simple Local Relief Model. This visualization removes extreme topographical features, which resulted in an excessive smoothing. The visualization for archaeological topography (VAT) produced the most washed-out visualization, which may be a result of the elevation differences being too subtle for the vast combination of functions in this tool. However, though the enclosure's components are less visible in the Simple Local Relief Model and VAT tool, it is visible to some extent in all of them.

Therefore, the presence of the enclosure is not just one-toned. There appears to be three components making up the enclosure: a lower elevation value, presumably the ditch, represented by darker shading, with higher elevation values on either side of the lower ditch, represented by lighter shading, which is the first instance of evidence for the potential for a dual embankment.

Figure 8. Positive-Openness LiDAR visualization made with RVT.

Figure 9. Sky View Factor LiDAR visualization made with RVT.

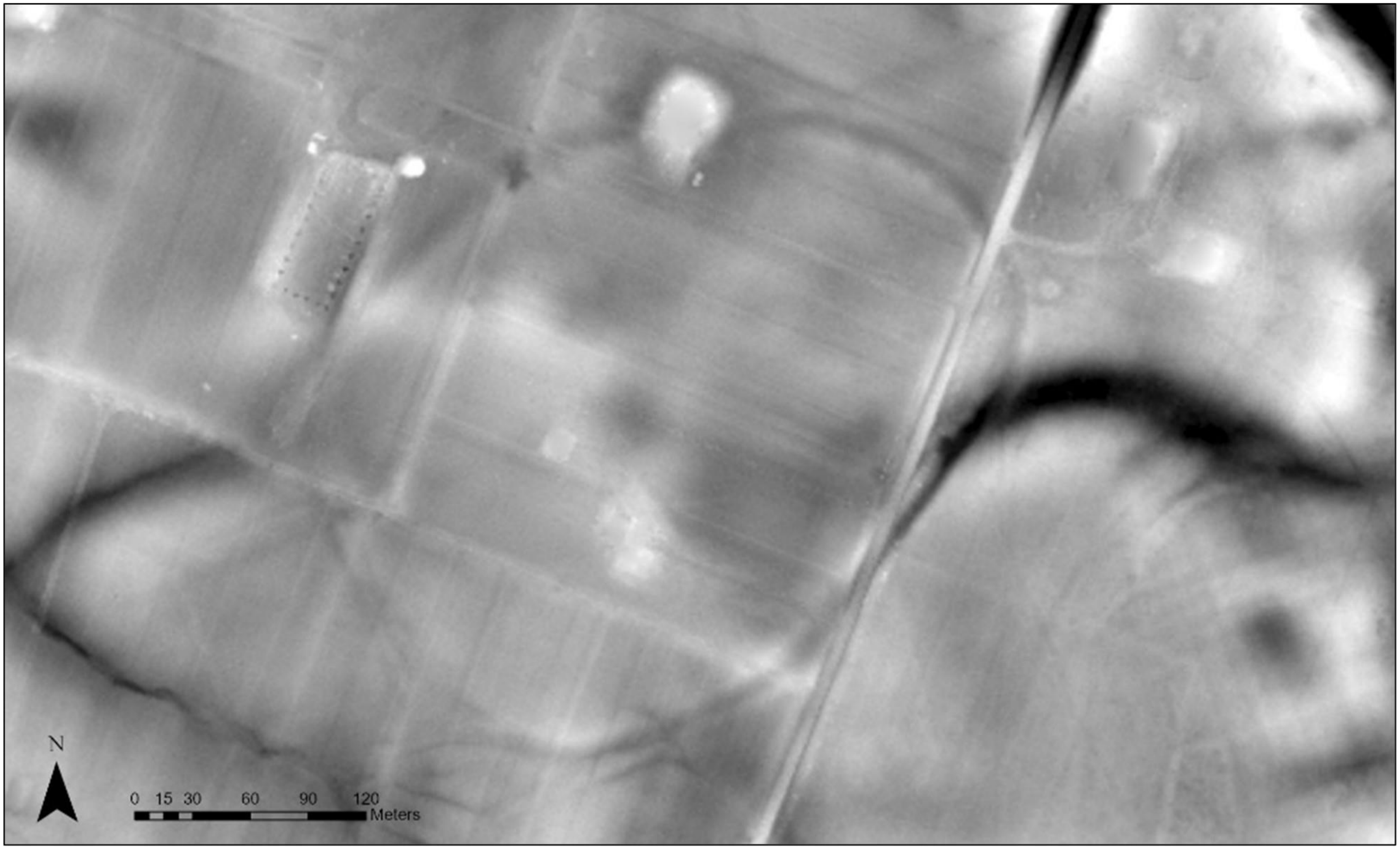

Figure 10. Simple Local Relief Model LiDAR visualization made with RVT.

Figure 11. Visualizations for Archaeological Topography (VAT) LiDAR visualization made with RVT.

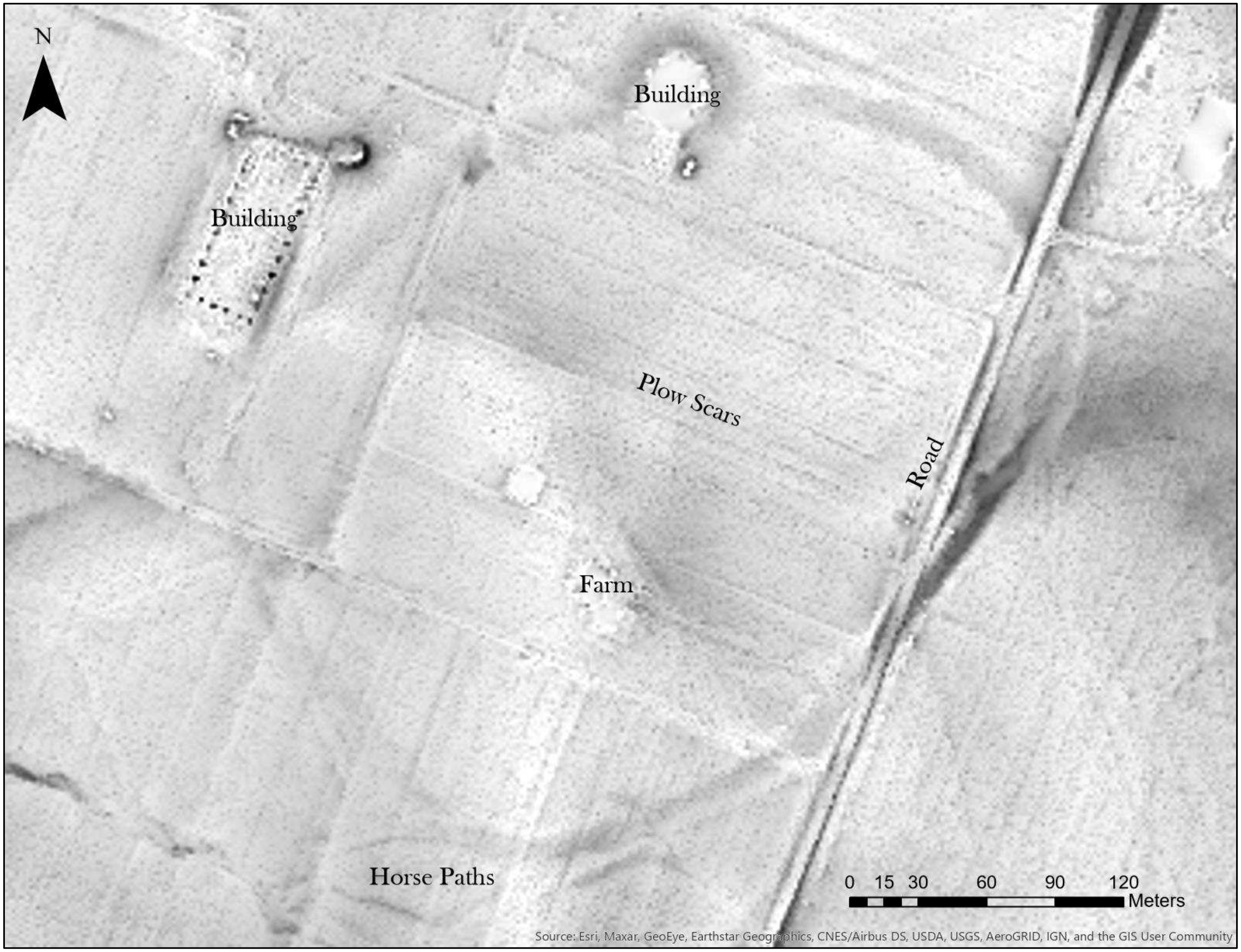

Figure 12. Modern disruption (linear features, buildings, plow scars, water features on the Sky View Factor visualization.

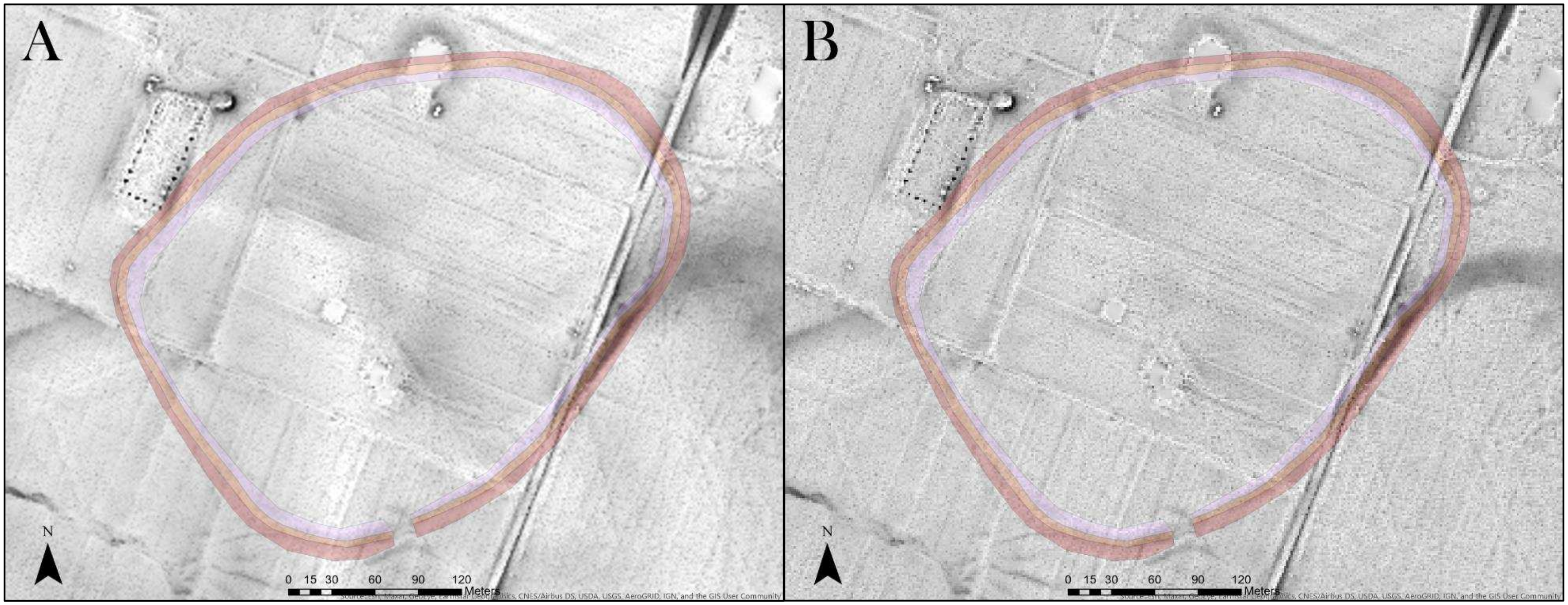

Figure 13. Sky View Factor (A) and Positive-Openness (B) with ditch and embankments highlighted.

DEM Elevation Profiles

I divided the enclosure into five sections of four elevation profiles each: Section 1 (Profiles 1-4), Section 2 (Profiles 5-8), Section 3 (Profiles 9-12), Section 4 (Profiles 13-16), and Section 5 (Profiles 17-20). The sections are arbitrary for all but the disruptions of modern features (buildings, roads, etc.). Disturbances in the elevation from modern features limited the observation of some regions. All profiles start from the outside of the enclosure and end with the inside of the enclosure (Figure 14).

Section 1 (Profiles #1-4)

Section 1 is in the northwestern area of the enclosure. All the profiles in this section have two decreases in elevation. Though the exact elevation height is variable between the profiles, the decreases in elevation are between 0.1 and 0.2 m, and all occur approximately 10 m from one another. The elevation also increases from the inside to the outside of the enclosure, about a meter over the course of the profiles. Overall, these profiles reflect similar trends (Figure 15).

Section 2 (Profiles #5-8)

Section 2 is in the western area of the enclosure. A modern road separates it from Section 1. Profiles 5, 6, and 7 have two subtle decreases in elevation, with a significant increase in elevation between the decreases. All the decreases are less than 0.25 m in depth, but the increase between them is just under 0.5 m. The elevation also increases from the inside to the outside of the enclosure about 1.0 to 1.5 m over the course of the first 30 m of the profiles. The decreases and the increases are all about 5 m in length. Profile 8 is different from the other profiles in this section. There is a large decrease that is about 15 m in length, and about a meter in depth. The profile also starts at a higher elevation than it ends. Profile 8 is close to the modern road, whereas the other three profiles are further from the road. This could account for the variation in profiles (Figure 16).

Section 3 (Profiles #9-12)

Section 3 is in the southern area of the enclosure. The road separates it from Section 2. Profiles 9, 10, and 11 have two decreases in elevation, surrounded by higher elevations. Though all the decreases and increases appear to be approximately 5 m in length, they vary in prominence. The decreases and increases for Profile 9 are about 0.3 m, Profile 10 about 0.1 m, and Profile 11 about 0.4 m. The elevation also increases from the inside to the outside of the enclosure about 1.0 to 1.5 m. Profile 12 is different from the other profiles in this section. There are two small decreases, approximately 0.1 m deep, separated by a slight increase approximately 15 m in length and less than 0.1 m in height. There is then a sharp increase of 0.3 m (Figure 17).

Section 4 (Profiles #13-16)

Section 4 is in the southwestern area of the enclosure. There is a water drainage feature that separates Sections 3 and 4. All the profiles in this section have a general increasing trend from the inside to the outside of the enclosure, with only slight variation. There is evidence for two decreases in elevation in Profiles 15 and 16, with some slight changes in Profiles 14 and 17 but are too slight to be recorded. In Profiles 15 and 16, the two decreases are about 5 m from one another, and less than 0.25 m in height for Profile 16, and about 0.1 m for Profile 15 (Figure 18).

Section 5 (Profiles #17-20)

Section 5 is in the northwestern area of the enclosure. The section is delineated by a modern building to the west and east. Profiles are not drawn near the modern buildings in case of disturbance. The profiles in this section have two distinctive increases and one decrease in elevation. Profile 20 has two additional slight dips visible, as well. The distinctive dip in all the profiles is about 10 m in length, and 0.25 m in depth. The increases also have a height of approximately 0.25, but a length closer to 5 m (Figure 19).

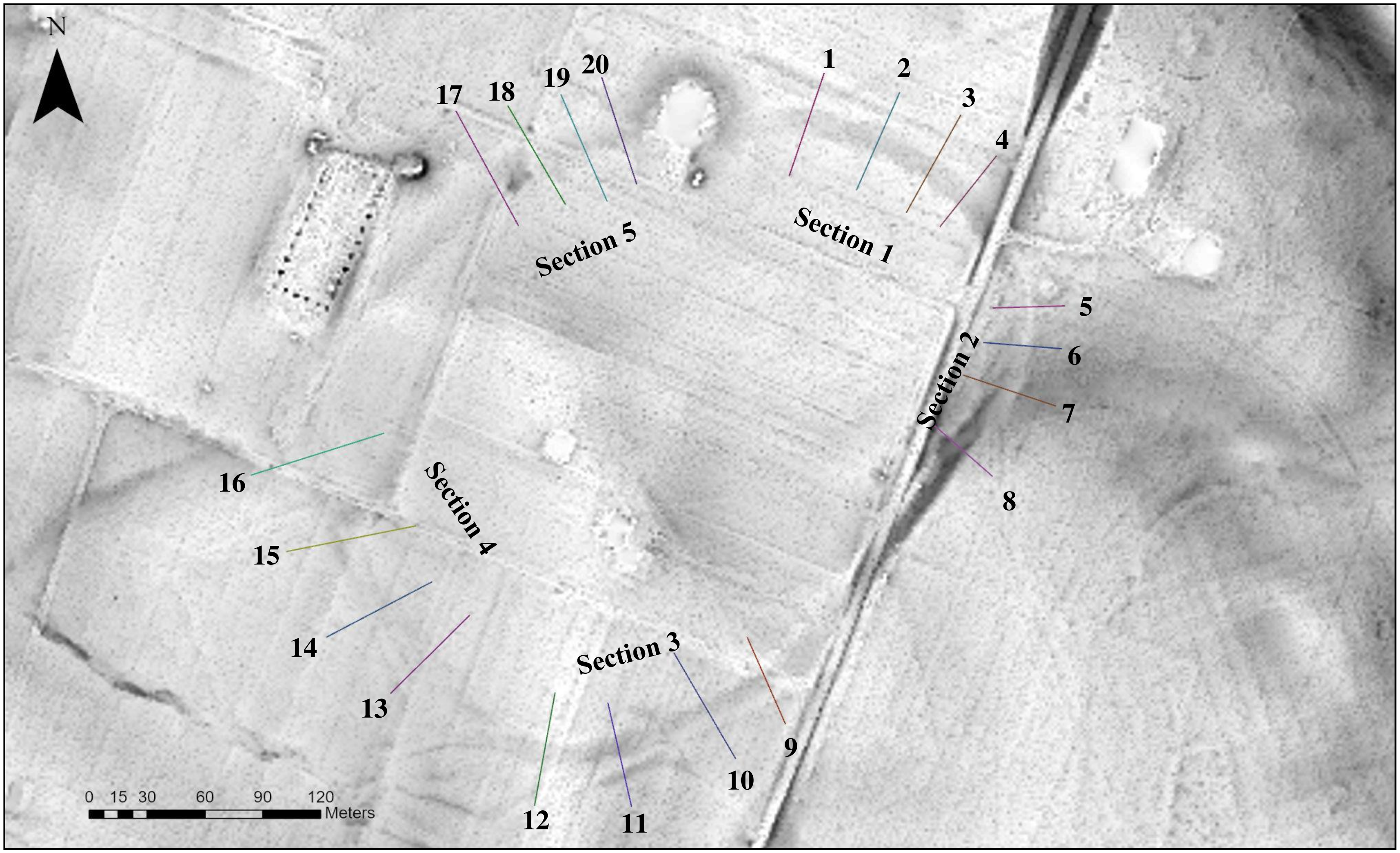

Figure 14. Elevation Profiles #1 through 20, Sections #1-5 on Sky View Factor visualization.

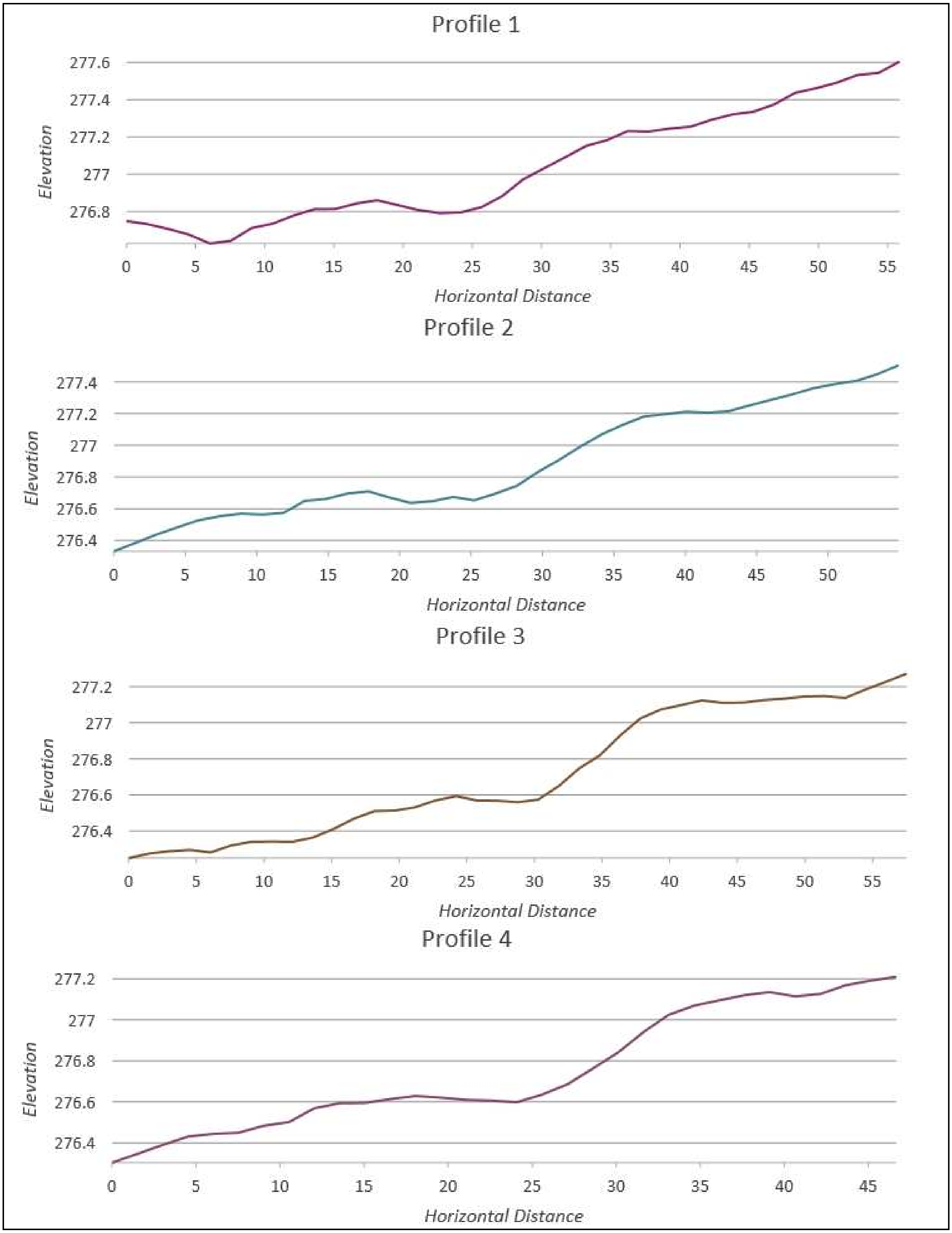

Figure 15. Section #1, Profiles #1-4.

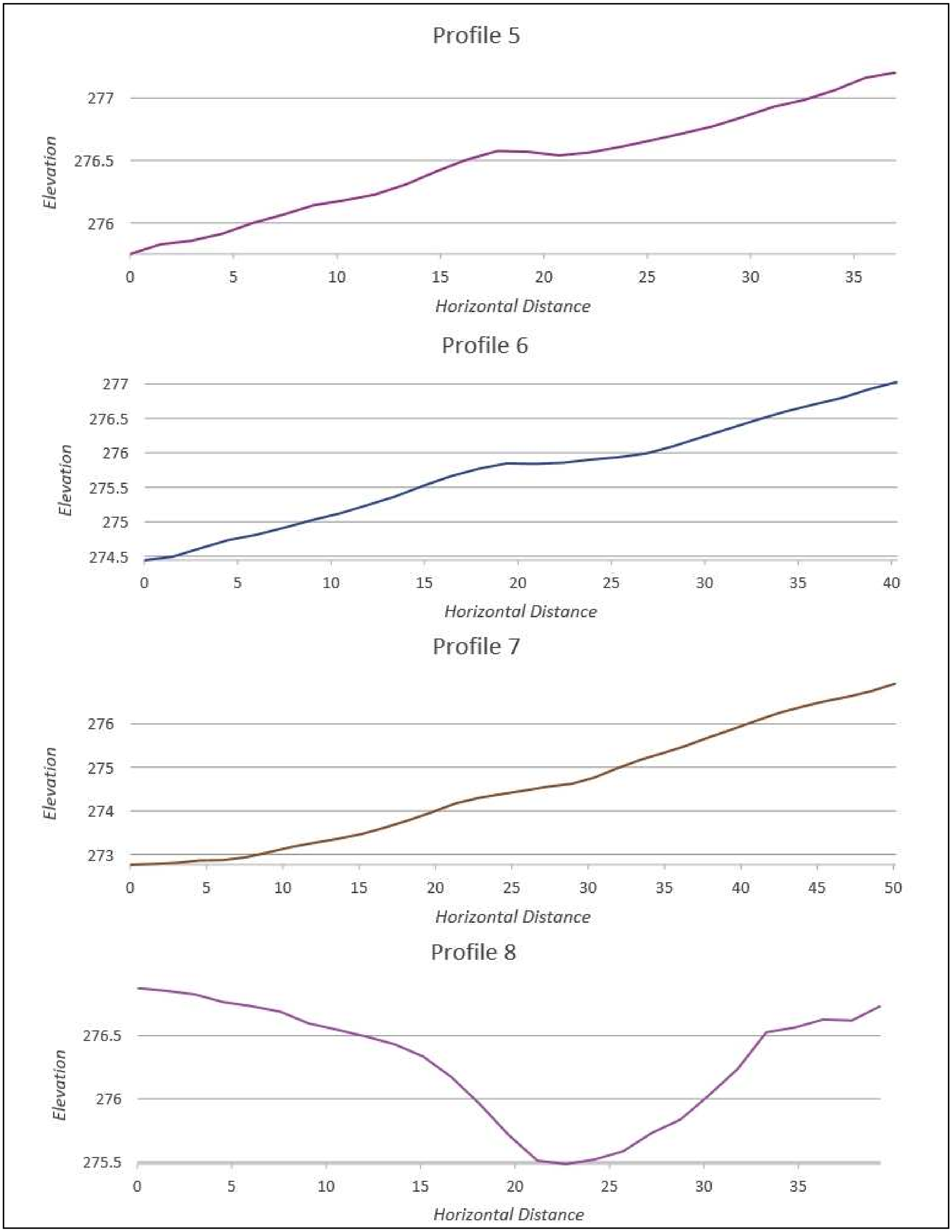

Figure 16. Section #2, Profiles #5-8.

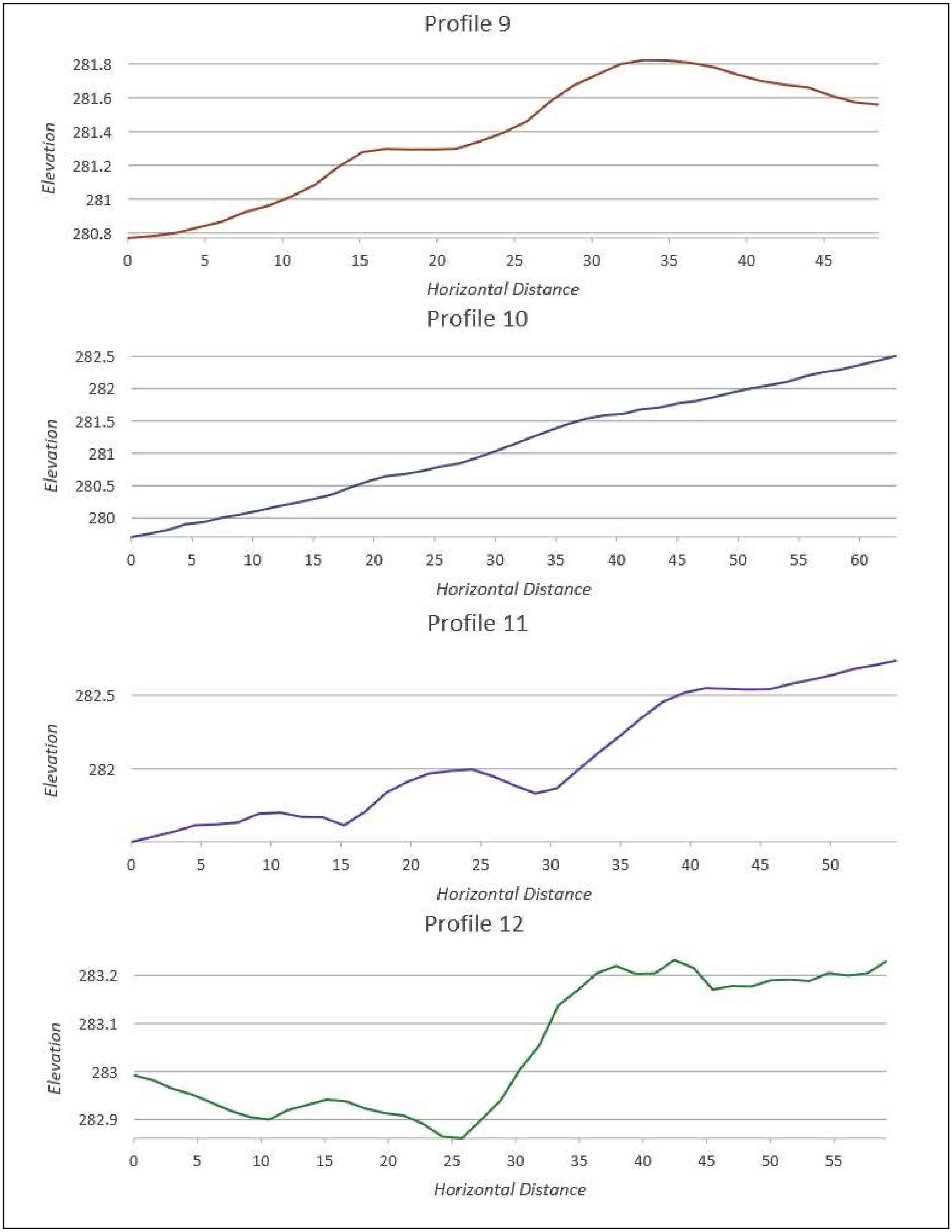

Figure 17. Section #3, Profiles #9-12.

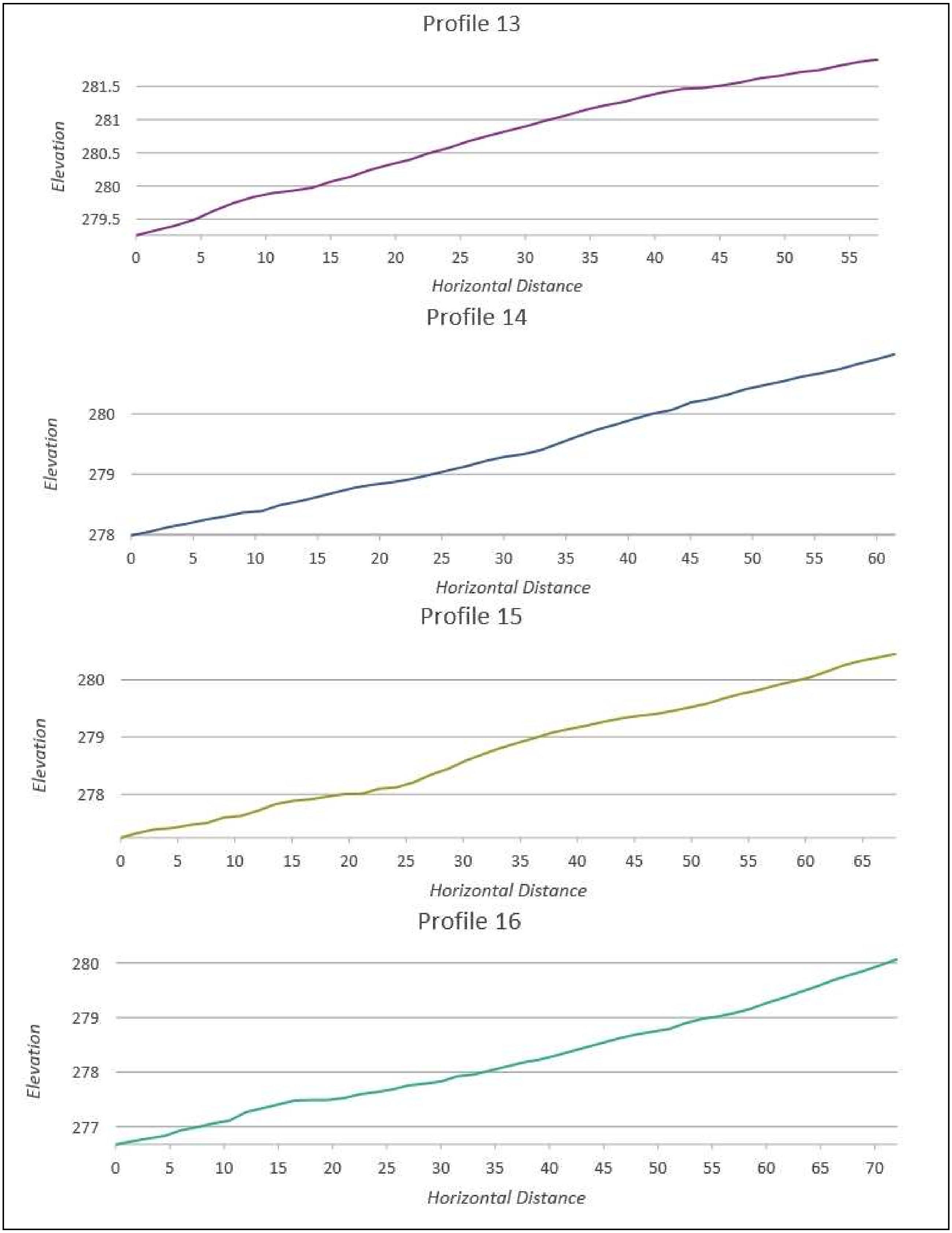

Figure 18. Section #4, Profiles #13-16.

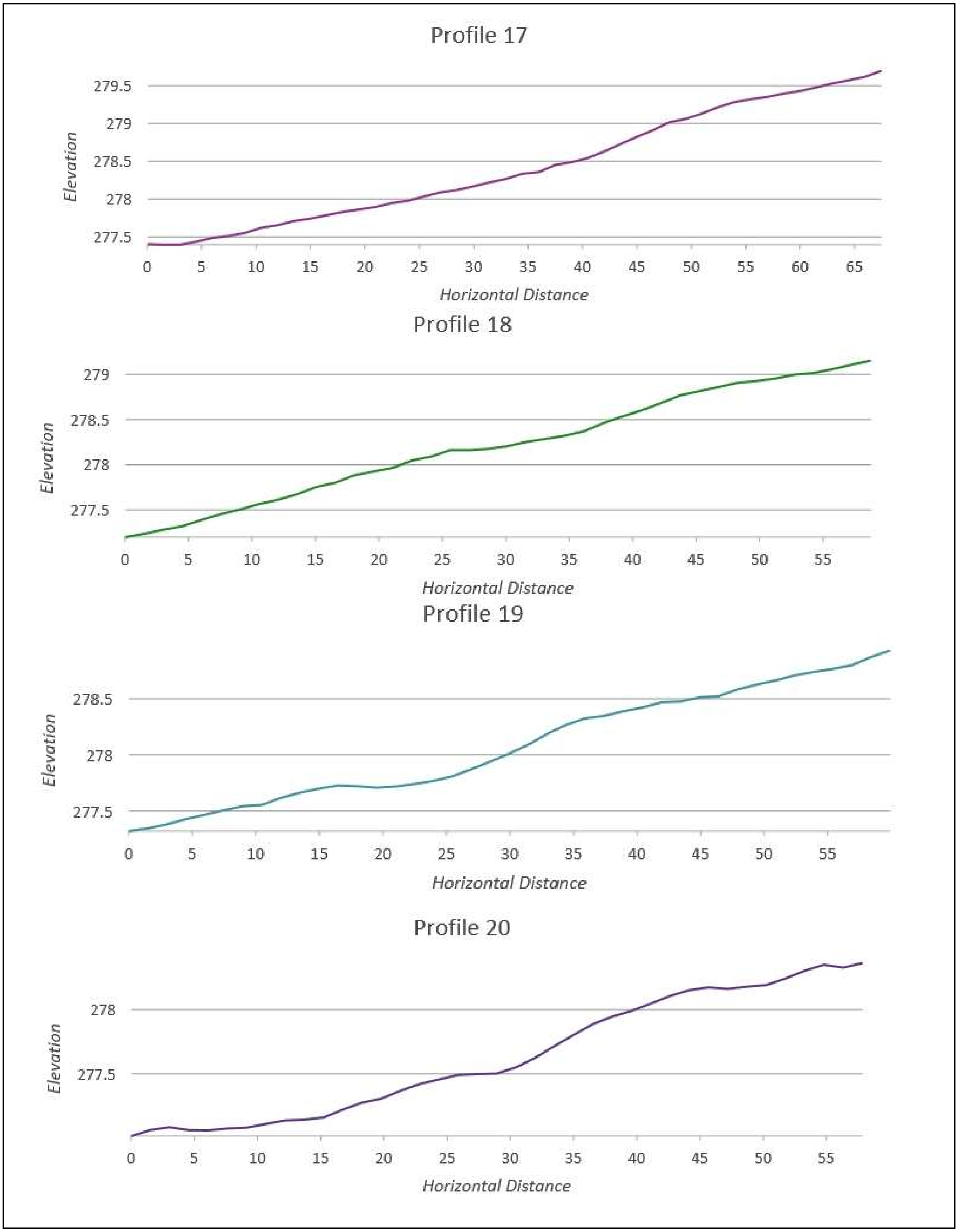

Figure 19. Section #5, Profiles #17-20.

Magnetometry

In this section, I discuss the magnetometry data collected on site which I processed using TerraSurveyor. As mentioned, Dr. Henry used two different machines to collect magnetometry data on site: the Forester Ferex with three different areas totaling 106,200 m^2 in size using 0.5 m transects and the smaller 80 x 80 ft area (area=6400 m^2) collected with a Bartington gradiometer using 0.25 m transects (Figure 20). Below, I discuss the data based on the collection area.

<u>Essence Bed & Breakfast</u>

Magnetic data were collected in the northern-most portion of the site over a 19200 m^2 area, collected on a 160x120 m sized grid (Figure 21). There is a road and metal debris throughout, disturbing the area. The ditch is visible with high magnetic values, and then there are low readings on either side of the ditch, likely indicating the embankments.

<u>Castleton Farm Area</u>

The "Castleton Farm" data were collected in the eastern-most part of the site over an 8000 m^2 area, collected in a 40 x 200 m grid (Figure 22). There are no significant modern features disturbing the area, though there is still metal debris present. The ditch in this portion of the site is represented by a high magnetic central reading, with a low reading on either side, similar as above. Again, this likely indicating the embankments the embankment. The reading of the ditch is strong in the southern portion of this section but weakens as it moves north.

<u>Betz Farm Area</u>

The Betz Farm data were collected in the southern-most portion of the site over an area 79,000 m^2 in size with an irregular grid shape (Figure 23). There are many modern disturbances, as well as potential features located in this area. There is a lightning strike in the northwestern portion of the area, which would be considered a natural feature. There is also evidence for an entrance, as there is a break in the enclosure which is not seen in any other data collected. Near this opening there are what appear to be linear features, one that may even connect to the open area. It was in this general area that Dr. Henry collected the Bartington magnetometry data (Figure 24). These features appear smoother due to the 1 m separation of the magnetometer sensors in that instruments' configuration. Nevertheless, they confirm the presence of unique anomalies in this portion of the site. Like in the other data areas, there is the high magnetic values on the inside of the ditch, and the low on either side. As in all other sections of magnetometry data collection, there is a significant amount of metal debris, but also numerous horse paths.

Figure 20. Magnetometry survey areas

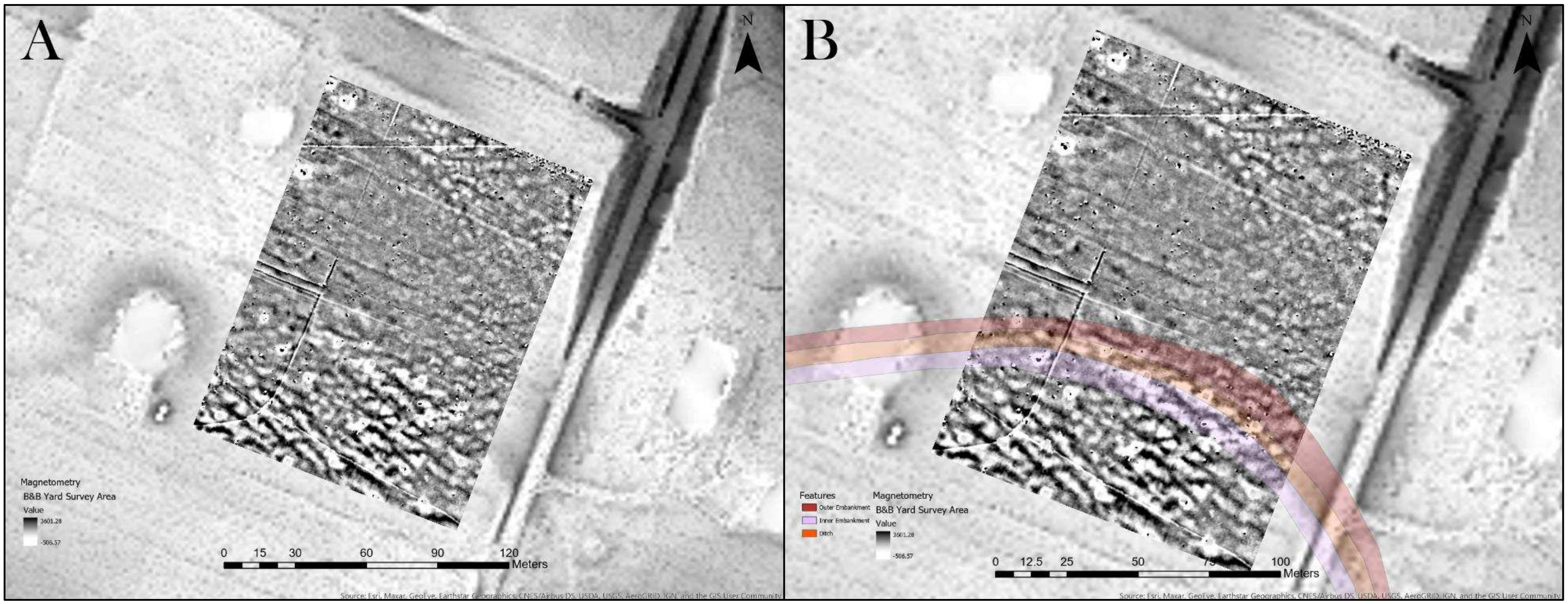

Figure 21. Magnetometry data collected in the Bed & Breakfast Yards survey area (A) and the ditch and embankments highlighted in the survey area (B).

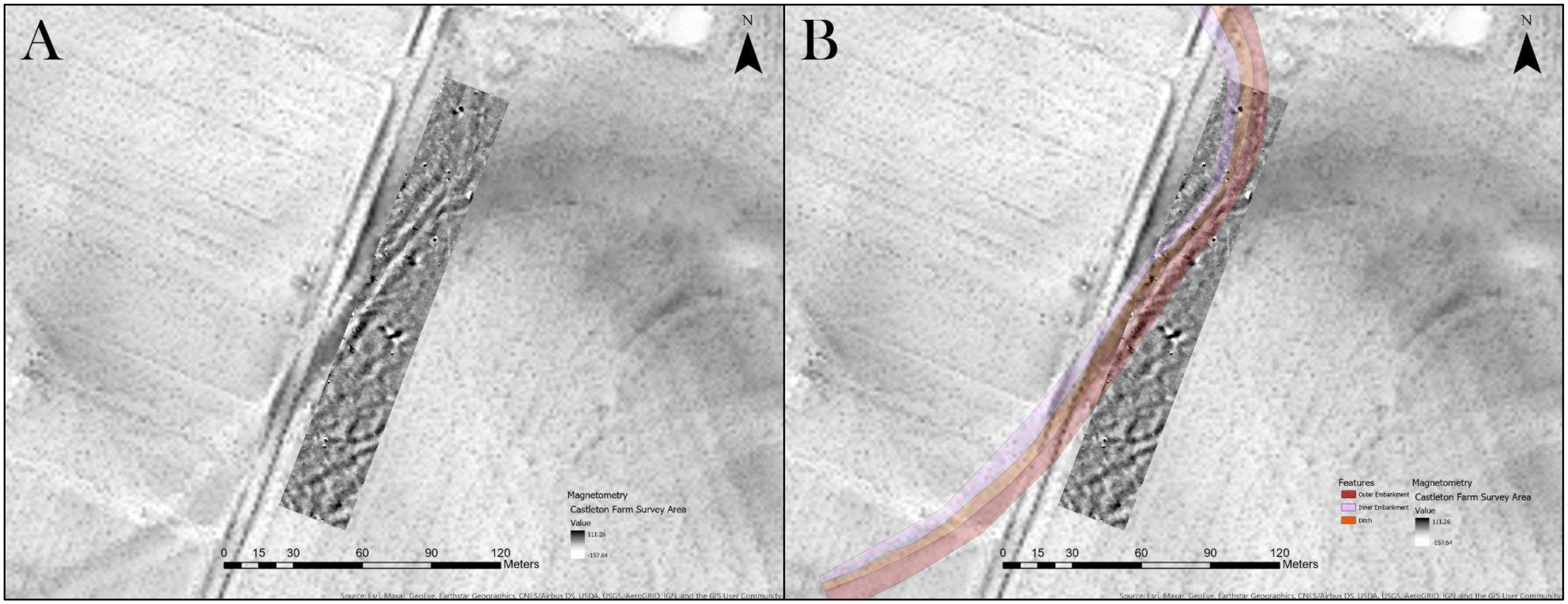

Figure 22. Magnetometry data collected in the Castleton Farm survey area (A) and the ditch and embankments highlighted in the survey area (B).

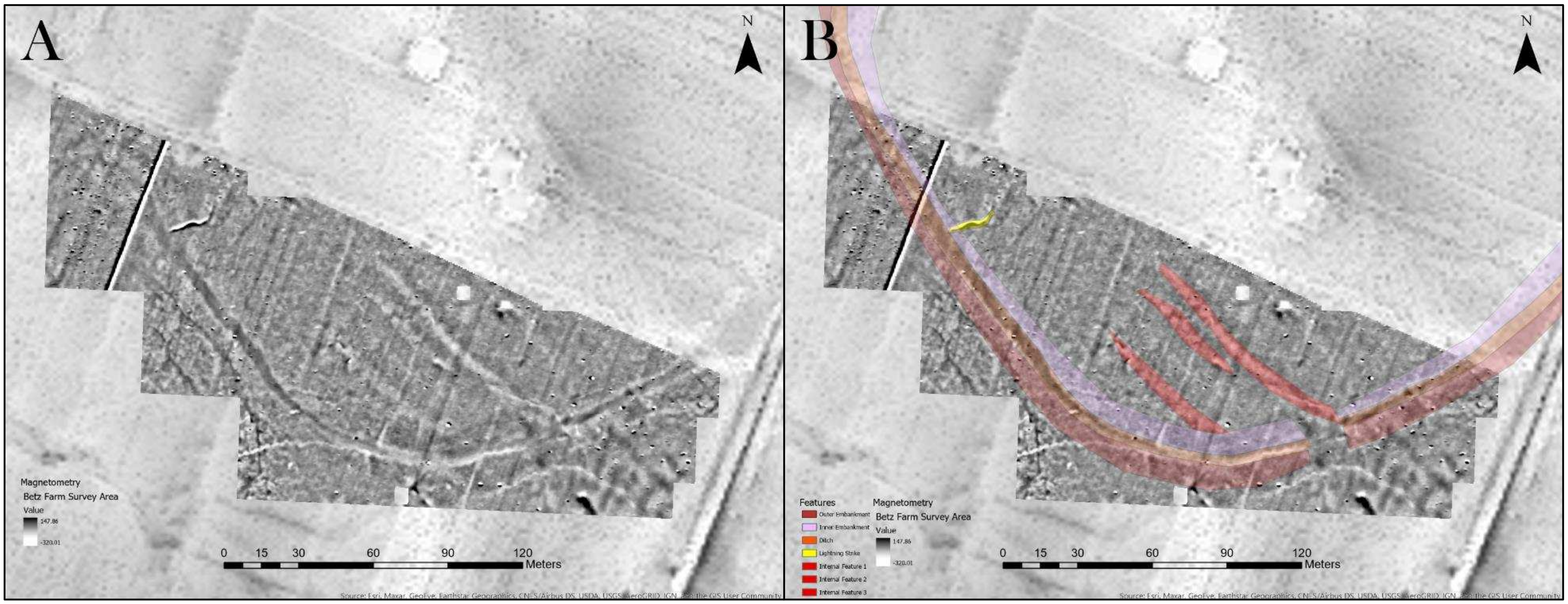

Figure 23. Magnetometry data collected in the Betz Farm survey area collected using the Foerster gradiometer (A) and the ditch and embankments highlighted in the survey area (B).

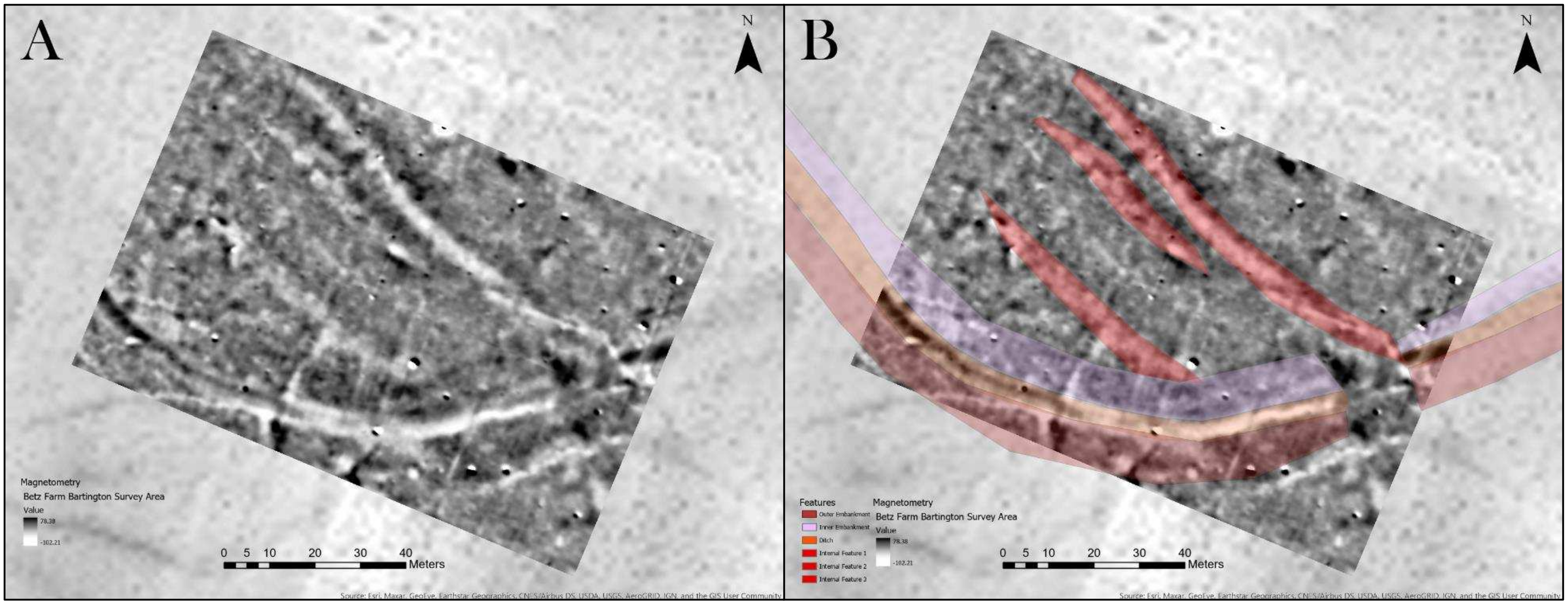

Figure 24. Magnetometry data collected in the Betz Farm survey area collected using the Bartington gradiometer (A) and the ditch and embankments highlighted in the survey area (B).

Electromagnetic Induction (EMI)

In this section, I discuss the four visualizations created from the EMI data collected on site. The four visualizations are a result of the dual-coil system: two sensors spaced 0.5 m apart both measuring magnetic susceptibility (in-phase) and conductivity (quad-phase), as explained previously. Unfortunately, the data collected was in an area likely disturbed due to the redistribution of soil from the construction of the building near the survey area. There are also trees in the survey area, as well (Figure 25). However, the EMI conductivity and magnetic susceptibility from the 50 cm coil captured three important features: the ditch and both embankments. For each visualization, I discuss the data below.

Conductivity, 50 cm

There are three areas highlighted in the conductivity data collected with the 50 cm coil: high conductivity represented in oval-like shapes following an arc, a continuous high conductivity arc above the oval-shaped conductivity, and a medium to high conductivity arc below the oval-shaped conductivity (Figure 26). When matched to aerial photography, the oval-shaped high conductivity matches up with a series of trees in the area. However, these trees also match up with the location of the ditch. The arc of high conductivity is just above the ditch and therefore located on the outside of the enclosure. The fainter, higher-conductivity arc pictured below the oval-arc is located on the inside of the ditch. These continuous, medium to high ranging conductivity features appear to represent the locations of the embankments.

Conductivity, 1 m

Conductivity collected with the 1 m coil also contains some remnants of the three arc-shaped features seen in the 50 cm coil data above. However, the data is fainter and more skewed; general similarities and trends remain, but there is much less detail (Figure 27).

In-Phase (Magnetic Susceptibility), 50 cm

The in-phase (magnetic susceptibility) data collected with the 50 cm coil appear to represent similar trends as the 50 cm coil for conductivity: there are strong high readings where the ditch has been defined based off previously presented research, particularly with high-magnetic susceptibility around the trees, and an inner and outer arcing feature which may represent an inner and outer embankment (Figure 28). However, these readings are not as strong as the conductivity readings at this depth.

In-Phase (Magnetic Susceptibility), 1 m

The 1 m coil readings for in-phase (magnetic susceptibility) are less comprehensible than the 1 m conductivity readings. However, the ditch is still visible in this visualization, with some remnants of the inner and outer arcing features (Figure 29).

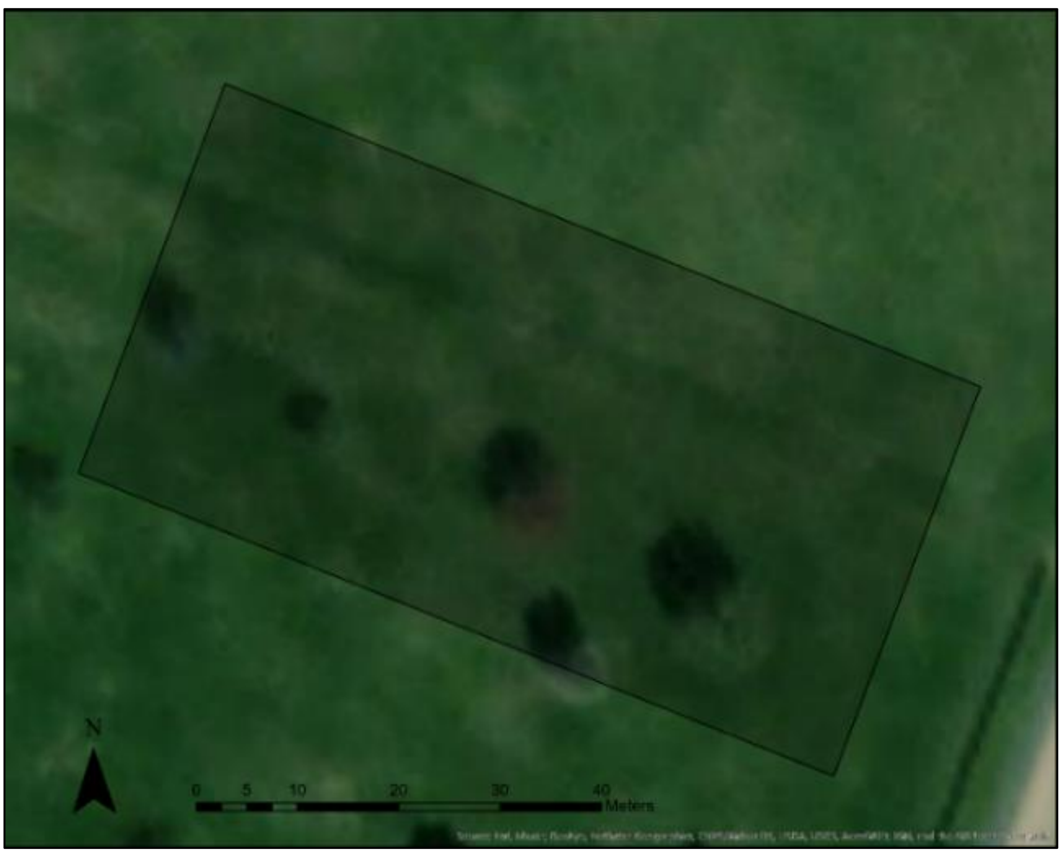

Figure 25. Aerial imagery of the EMI survey area.

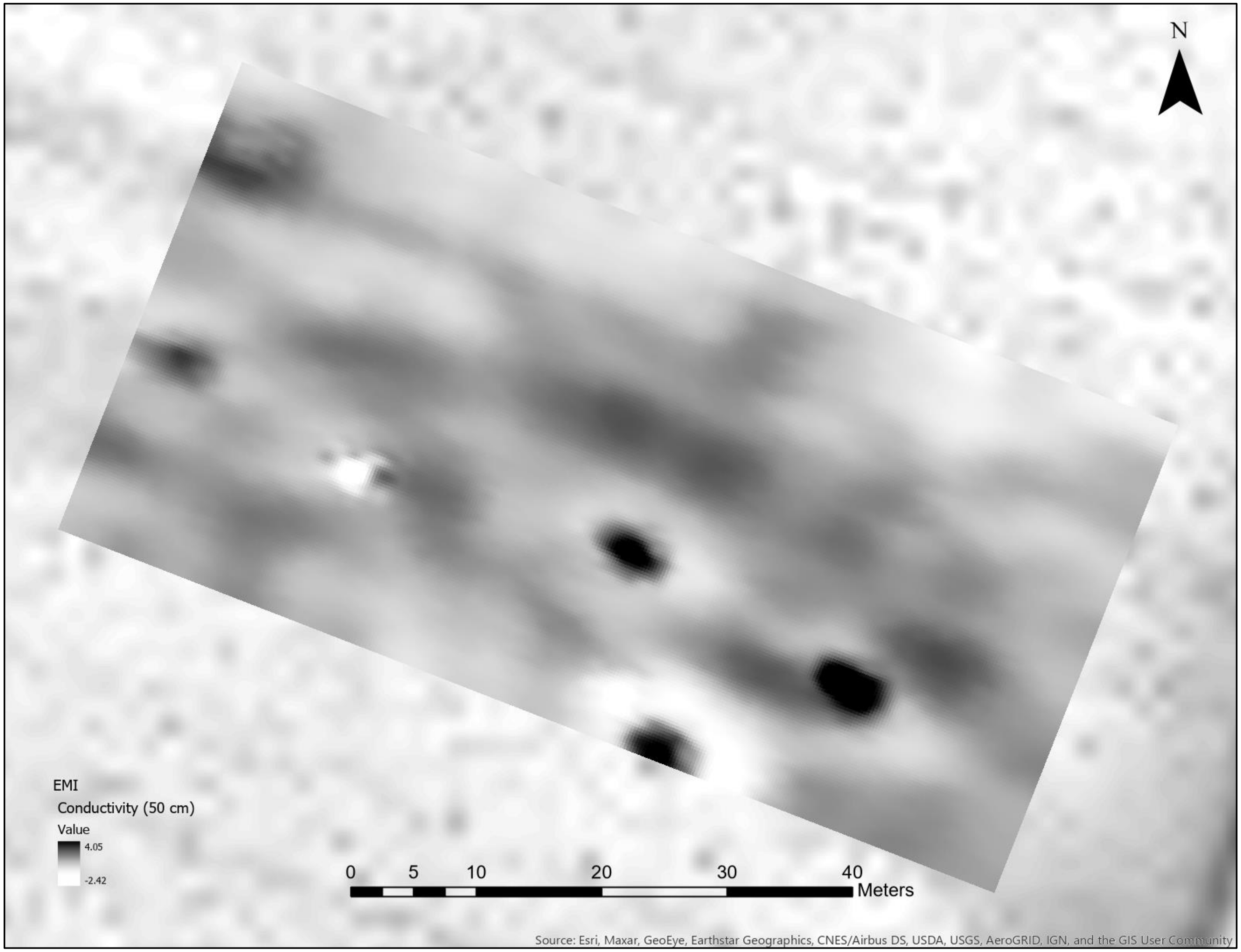

Figure 26. Electrical conductivity measured with the 50 cm coil.

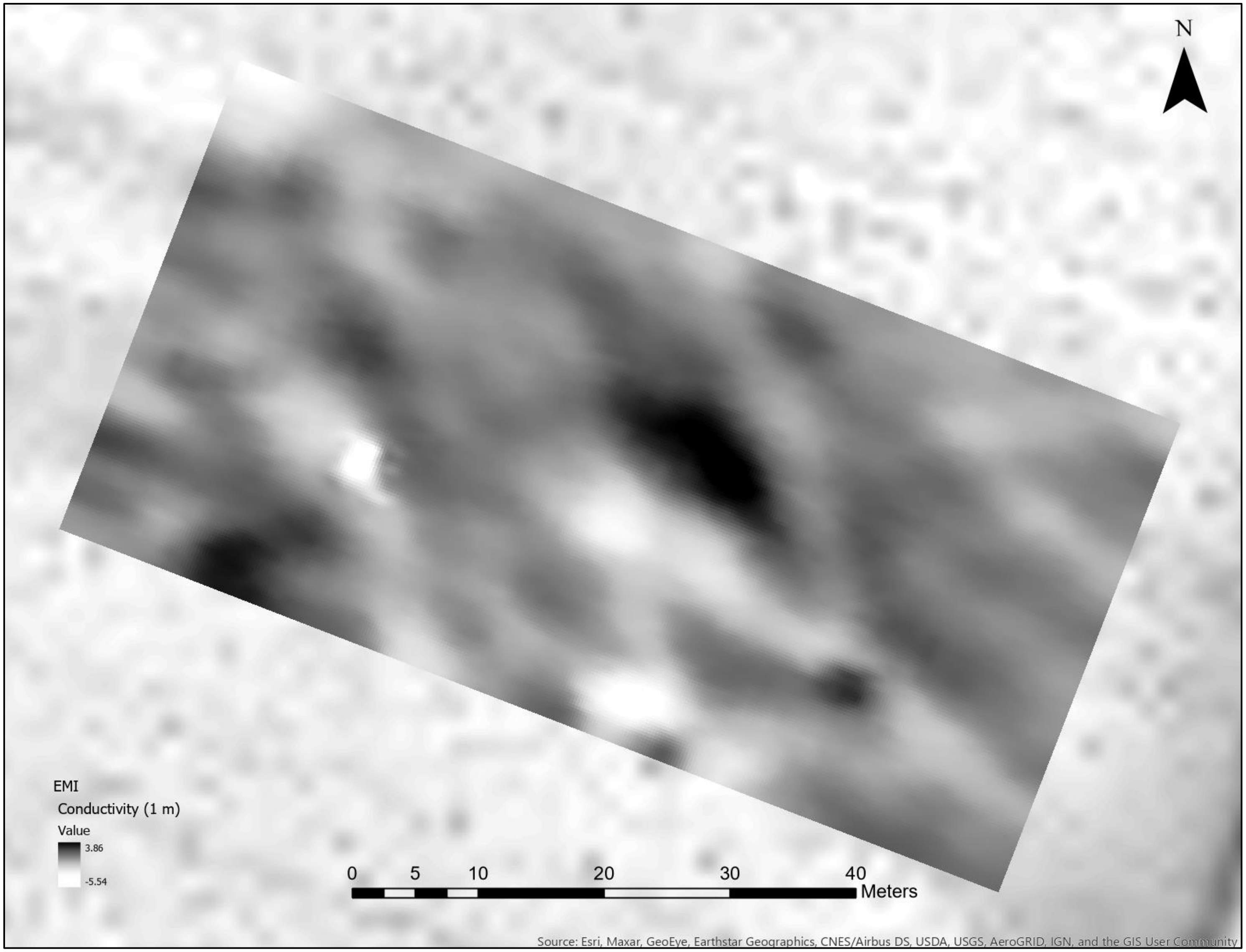

Figure 27. Electrical conductivity measured with the 1 m coil.

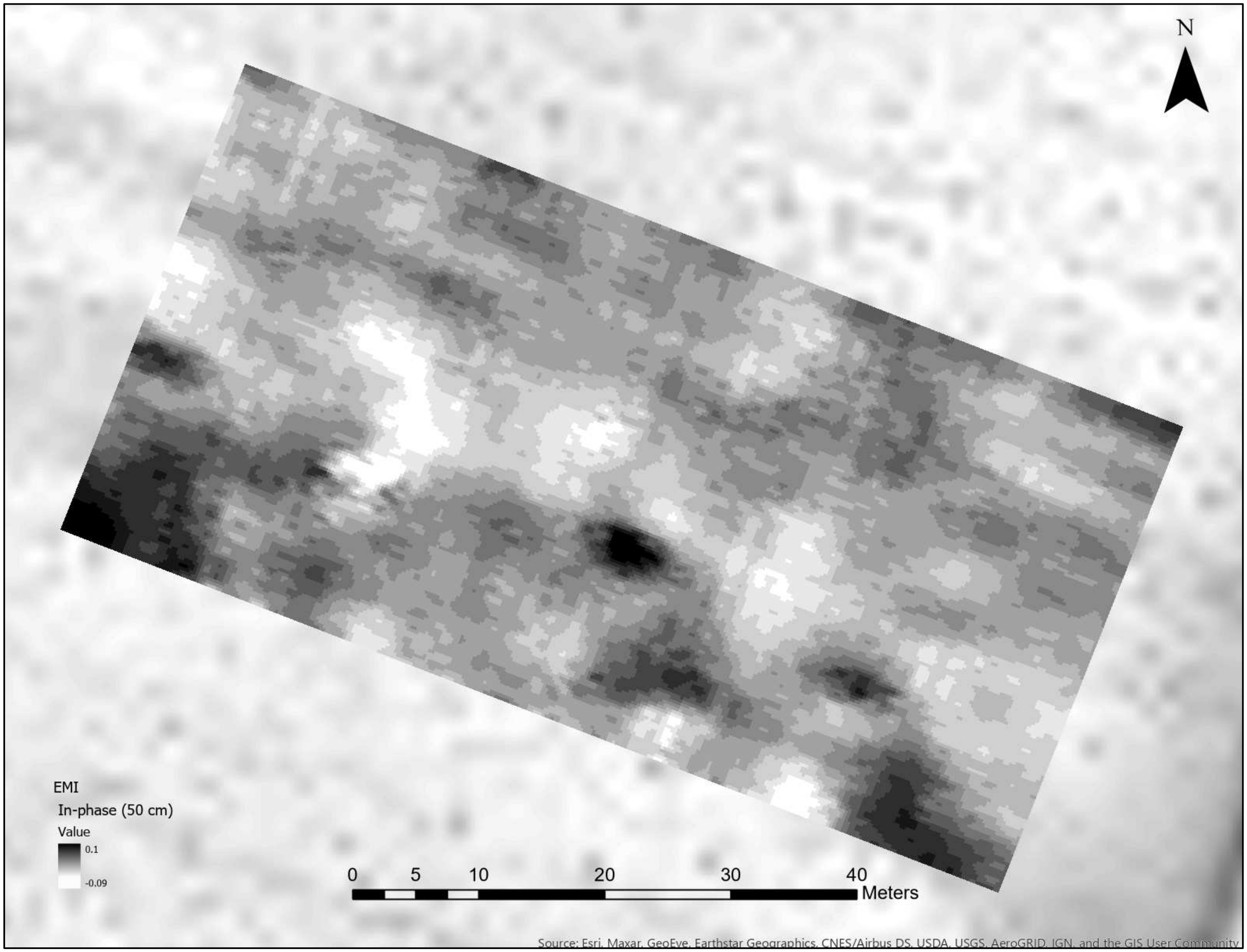

Figure 28. Magnetic susceptibility measured with the 50 cm coil.

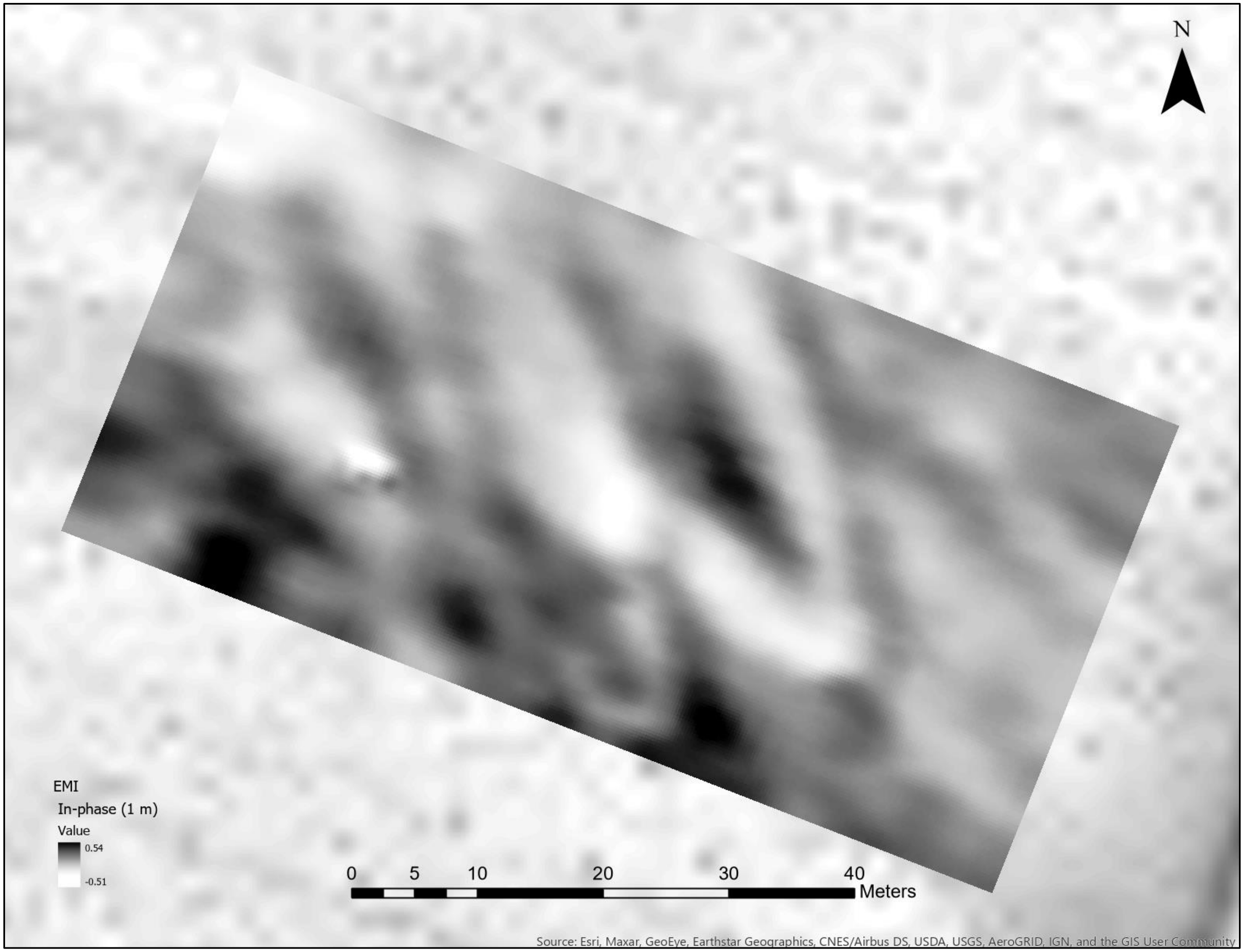

Figure 29. Magnetic susceptibility measured with the 1 m coil.

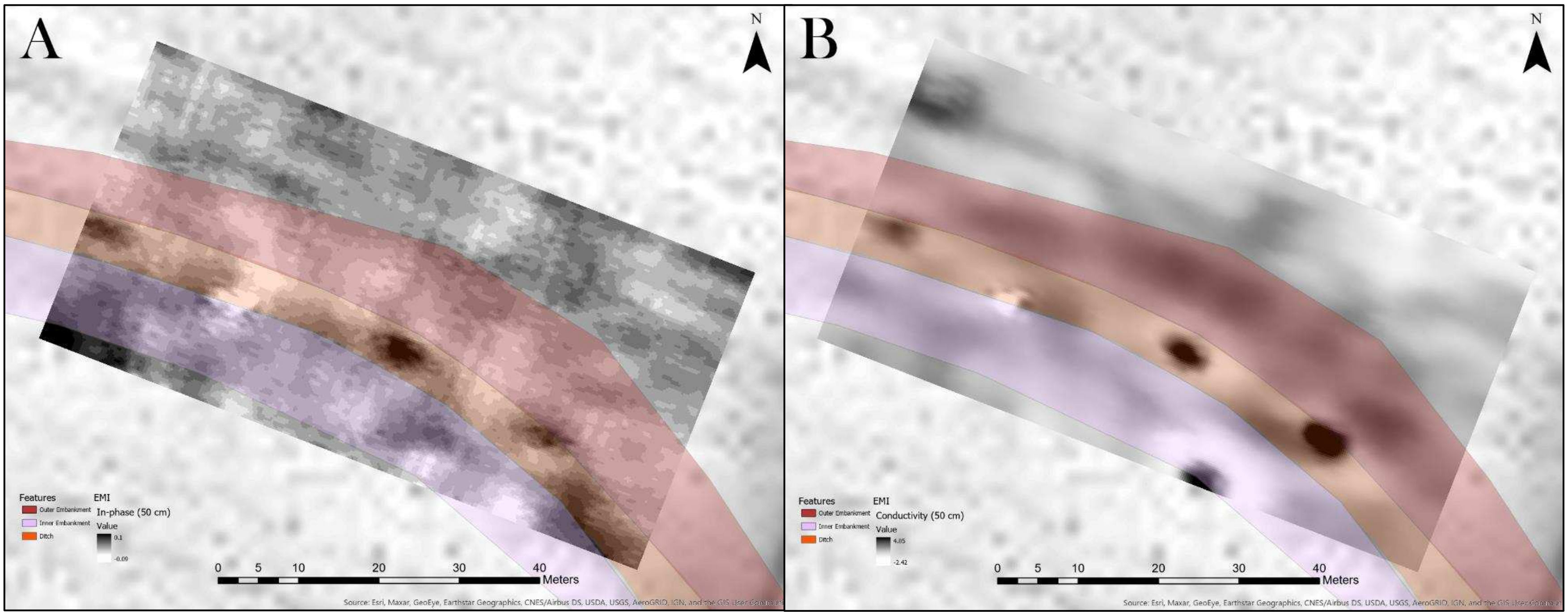

Figure 30. EMI magnetic susceptibility (A) and conductivity (B) collected with the 50 cm coil about 0.75 m below surface.

__Ground Penetrating Radar (GPR)__

The EMI was collected in the same location as the EMI (Figure 31). The GPR Slice software produced fifteen slices with the GPR data collected on site in 2015 (Figure 32). These slices are of the following depths: 0-0.2 m, 0.1-0.3 m, 0.2-0.4 m, 0.3-0.5 m, 0.4-0.6 m, 0.5-0.7 m, 0.6-0.8 m, 0.7-0.9 m, 0.8-1.0 m, 0.9-1.1 m, 1.0-1.2 m, 1.1-1.3 m, 1.2-1.4 m, 1.3-1.5 m, and 1.5-1.6 m. Below, I discuss the GPR slices in sections which have similar patterning. Unfortunately, the GPR data do not show strong evidence for the presence of the embankments in any of the 15 slices produced. It is even hard to distinguish high values that may represent the ditch from the high values represented by the trees present in the survey area. It is likely that the presence of the trees likely affected the GPR data collection greatly.

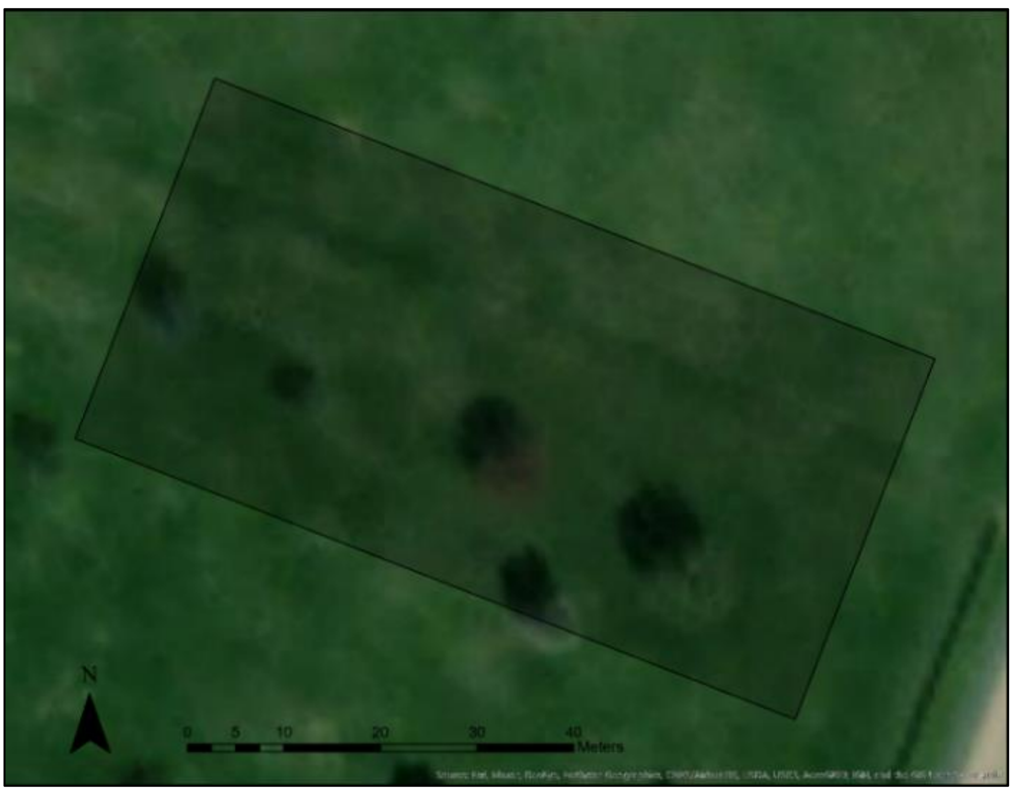

Figure 31. GPR survey area.

Slices 1 and 2 (0.0-0.3 m)

The first two slices (0.0-0.3 m) show the best evidence for archaeological features, though even this slice is obscured by the trees in the same location as the ditch (Figure 33). There are faint 6 to 7 m thick low-value sections on either side of the ditch, possibly the locations of the inner and outer embankments. Also visible in these slices is a road in the northern section of the survey area.

Slices 3 to 5 (0.2-0.6 m)

In these slices, the trees become less visible, especially in Slice 2 (0.3-0.5 m). The ditch, while visible in Slice 3 (0.2-0.4 m) also becomes less visible by Slice 5 (0.4-0.6 m). By Slice 5, the trees are become more visible, though archaeological signatures are nearly no longer visible. The road seen in the previous slices is still visible in the northern portion of the survey area.

Slices 6 to 11 (0.5-1.1 m)

In these slices (0.5-1.1 m) any possible signatures of archaeological features continue to fade. There is some evidence of high values between the trees (which are still observable), however it is not as strong as previous slices. Also, the lower values surrounding either side of the ditch is not visible past some slight remnants in Slice 6 (0.5-0.7 m). The road is still present in these slices.

Slices 12 to 15 (1.0-1.6 m)

At this depth (1.0-1.6 m), the ditch, represented by the high values between the locations of the trees, is no longer visible. The trees remain prominent in the data visualization until the bottom depth of the GPR slices (~1.6 m). The road is also mostly visible until the end, as well. Therefore, in these slices modern features are what are the most visible, whereas the visibility of archaeological features is no longer prominent.

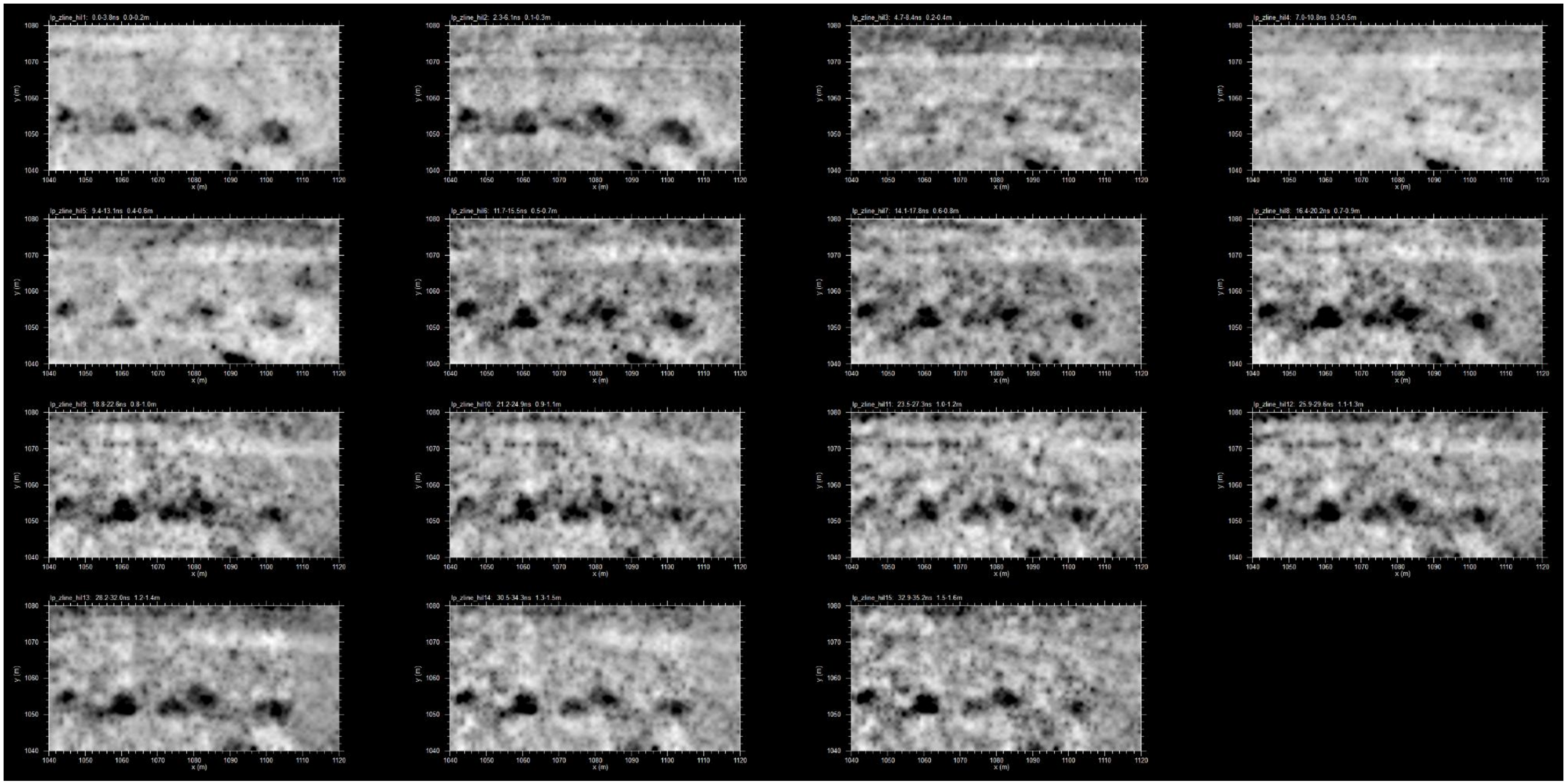

Figure 32. All 15 GPR slices.

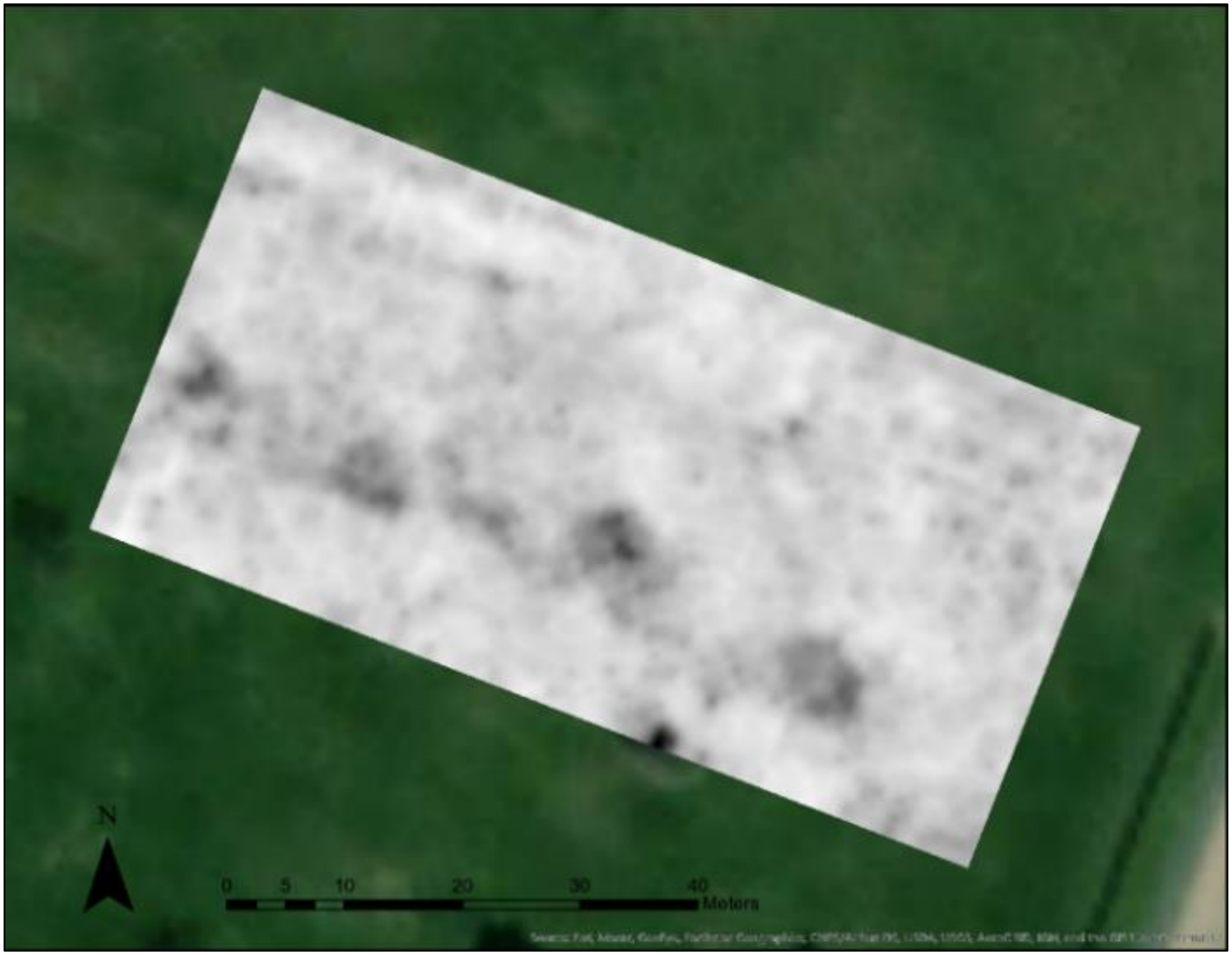

Figure 33. Aerial imagery with the GPR survey area with Slice 1 (0.0-0.2m).

Soil Core Analysis

In this section, I discuss data from the eight soil cores that Dr. Henry collected on site at Peter Village using a 6.35 cm hydraulic bull auger. Included in this section are detailed outlines of the soil core descriptions, magnetic susceptibility, and loss-on-ignition for each core. Also in this section are figures made in Golden Software's Strater for each core that compare the soil core descriptions, low frequency magnetic susceptibility, frequency dependent magnetic susceptibility, percentages of burned material from loss-on-ignition fired at 550° C, and percentages of burned material from loss-on-ignition fired at 1000° C for each individual core. These components are also further described, in 5 cm intervals, for each core in Tables 4 and 5. The high frequency magnetic susceptibility is recorded in Table 5, but not described elsewhere. This is because the low frequency and high frequency susceptibility show the same patterning.

<u>Core 1</u>

General Overview

Core 1 is located in the inner embankment, according to the LiDAR. Core 1 is 243 cm long, starting at the elevation 276.68 m, and ending at 274.24 m (see Figure A1 for core visual).

Soil Core Description

Core 1's profile consists of an Ap (0-20 cmbs), B1a (20-45 cmbs), B1b (45-96), B1c (96-121 cmbs), Bt1 (121-147 cmbs), Bt2a (147-198 cmbs), Bt2b (198-225 cmbs), and BC/C (225-243 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The B1 designation is used due to a slight increase in clay content from a silt loam to a silty clay loam, but distinguished into three horizons because of differing colors, inclusion size and frequency, and boundaries. The Bt designation is used because there is a significant increase in clay from silty clay loam to silty clay but distinguished because of different mottling and inclusions. There is a Bt1 and Bt2 because of increasing clay content. There is a gradual boundary between them. The final horizon is a BC/C is a silty clay to clay, not a full clay, but there are pieces of bedrock fragment. Therefore, Core 1 demonstrates a soil profile that increases in clay going down the core. There is nothing strikingly abnormal about this core, however it is important to note that there are large sections of the core that are relatively uniform in terms of texture, and color differences are sometimes only slightly different. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A1.

Magnetic susceptibility

i. Low frequency

The low frequency magnetic susceptibility readings for Core 1 have a minimum value of 7.98E-08, though this is an extreme outlier value, and a maximum value of 2.34E-06 (for detailed information about individual values every 5 cm please see Table A2). Values fluctuate slightly at the top of the core, with a slight decrease in low frequency value around 60-65 cmbs at 1.85E-06. This continues until about 80-85 cmbs at 1.80E-06, with a significant increase in values beginning at 85-90 cmbs with a starting value of 2.11E-06. This continues until around 125-130 cmbs, with a final value of 1.91E-06. There is then a significant decrease back to 1.56E-06 at 130-135 cmbs, with similar values lasting for the rest of the core, and the anomalous low value of 7.98E-08 at 215-220 cmbs.

ii. Frequency dependent

The frequency dependent magnetic susceptibility values for Core 1 have a minimum of 9.31%, and a maximum value of 17.09% (for detailed information about individual values every 5 cm please see Table A2). These values remain within a range of 9.31% to 10.30% for the top 120 cm of the core. Around 120-125 cmbs there is an increase in the frequency dependent values through the rest of the core with a range of 11.02% to 17.09%. However, most of the values are between 13% and few values larger than 15%.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 1 range from 3.61% to 10.47% (for detailed information about individual values every 5 cm please see Table A2). The first 5 cmbs have the highest value, which is typical because of the modern organic material that is typically in the first 5 cmbs, up to 10-15 cmbs. It then drops to 6.91% and continues to drop below 6% (10-20 cmbs), then below 5% (20-40 cmbs), then 4% (65 cmbs), steadily decreasing with depth. Then, at 65-70 cmbs, values begin to increase above 4% again from 65-95 cmbs. There is then a bit of a spike at 95-100 cmbs with a percent value of 6.24%, then a slight decrease below 6% (100-125 cmbs). Then percentages begin to increase significant first back above 6% (125-135 cmbs), above 7% (135-185 cmbs), and then above 8% (185-200 cmbs). Values then decrease below 8%, with a low of 6.15% (210-215 cmbs), but typically above 7%, from 200-235 cmbs. The last 10 cm of the core are high, both about 9.5%.

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 1 range from 1.56% to 4.29% (for detailed information about individual values every 5 cm please see Table A2). Core 1 LOI_{1000} percentages begin at 1.99%, and then steadily decrease until 40 cmbs. Then, the values begin to increase and move towards 2% from 45-75 cmbs. The values then go above 2% at 75-80 cmbs, and steadily increase to above 3% by 125-130 cmbs. The values continue to increase above 3% from 125-205 cmbs, and then above 4% at 205-210 cmbs. Other than the value 3.51% at 210-215 cmbs. The percentages then remain above 4% until 230 cmbs, but then dips down to 3.4170%. The percentage then goes down below 3% (2.81%), and back up above (3.50%) in the last 10 cm of the core.

Core 2

General Overview

Core 2 is located close to the outer perimeter of the ditch, in the outer embankment, according to the LiDAR. Core 2 is 240 cm long, starting at an elevation of 276.74 m and ending at 276.02 m (see Figure A2 for core visual).

Soil Core Description

Core 2's profile consists of an Ap (0-23 cmbs), B1a (23-46 cmbs), B2b (46-72 cmbs), Bt1a (46-72 cmbs), Bt1b (98-118 cmbs), Bt2a (118-156 cmbs), Bt2b (156-177 cmbs), B2a (177-185 cmbs), B2b (185-191 cmbs), Bt2c (191-219 cmbs), and BC/C (219-240 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The B1 designation is used because of a slight increase in clay content from silty loam to silty clay loam but differentiated because there are differences in color. The Bt designation is used due to a significant increase in clay and differentiated between Bt1 and Bt2 because of a second increase in clay. There are variations in color, boundaries, mottling, and inclusions. The B2 horizon is used to differentiated abnormal horizons. The last horizon is identified as a BC/C like in Core 1 because it is a silty clay soil but has some disintegrated bedrock. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A2.

Magnetic susceptibility

i. Low frequency

The low frequency magnetic susceptibility values from Core 2 range from 7.99E-07 as the lowest value and 2.37E-06 as the highest (for detailed information about individual values every 5 cm please see Table A2). The first 5 cm of the core is a little low, with a value of 1.66E-06. From 5 cm down to 95 cmbs the values are fairly consistent, and only range from a low of 1.89E-06 and a high of 2.13E-06. Then from 95 to 105 cmbs the value is 2.37E-0, slightly higher than what is in the above section of the core. There is then a slight decrease in value from 105 to 120 cmbs, with a high of 2.21E-06 and a low of 1.78E-06. At 120-125 cmbs there is a significant decrease to 1.46E-06 which steadily decreases to 1.30E-06 at 145-150 cmbs. AT 150-155 cmbs h value becomes 1.06-06, then fluctuates down to 7.99E-07, and this fluctuation continues down to 165-170 cmbs and then stays low from between the values of 6.21E-07 and 8.90E-07 until 205 cmbs. Then, other than one significantly low value of 5.72E-07 at 220-225 cmbs, the value ranges from 205 to 230 cmbs, fluctuates between 1.01E-06 and 1.22E-06. The bottom 10 cm of the core (230-240 cmbs) goes up to 1.77E-06, then back down to 1.80E-06.

ii. Frequency dependent

The frequency dependent values of Core 2 range from 9.09% and 15.35% (for detailed information about individual values every 5 cm please see Table A2). The top 120 cm of the core are fairly consistent, with a range of just 9.09% to 10.4154%. Then at 120-125 cmbs there is an increase to 12.50%, and then a continued increase until the bottom of the core with a range of 13.53% to 15.35%, with particularly higher values in the lady 20 cm of the core (range of 14.54% to 15.35%).

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 2 range from 4.01% to 10.46% (for detailed information about individual values every 5 cm please see Table A2). The first value, as is typical, is the highest value because of the organic material near the surface. There is then a decrease to 7.73%

(5-10 cmbs), then 6.23% (10-15 cmbs). Then, the values dip below 6% from 15-65 cmbs, the below 5% from 65-95 cmbs. Then values go back above 5% from 95-110 cmbs, and then above 6% from 110-150 cmbs. There is a slight decrease below 6% (5.81%, then 5.20%) from 150-160 cmbs, then a spike to 7.18% (160-165 cmbs), then back below 6% (165-185 cmbs). For 185-230 cmbs values are a bit sporadic, with a range of 4.01% to 6.11%, with values going up and down. From 230-240 cmbs, values rise above 8% which is commonly seen across cores.

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 2 range from 1.51% to 5.02% (for detailed information about individual values every 5 cm please see Table A2). The first value is relatively higher at 3.04%, but then decreases below 2%, though just so and typically range from 1.8% to 1.9%, from 5-35 cmbs, with a spike above to 2.38% at 35-40 cmbs, but then back below, and steady decrease from 40-75 cmbs (range 1.83% to 1.51%), and then the values begin to increase, but stay under 2% from 75-100 cmbs, then go over 2% from 100-125 cmbs, then above 3% 120-180 cmbs, then above 4% (180-190 cmbs). The rest of the core has rather sporadic values, with a range 3.58% to 5.02% until the bottom of the core (240 cmbs).

<u>Core 3</u>

General Overview

Core 3 is located inside of the enclosure, in the inner embankment, based on LiDAR interpretations. Core 3 is 235 cm long and starts at an elevation of 277.02 m and ends at 274.67 m (see Figure A3 for core visual).

Soil Core Description

Core 3's profile consists of an Ap (0-24 cmbs), B1a (24-45 cmbs), B1b (45-76 cmbs), BC (76-120 cmbs), B1c (120-138 cmbs), B1d (138-200 cmbs), and Bt (200-235 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The B1 designation is used due to a slight increase in clay, and there are differentiations because of different colors, inclusions, and boundaries. The final horizon is Bt as there is a significant increase in clay, and no evidence for bedrock. It is very mottled and there are smaller and less frequent inclusions. This core is abnormal because the silty clay loam goes deeper than it typically would in a profile at this site. Other than the one disruption of the high clay-content soil, the stratigraphy of this core is fairly uniform. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A3.

Magnetic susceptibility

i. Low frequency

The low frequency magnetic susceptibility values in Core 3 range from 2.49E-06 as the highest and 6.95E-07 as the lowest value (for detailed information about individual values every 5 cm please see Table A2). Values begin relatively high for the top 45 cm of the core with a range of 1.92E-06 to 2.49E-06. Then a 45-50 cmbs the value decreases to 1.65E-06 and continues to decrease until 70-75 cmbs where there is then an increase to 1.86E-06 and values last around this until 90-95 cmbs where there is another increase to 2.12E-06. Values remain around this value, ranging from 1.93E-06 to 2.20E-06 until 125-130 cmbs. There is then a dip in values that begin at 1.64E-06, but steadily decrease. Values continue to get smaller, dropped to values around 1.22E-06, and they continue to decrease to below 1.0E-06 to 9.88E-07 at 170-175 cmbs. The values continue to decrease from there, decreasing down to 6.95E-07 at 205-210, and then back up to 8.60E-07 by the end of the core.

ii. Frequency dependence

The frequency dependent percentages range from 8.42% to 14.21% for Core 3 (for detailed information about individual values every 5 cm please see Table A2). Values begin low, comparatively to the rest of the core, ranging from 8.42% to 10.48% for the top 130 cm of the core. There is an increase to 11.27% at 130-135 cmbs and then a steady increase to the bottom of the core at 14.21%, with some up and down fluctuations, but no values less than the initial 11.27%.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 3 range from 4.09% to 9.92% (for detailed information about individual values every 5 cm please see Table A2). The first value from 0-5 cm is the maximum value, as is usual. There is then a slight decrease from 7.52% (5-10 cmbs), 6.26% (10-15 cmbs), and 5.66% (15-20 cmbs). From 20-95 cmbs, the value remains under 5%, but there is a decrease from 20-60 cmbs, then an increase from 60-95 cmbs. Then the values rise above 5%, with one exception at 105-110 cmbs that is just about 5% (5.00%), from 95-40 cmbs, approaching 6%. From 140-185 cm, the values are above 6%, with an increase from 140-160 cmbs, then a decrease 160-185 cmbs. From 185-230 cmbs the values remain below 6%, with fairly steady decrease, slight decrease towards the end. Then the final value rises back above 6% at 6.02% (230-235 cmbs).

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 3 range from 1.17% to 3.07% (for detailed information about individual values every 5 cm please see Table A2). The values begin at 1.33%, and then decreases until 45 cmbs. Then, there is a rise in values to 75 cmbs, but staying below 1.5%. Then, there is an abrupt high value of 3.07% (45-50 cmbs), and then the gradual rise continues from the value before this one to 110 cmbs. At 110-115 cmbs, the values rise above 2%, and continue to rise until 155 cmbs. The rest of the core the values stay below 3%, but are a bit sporadic, ranging from 2.66% to 2.96%.

<u>Core 4</u>

General Overview

Core 4 is one of two cores that are located inside of the ditch (see Core 7 for the other ditch core) based on the LiDAR. Core 4 is 143 cm long and starts at an elevation of 276.7 m and ends at 275.25 m (see Figure A4 for core visual). It is important to note that this is abnormally short due to the encounter of something (e.g., limestone) that prevented the auger from coring as deep as other locations.

Soil Core Description

Core 4's consists of an AP (0-13 cmbs), B1a (13-39 cmbs), B1b (39-63 cmbs), B2 (63-68 cmbs), Bt1 (68-117 cmbs), B3 (117-136 cmbs), and B4 (136-143 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field, which is slightly smaller than usual. The B1, B2, B3, and B4 designations are used due to changing clay and sand contents. The Bt1 designation is used for a significant clay content increase. This core is abnormal which is only highlighted by the fact that the core is so short. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A4.

Magnetic susceptibility

i. Low frequency

Core 4's low frequency magnetic susceptibility values range from 1.58E-06 to 2.26E-06 (for detailed information about individual values every 5 cm please see Table A2). The values for this core are a bit sporadic, which may be heightened by its abnormally short length. The first

5 cmbs have a value of 1.73E-06, which increases to 1.86E-06 in the next 5 cm. Then from 15 to 130 cmbs, values range from 1.89E-06 to 2.26E-06, going up and down throughout between those two values. Then, at 125-130 cmbs the value decreases to 1.71E-06, increases to 1.85E-06 (135-140 cmbs), then decreases to 1.58E-06 (140-143 cmbs).

ii. Frequency dependent

The frequency dependent magnetic susceptibility values range from 8.70% to 11.59% and are somewhat sporadic in terms of value and consistency (for detailed information about individual values every 5 cm please see Table A2). The entire core fluctuates between these values, with not many prominent patterns in the core values.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 4 range from 5.69% to 11.00% (for detailed information about individual values every 5 cm please see Table A2). The initial value is the maximum value, as is typical. There is then a steady decrease from 7.65% (5-10 cmbs), to 6.28% (10-15 cmbs). Then the value goes just under 6%, but hovers around the 6% mark from 15-45 cmbs (range 5.85% to 6.09%). Values then stayed above 6% from 45-105 cmbs, with a range of 6.09% to 6.69%. There was increase from 40 to 65 cmbs, then decrease from 64-105 cmbs. Then the values go under 6% from 105-120 cmbs, increasing back above (6.32% at 120-125 cmbs), back below from 125-135, and then an increase above 6% (135-140 cmbs), then above 7% (140-143 cmbs).

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 4 range from 1.81% to an anomalous value of 12.25% (for detailed information about individual values every 5 cm please see Table A2). The values begin at 1.91% and stay around this value until 30 cmbs. There is then a small spike to 2.45% from 30-35 cmbs, then values continue to be similar to the initial value from 35-55 cmbs. There is then a spike at 55-60 cmbs to 3.32%. The values then decrease to just under 1.9%. There is then another spike to 4.61% (70-75 cmbs), and then values decrease to about 2% from 75-110 cmbs. There is then an increase above 2% from 115-135 cmbs. At 135-140 cmbs, there is an anomalous high value of 7.80%, and then 12.25% in the final 3 cm of the core. Though the values are usually higher at the bottom, they are not usually this high.

Core 5

General Overview

Core 5 is located well inside of the enclosure, away from ditch and embankments according to the LiDAR data. This core was taken as a test core, which was meant to provide a normal stratigraphic profile for the site. Core 5 is 243 cm long and starts at an elevation of 277.02 m and ends at 274.69 m (see Figure A5 for core visual).

Soil Core Description

Core 5's profile consists of an Ap (0-21 cmbs), B1 (21-54 cmbs), Bt1 (53-85 cmbs), Bt2a (85-120 cmbs), BC1 (152-221 cmbs), and BC2 (221-243 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The B1 designation is used due to a slight increase in clay. The Bt1 designation is used for a significant increase in clay content, along with a Bt2 to highlight continued clay increase. The BC designations are used because of another increase in clay. Overall, this core is an accurate representation of what a core should look like in this region, making it the test core used for comparison of the other profiles; it is a representation for what is normal for the site outside of a human-altered context, other than modern alterations like plowing. This profile’s horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A5.

Magnetic susceptibility

i. Low frequency

The low frequency magnetic susceptibility values for Core 5 range from 8.00E-07 to 3.45E-06 (for detailed information about individual values every 5 cm please see Table A2). Core 5 begins with high values, ranging from 3.45E-06 to 2.11E-06 until 60-65 cmbs, with a steady decrease in values between 30-65 cmbs. The values continue to decrease, starting with 1.78E-06 at 65-70 cmbs, and steadily decreasing to 1.47E-06 at 90-95 cmbs, and then a slight increase in the next 10 cm back up to 1.67E-06 at 100-105 cmbs. Then, at 105-110 cmbs there is a significant increase to 1.94E-06, and then a spike to 2.33E-06 and then 2.70E-06 in the next 10 cm. Until 140-145 cmbs there remains fairly high values, with some decrease, ranging from 2.02E-06 to 2.44E-06. There is then a slight dip in values from 145-155 cmbs, to about 1.77E-06. There is then an increase in value from between 155 to 165 cmbs to just above 2.0E-06, then a slight decrease to 1.83E-06. At 170-175 cmbs there is a significant decrease in low frequency values to 1.31E-06, and then further decrease to until 220-225 cmbs, ranging from 1.07E-06 to the initial value of 1.31E-06. At 225-230 cmbs the values decrease below 1.0E-06, to 9.871E-07 and then continue to decrease to 8.00E-07 at the bottom of the core.

ii. Frequency dependent

The frequency dependent percentage values for Core 5 have a significant range from 6.78% to 15.84% (for detailed information about individual values every 5 cm please see Table A2). The frequency dependent values for this core are a bit sporadic, beginning with a middle of the range 10.09%, which then decreases slightly over the next 20 cmbs to a low of 7.97%, but typically not below 9%. There is then an increase at 30-35 cmbs back above 10%, then the next 10 cm it decreases to about 9.5 to 9.6%. Between 45-65 cmbs there is a fairly consistent value of approximately 10.4% (range 10.3985% to 10.4602%). There is then a decrease in values ranging from 8.73% to 9.82% in the next 15 cm. There is a spike in value at 80-85 cmbs of 12.08%. There is then a significant decrease in percentages with a range of 6.78% to 8.95% from 85-120 cmbs. There isa slight increase in values form between 120-175 cmbs with a range of 8.62% to 10.88%. There is then a significant increase in values from 175-210 cmbs ranging from 11.63% to a spike of 15.84% right at the end of this section. There is then a dip in values between 210-220 cmbs, with values of 9.75% and 8.30%. From 225-243 cmbs (bottom of the core), the values are similar ranging from 14.40% to 14.79%.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 5 have a range of 4.28% to 10.04% (for detailed information about individual values every 5 cm please see Table A2). The first value of this core is the maximum, as is typical. There is then also the typical steady decrease downward. A 15-20 cmbs the values go below 6% and continues into steady decrease until 60-65 cmbs at 4.29%. There is then an increase trend that begins at 65-70 cmbs begins at 4.43%, which continues until 110-115 with an end value just above 5%, at 5.15%. There is then a sudden pike to 8.90% at 115-120 cmbs. In the next 5 cm there is a start value of 4.87% which then begins a steady increase until 200-205 cmbs (above 5% at 130-155 cmbs, above 6% at 155-180 cmbs, and above 7%180-205 cmbs). There is then a slight decrease back under 7%, but still about 6.8-6.9%, and then another increase above 7% from 215-235 cmbs. The last 10 cm there is a decrease back below 7%.

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 5 have a range of 1.69% to 3.86% (for detailed information about individual values every 5 cm please see Table A2). The first value is 2.11%, which then follow a pattern of steady decrease until 30-35 cmbs at 1.70%. Then there is a period of values that range from 1.73% to 1.83% from 35-75 cmbs. There is then an increase at 75-80 cmbs to 1.85%, which then continues to remain within a range of this value to 1.96% until 115-120 cmbs. Then there is a significant increase to 2.8405, and then another increase to 3.30% from 120-125 cmbs. The values drop back down to about 2.1% and continue to steadily increase until about the end of the core (range of 2.10% to 3.88%), with some exceptions of slight dips.

<u>Core 6</u>

General Overview

Core 6 is located on the inside of the enclosure according to the LiDAR. It is located where there has been an inner embankment identified. The core is 234 cm long and begins at an elevation of 276.76 m and ends at 274.32 (see Figure A6 for core visual).

Soil Core Description

Core 6's profile consists of AP (0-22 cmbs), B1 (22-35 cmbs), Bt1 (35-50 cmbs), Bt2a (50-60 cmbs), Bt2b (60-77 cmbs), Bt2c (77-119 cmbs), Bt2d (120-143 cmbs), BC1 (143-194 cmbs), and BC2 (194-234 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The B1 designation is used due to a slight increase in clay. There is another clay increase, therefore the Bt1 designation is used. Bt2 signifies another increase in clay but is differentiated due to different colors and inclusions. The BC designations are used for another increase in clay, and the presence of mottling. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A6.

Magnetic susceptibility

i. Low frequency

Core 6's low frequency magnetic susceptibility values range from 7.20E-07 to 2.53E-06 (for detailed information about individual values every 5 cm please see Table A2). The beginning of the core has some fluctuations, but between the top of the core to 55 cmbs, the value range is 2.04E-06 to 2.53E-06. At 55-60 cmbs, the values then dip below 2.0E-06 and remain so until 90-95 cmbs with a range of 1.60E-06 to 1.98E-06. The values then go back above 2.00E-06 at 95-100 cmbs and continue until 135 cmbs with a range of 2.03E-06 to 2.50E-06. At 135-140 cmbs the values dip below 2.00E-06 and continue into a steady decrease for the rest of the core. At 185-190 cmbs the values go below 1.00E-06 to 9.92E-07. These values remain below 1.00E-06 for the rest of the core with a low of 7.20E-07.

ii. Frequency dependent

The frequency dependent magnetic susceptibility percentage values range from 8.72% to 14.33% (for detailed information about individual values every 5 cm please see Table A2). The first 80 cmbs stays approximately between 9% and 10%, with only one value going slightly above this range. From 80 cmbs to 145 cmbs the value range stays between 8.7% to just under 10%. At 145-150 cmbs the percentage increases to above 10% and continues to increase down through the rest of the core. Values increase above 10% at 170-175 cmbs, then a to about 12% to 12.5% between 185-195 cmbs. Then at 195-200 cmbs, the value raises above 13% for the rest of the core, with two instances towards the bottom of the core with the value increasing above 14%.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 6 range from 4.09% to 11.77% (for detailed information about individual values every 5 cm please see Table A2). As usual, the first 5 cmbs is the maximum value. There is then the regular decrease that begins just under 8% (5-10 cmbs), then goes to 6.41 (10-15 cmbs). Then values are about 6% or just under from 15-30 cmbs. Then, there is a significant decrease to just about 5% (30-35 cmbs), then below 5% and decreasing continues from 35-55 cmbs. Values remain under 5% but begin an upward trend from 55-95 cmbs. Values then increase above 5% but continue in the same steady trend upwards from 95-125 cmbs. There is then a dip in values, which is followed by other values under 6% that range from 5.10% to 5.99%. There is then a dip down to 4.86% (150-155 cmbs), but then an increase back to 5.75% which then continues in an upward trend until 210 cmbs. The final 20 cm are a bit sporadic with a decrease to just under 6%, then in increase above 6%, and then two values around 5.5%.

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 6 range from 1.19% to 4.11% (for detailed information about individual values every 5 cm please see Table A2). The first value begins at 1.66% and remains at around 1.6% until 20 cmbs. There is then an increase to 2.1691% (20-25 cmbs), then a slight decrease to 1.86% (25-30 cmbs). There is then another decrease to 1.50% which then leads into a steady downward trend from 30-55 cmbs, and then an upward trend that stays until 2% from 55-105 cmbs. Then, at 105-110 cmbs the value increases over 2% and continues in the same upward trend as before from 105-120 cmbs, then a downward trend from 120-135 cmbs. From 135-160 cmbs, values remain around 2%. There is then a sudden increase to 2.41%, which then steadily increases to be above 3% through 160-210 cmbs. There is then a sudden decrease at 210-215 to 1.19%, but then in increases to where previous values were trending, just about 3% from 215-230 cmbs. The final value is above 4% at 4.11% (230-235 cmbs).

Core 7

General Overview

Core 7 is the second of two cores taken within the ditch (see Core 4 for the other example) according to the LiDAR. The core is 215 cm in length and begins at an elevation of 276.76 m and ends at 274.71 m (see Figure A7 for core visual).

Soil Core Description

Core 7's profile consists of an AP (0-19 cmbs), B1a (19-110 cmbs), B1b (110-142 cmbs), B1c (142-189 cmbs), and BC (189-215 cmbs). The top horizon is an Ap because it is a darker silt loam in a plowed field. The Bt1 designations are used due to an increase in clay. They are differentiated due to differing inclusions. The BC designation is used as there is an increase in clay and mottling. Though these horizons are continuous, this does not mean they are normal for the site. This core is abnormal as it is continuous and has silty clay loam deeper than it should if unaltered. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A7.

Magnetic susceptibility

i. Low frequency

Core 7's low frequency magnetic susceptibility range is from 7.92E-07 to 2.20E-06 (for detailed information about individual values every 5 cm please see Table A2). The values do not increase above 2.00E-06 until 40-45 cmbs and begin at 1.74E-06. The values then hover in the upper 1.80E-06 to just above 2.00E-06 until 180 cmbs with a range of 1.80E-06 to 2.16E-06. At 180-185 cmbs, the value is 1.66E-06, and continues to decrease for the rest of the core. At 200-205 cmbs the values do not increase back above 1.00E-06, with a minimum of 7.92E-07.

ii. Frequency dependent

Core 7's frequency dependent percentage values have a range of anomalous values of 2.10% to 17.18% (for detailed information about individual values every 5 cm please see Table A2). Without these values, the range is 8.95% to 12.85%. The high value is the first 5 cmbs. There is then a value range of just about 9% to just over 10% until 20-25 cmbs. Then at 25-30 cmbs there is the anomalous low percentage of 2.10%. Other than one high value above 11% at 35-40 cmbs, from 30-175 cmbs, the values range from about just over 9% to low 10%'s (range 9.38% to 10.70%). At 170-175 cmbs, the values then increase above 11%, and for the rest of the core remain between 11% and nearly 13% (11.42% to 12.85%).

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core 7 have a range of 4.79% to 10.49% (for detailed information about individual values every 5 cm please see Table A2). As is typical, the first 5 cm has the maximum value. As is typical, the second value is also higher at 7.71%. There is then a decrease to below 6%, and this downward trend continues from 10-35 cmbs, all above 5%. Then here is a spike at 35-40 cmbs to 8.40%. Then, the trend of over 5% continues with a steady increase from 40-60 cmbs. At 55-65 cmbs, there are two values above 6%, but not greater than 6.3%. The values then dip back down to below 6%, at 70-75 cmbs with a starting percentage of 5.45%. These values remain above 5% from 70-90 cmbs, and then at 90-95 cmbs the values are just about 5% and remain around this value from 90-130 cmbs. There is then a slight decrease to 4.79%, and then an increase above 5% again ranging from 5.07% to 5.52% from 135-160 cmbs. At 160-165 cmbs, values decrease below 5%, and remain so from 160-185 cmbs, with no value going below 4.8%. At 185-190 cmbs, value increase above 5% (range 5.41% to 5.79%), and then at 200-205 cmbs, value raise above 6% (range 6.01% to 6.48%).

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 7 range from 1.75% to 2.70% (for detailed information about individual values every 5 cm please see Table A2). The first value starts at 2.51% and remains between 2.4% to just under 2.7% from 0-30 cmbs. There is then a sudden decrease at 30-35 cmbs, to 1.75%, which then increases to 2.37% (35-40 cmbs), which then stays between 2.2% to about 2.5% from 35-105 cmbs. At 105-110 cmbs, there is a trend upwards that begins at 2.55, and values remaining between 2.5% and about 2.7% from 105-125 cmbs. There is then a dip in values to 1.83% There is then a decrease in values that range from about 1.7% to around 2.1% from 125-185 cmbs. There is then an increase and the rest of the core (185-215 cmbs remains between 2.3% and 2.7%. Values for this core exist within a 1% range and are fairly consistent.

Core 8

General Overview

Core 8 is located on the outside of the ditch. It is located in the outer embankment, as identified in the LiDAR data. The core is 240 cm long and begins at the elevation 276.7 m and ends at 274.58 m (see Figure A8 for core visual).

Soil Core Description

Core 8's profile consists of an AP (0-24 cmbs), B1 (24-41 cmbs), Bt1a (41-109 cmbs), Bt1b (109-118 cmbs), Bt2a (118-131 cmbs), Bt2b (131-152 cmbs), Bt2c (152-177 cmbs), Bt2d (177-215 cmbs), and BC/C (215-240 cmbs). The top horizon is an Ap as it is a darker silt loam in a plowed field. The Bt1 designation is used because there is an increase of clay, but are differentiated due to differences in color, mottling, and inclusions. The final horizon is a BC/C, which appeared to have a higher sand content, but this could have also been fine bedrock fragments, therefore making this more of a BC/C. However, here it is identified as a BC because it did not have enough clay and the bedrock as not as explicit as other cores. This profile's horizon, color, texture, inclusions, mottling, and boundaries are recorded in Table A1 and Figure A8.

Magnetic susceptibility

i. Low frequency

The low frequency magnetic susceptibility values from Core 8 range from 6.59E-07 to 2.13E-06 (for detailed information about individual values every 5 cm please see Table A2). The first 15 cm remain below 2.00E-06, but then rises above at 15-20 cmbs to 2.02E-06. Then, values range between 1.85E-06 to 2.13E-06 for the next 35 cm, until 50-55 cmbs. There is then a slight decrease in values which remains between 1.66E-06 to 1.89E-06 until 115 cmbs. At 115-125 cmbs there is a significant decrease with values at about 1.55E-06. AT 130-135 cmbs, values continue to decrease to just over 1.00E-06, and then dip below that mark at 140-145 cmbs. The rest of the core increases above 1.00E-06 twice for the rest of the core at 200-205 cmbs and 235-240 cmbs, but otherwise the range is 6.59E-07 to 9.72E-07.

ii. Frequency dependent

The frequency dependent magnetic susceptibility percentage values for Core 8 are quite sporadic. The range is between 7.99% to 14.49% (for detailed information about individual values every 5 cm please see Table A2). The first 20 cm remains under 10%, ranging from 8.57% to 9.47%. At 20-25 cmbs the value reaches above 10% at 10.22%, but then dips below again to similar values as above until 40-45 cmbs where there is a value of 11.2791%. Values then remain just under 8% to just under 10% until 95-100 cmbs (range 7.99% to 9.97%). There is then an increase of values around 10% for the next 15 cm (9.77% to 10.47%), with a dip at 115-

120 cmbs to 7.99% and then back up to similar values for the next 5 cm. Then there is an increase of values above 12%, except one dip to 11.64% for the next 30 cmbs, ending at 150-155 cmbs. There is then a dip down (9.90%), back up (13.04%), then down again (10.52%). Then, the values remain higher (12.20% to 14.49%) until 210-215 cmbs. There is a dip at 215 cmbs to 11.0%, and then an up and down value range until the end of the core fluctuating between about 10% and 13%.

Loss on ignition

i. Burn at 550°C

The LOI_{550} percentages for Core8 the range is 3.62% to 11.72% (for detailed information about individual values every 5 cm please see Table A2). The first value is the maximum, as is typical. The second value is still high at 8.12% which is also usual for the top 10 cmbs. There is then a decrease to 6.57% (10-15 cmbs), and then continued decrease to 5.57% (15-20 cmbs). This value initiates a downward trend from 20-50 cmbs, which then becomes an upward trend from 50-85 cmbs, with one disruption at 60-65 cmbs of a low value of 3.62%. The upward trend then continues until 80-85 cmbs. There is then a high spike at 85-90 cmbs, at 7.47%. After the high spike, the steady upward trend continues and is above 5% until 120-125 cmbs, then there is a slight jump and value go above 6% and remain above 6% from 125-170 cmbs. At 170-175 cmbs there is a disruption with a low value at 5.74%, and then there are 10 cm more of values above 6%. Then values decrease and remain between 4.7% to about 5.5% (185-235 cmbs). The final value for the core is higher at 6.14%.

ii. Burn at 1000°C

The LOI_{1000} percentages for Core 8 ranges from 1.49% to 4.29% (for detailed information about individual values every 5 cm please see Table A2). Values begin at 1.59%, and then there is inconsistent up and down shifts between 1.4% to about 1.9% from the top to about 105 cmbs. There is then an increase well above 2% to 2.43% at 105-110 cmbs. Values remain above this value to around 3% from 105-180 cmbs. Values then increase above 3% consistently for the rest of the core, not going above 4.3%, with one exception at 225-230 cmbs with a low spike to 2.09%.

Radiocarbon & Bayesian Modeling Analyses

All radiocarbon dates evaluated as part of this research are in Table 4, which includes both dates in the model and those that are not. With so few dates, modeling the remaining dates was done in a way that sought to make no unsupported assumptions. Therefore, the dates were modeled as one phase of contiguous "occupation" of the site. "Occupation" for this model is defined as any activity relating to the use of the post structure or ditch.

The estimated dates for the contiguous phase are presented in Table 5. The model estimates the use and construction of Peter Village started in *1265-420 BC* (*95% probability*; Fig. 34; *Boundary Start Peter Village*) and likely in *815-495 BC* (*68% probability*; Fig. 34; *Boundary Start Peter Village*); the median falling at *690 BC (95% probability)*. The two dates from post fills model differently from one another, with Post 4 modeling to *750-415 BC* (*95% probability*; Fig. 34; *R_Date Post 4*), and likely *735-420 BC* (*68% probability*; Fig. 34; *R_Date Post 4*). However, Post 12 only models to *395-205 BC* (*68% probability*) or *420-150 BC* (*95% probability*; Fig. 34; *R_Date Post 12*). On the other hand, two of the ditch dates model to be very close in age, with Ditch Date 3 (165-185 cmbs), *modeling to 340-150 BC* (*68% probability*; Fig. 34; *R_Date Ditch 3*) or *345-105 BC* (*95% probability*; Fig. 34; *R_Date Ditch 3*), and Ditch Date 2 (125-130 cmbs) modeling to *345-165 BC* (*68% probability*; Fig. 34; *R_Date Ditch 2*) or *350-110 BC* (*95% probability*; Fig. 34; *R_Date Ditch 2*). However, the third date, Ditch Date 1 (100-

110 cmbs) models to be much later at 4*0 BC-AD 30 (68% probability*; Fig. 34; *R_Date Ditch 1*) or *45 BC-AD 60 (probability 95* Fig. 34; *R_Date Ditch 1*).

It is important to recognize some limitations to this model. First, there are not many dates, therefore a complex model of which certain aspects are accounted for is not possible (multiple phases, outliers, etc.). Second, though the post dates are from single posts, it is important to recognize that the post dates reflect when the tree the post is made out of stopped taking in carbon, not necessarily its exact time of use. However, even accounting for these two limiting variables, the dates surrounding occupation come back very early, and the post structure dates significantly earlier than the enclosure.

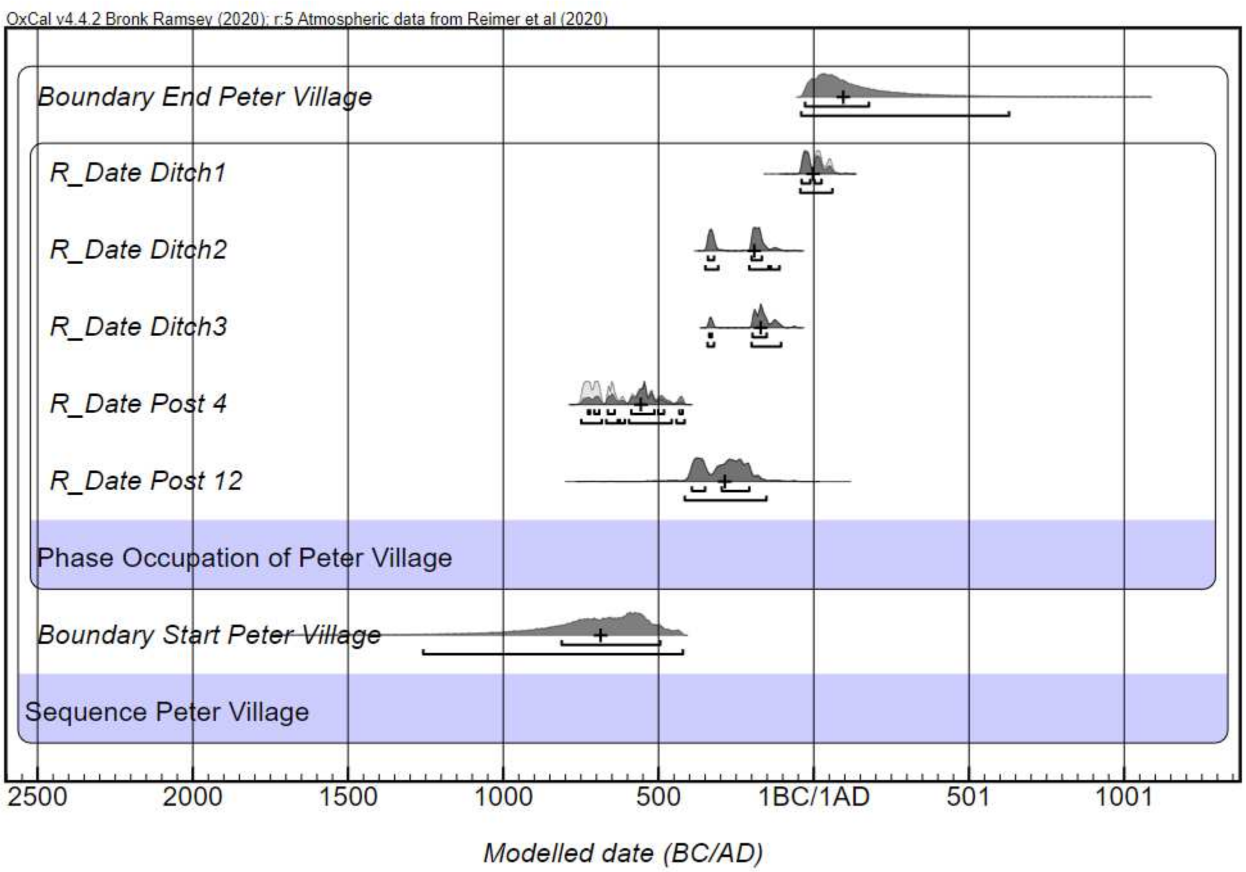

Figure 34. Modeled results from OxCal v4.4.2.

Table 4. All radiocarbon dates taken from the Peter Village site.

Lab #	Material Dates	^{14}C age (BC)	±	Context Location	Pooled/ Single	Used in OxCal?
Beta-7758	Post wood charcoal	610	90	Posts 3 and 4	Pooled	No
Beta-7755	Post wood charcoal	310	60	Post 12	Single	Yes
Beta-7756	Unidentified wood charcoal	190	10	Charcoal layer in ditch (165-185 cm)	Single	Yes
Beta-7757	Unidentified wood charcoal	270	100	"Between the ditch and stockade" (Clay 1985:15).	Single	No
-	Bone	-	-	Bottom of Feature 2 (pit).	Single	No
-	Bone	-	-	Bottom of Feature 4 (pit)	Single	No
243198	Post Mold L4	515	15	60.5 L2 E.	Single	Yes
243199	Unidentified wood charcoal	50	15	Ditch 100-110 cm	Single	Yes
243200	Unidentified wood charcoal	205	15	Ditch Core 7 125-130 cm	Single	Yes

Table 5. Modeled radiocarbon dates using OxCal v4.2.2.

Name of Phase	Modelled Dates (BC/AD)						
	From	To	%	From	To	%	Median
Start Boundary of Peter Village Occupation	815 BC	495 BC	68	1265 BC	420 BC	95	690 BC
Date, Post 12	395 BC	205 BC	68	420 BC	150 BC	95	285 BC
Date, Post 4	735 BC	420 BC	68	750 BC	415 BC	95	560 BC
Ditch Date 3 (165-185 cmbs)	340 BC	150 BC	68	345 BC	105 BC	95	170 BC
Ditch Date 2 (125-130 cmbs)	345 BC	165 BC	68	350 BC	110 BC	95	190 BC
Ditch Date 1 (100-110 cmbs)	40 BC	AD 30	68	45 BC	AD 60	95	5 BC
End Boundary of Peter Village Occupation	30 BC	AD 180	68	45 BC	AD 630	95	AD 95

Chapter 6: Discussion

The archaeogeophysical and geoarchaeological investigations conducted on data collected from the Peter Village site provides new information regarding the delineation of the site with new data regarding the inner embankment and outer embankment and the discovery of a possible entrance and related internal linear feature(s). Other data collected from radiocarbon dating suggests that the post structure once present at Peter Village came before the enclosure. However, the radiocarbon dates from Peter Village presented in this research are modeled with early potential start dates around, or even before, 350 BC, which is cited by some scholars as when the widespread practice of earthen enclosure construction in the Middle Ohio Valley region began to become popular (Wright 1990). Not only does this research help to detect and better understand these features, but it also demonstrates the benefits to a multiple method approach. It is only with such a diverse array of datasets that a discussion of space at the Peter Village site is possible. This multiple method study at the Peter Village site is an example of how using multiple methods can provide insight into small scale societies from the past on more theoretical subjects, such as the spatial delineation of landscapes.

Two Embankments

The methods used in this investigation provide evidence for a dual embankment to be present on either side of the ditch. This was briefly considered by Clay (1985, 1988) based on his electrical resistivity survey, however, there remains uncertainty whether the embankment he detected was just on the inside, or if his results showed evidence for possibly two embankments. Regardless, there was no research that interrogated this possible phenomenon any further than speculation. With these new methods applied to the site, there now exists multiple lines of evidence for a second embankment.

I first observed what could be described as an exterior embankment in the LiDAR data enhanced using the Relief Visualization Toolbox. As discussed above, there are indications in the visualizations, notably Sky View Factor and Positive-Openness, of the possibility of a feature on both the inside and outside of the ditch given the width and values of data on either side of the ditch (Figure 13). Using the Elevation tool in ArcGIS Pro on the LiDAR, elevation profiles were drawn which continued to hint at the embankment's presence with patterns matching a high-low-high pattern around most of the enclosure (Figures 15-19).

After processing the surface geophysical data, more evidence emerged for two embankments. The magnetometry collected using the Foerster Ferex for the larger surveys also show evidence for the presence of the embankments with the high-value magnetic ditch surrounded by low-value magnetics on either side (Figures 21-23). Also, the Bartington gradiometer in the small survey area in the southern portion of the site shows the same low, high, low patterning but in much more detail (Figure 24). Similar patterns of low magnetics representing embankments are found by Burks (2014) at the Steel Group earthen works. He describes this phenomenon as having happened as a result of the result of the removal of topsoil, and/or the using of subsoil to construct the embankment (Burks 2014:6-7).

In the 50 cm coil conductivity, there appears to be a clear, high conductivity arching figure on either side of the ditch which would match the suspected locations of the embankments (Figure 30). High conductivity readings have been found in relation to embankments when they are erased from the surface due to good water retention (Burks 2014; Burks and Cook 2011; Jefferies et al. 2013). These same patterns are seen in the 50 cm coil magnetic susceptibility, except there are low magnetic readings on either side of the high ditch reading (Figure 30).

Again, this pattern is expected in magnetic data relating to the embankments due to the removal of the topsoil (Burks 2014:6–7).

Finally, the lab analyses of the soil continued to suggest the presence of two embankments. In the analysis of the cores, the first 1.5 m below surface are focused on, as this is the expected maximum depth of the ditch and embankments based on the surface geophysical data, specifically the conductivity collected with the 1 m coil 1.5 m below surface of which the embankments and ditch are no longer present. Based on the LiDAR and surface geophysics, Cores 3 and 6 were taken from the inner embankment. When compared to Core 5, the test core, Cores 3 and 6 have very mixed colors (Figures A3, A5, and A6). Core 3 even has consistent mottling throughout nearly the entire core. Furthermore, the low frequency magnetic susceptibility of the first 1.5 m of Cores 3 (1.88E-06) and 6 (2.09E-06) averages lower than the magnetic susceptibility readings in Core 5 (2.18E-06) (Table A2).

The outer embankment cores based on LiDAR and surface geophysics are Cores 1, 2, and 8. Core 1 and 8 has a similar soil profile to Cores 3 and 6, with mixed up soil colors (Figures A1, A3, and A8). Core 8 has consistent mottling throughout most of the core, and some mottling present in Core 1. Core 2 has more consistent color, particle size, and texture column as the test core (Figure A2). However, Core 2 does have many different soil horizons identified, suggesting some mixing, and also is a more complex profile than the average profile for the region. The low frequency magnetic susceptibility also trends lower in Cores 1 (1.97E-06), 2 (1.88E-06), and 8 (1.68E-06) than in Core 5 (2.18E-06), similar to the inner embankment cores (Table A2).

Though the LOI did not show any strong evidence for the presence of two embankments, the data does suggest that there were not multiple construction events based off the lack of high calcium carbonate or organic material readings found throughout the data representing vegetation being allowed to grow due to exposure to the surface. One important thing to note is that there is a spike seen across some of the LOI soil core profiles, including Cores 1 ($LOI_{550^\circ C}$ and $LOI_{1000^\circ C}$), 3 ($LOI_{1000^\circ C}$), 4 ($LOI_{1000^\circ C}$), 5 ($LOI_{550^\circ C}$ and $LOI_{1000^\circ C}$), 8 ($LOI_{550^\circ C}$) between 275.3 to 276.2 m elevation (Figures A1, A3, A4, A5, and A8). What this spike represents in the landscape is uncertain, though it is possible it is a result of modern earth moving events associated with the house.

Other Features: Entrance, Linear Feature(s), and Unrelated Natural/Cultural Features

Though the embankments were the main features investigated in this research, there are other notable features to discuss. The gap in the enclosure found in the southern portion of the magnetometry survey is in a similar area depicted in the historical drawing/rendition of the entrance (Figure 35). To a lesser extent, this gap is also present in the LiDAR. Based on the magnetometry, historical references, and LiDAR, it is likely that this could be the location of an entrance to the enclosure. Furthermore, in the magnetometry data, there appears to be linear features connected to, as well as near, the opening in the enclosure (Figure 23 and 24).

It is also important to acknowledge that there are many natural and cultural features seen within this data which can lead to the obscuring of data related to the Peter Village enclosure. For example, there is a lightning scar found in the southern magnetometry survey area, with similar signatures seen in other studies (Figures 23 and 24). There are also horse paths, roads, and other walkways that appear throughout the site, as seen prominently in the magnetometry. In addition, there are buildings and farms/farming activity (plow scars, water drainage, etc.) seen throughout the study area. There is also a high content of magnetic debris seen in the magnetometry data across the site. It is important to identify these features as to not mistake them for archaeological features relevant to the enclosure.

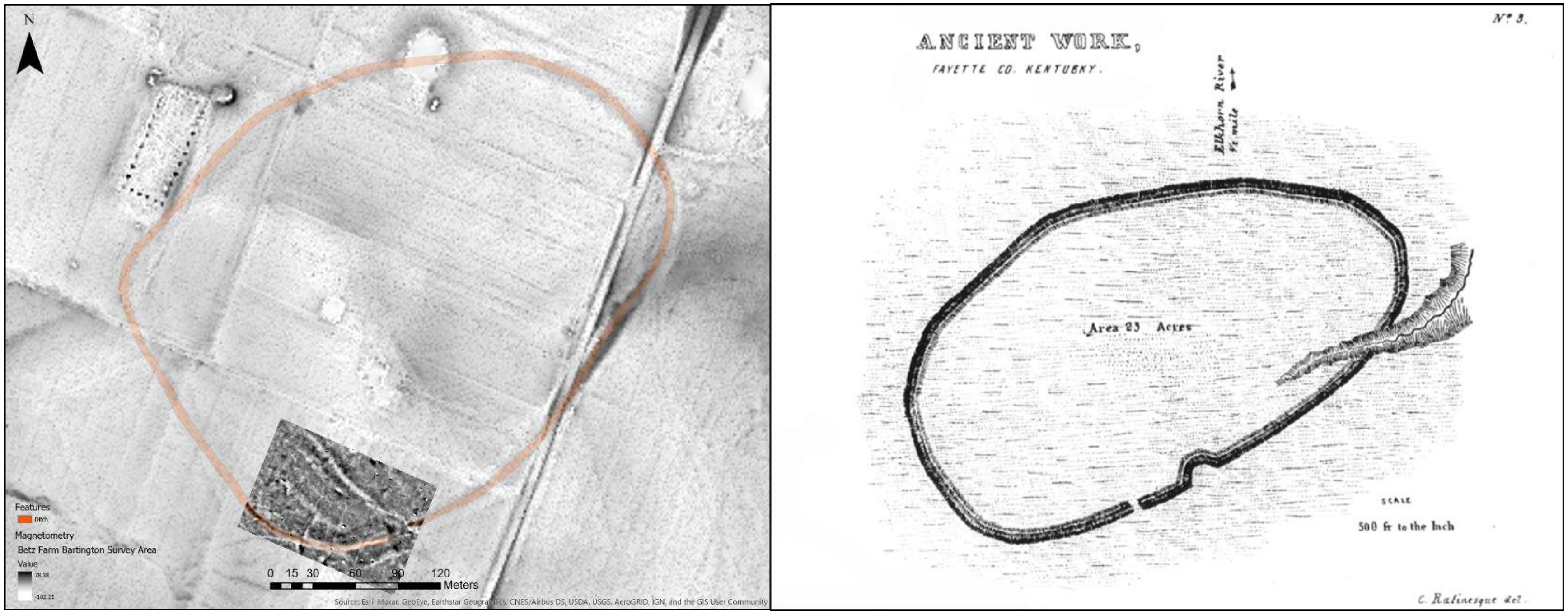

Figure 35. LiDAR and Bartington magnetometry of the Peter Village enclosure (left), historical drawing of Peter Village enclosure (Clay 1985, Figure 2 [Squier and David 1848, Plate XIV, No. 4).

The Chronology of Peter Village

Part of this research was also to evaluate the chronology of the Peter Village enclosure. With the new radiocarbon dates, as well as the Bayesian analysis including both new and legacy radiocarbon dates, I was able to reevaluate the initial timeline of site use presented by Clay (1985, 1988). The modeled radiocarbon dates presented in this research contain two modeled dates related to enclosure activity similar to Clay's suggested start occupation date of 300 to 200 BC (*Ditch Date 3* and *Ditch Date 2* in Fig. 34), with *Ditch Date 1* modeling later. Also, the post enclosure appears to have come before the earthen enclosure with *R_Date Post 4* and *R_Date Post 12,* though *R_Date Post* 12 models closer to the ditch dates. With the evidence from this model, I believe that Clay's proposed start date of occupation related to the earthen enclosure around 300 to 200 BC is accurate based on the present information.

It is important to acknowledge that without any dated material associated with the embankments, it is currently not possible to understand the temporal nature of the embankments in relation to one another or the ditch. It is possible that one of the embankments was constructed before the other; perhaps the inner embankment to keep something in, or the outer to keep something out, as suggested in Warner (2000). It is also possible that they were constructed at the same time, which would force us to reconsider the dichotomy of what it means to have an embankment on the inside or outside of a ditch all together.

Another important aspect of the chronology of Peter Village enclosure is situating its use within the Mt. Horeb Complex. This ritual complex contains the Winchester Farm site, which was recently discussed by Henry et al. (2021). Winchester Farm is a more regularly shaped enclosure for the Middle Ohio Valley; it is a small geometric 'squircle'. When considering the radiocarbon chronology of both enclosures, it appears that the Winchester Farm enclosure was built much later than the Peter Village earthen enclosure with possible dates of *cal AD 65–215* (*95% probability*); and *cal AD 80–170* (*68% probability*) from the Winchester Farm embankment (Henry et al. 2021: 18-19). Not only do these dates reflect a later timeline, they also likely represent dates relating to the construction of the enclosure. However, dates regarding Peter Village's enclosure are from the ditch, Ditch Date 3 (165-185 cmbs), *modeling to 340-150 BC* (*68% probability*; Fig. 34; *R_Date Ditch 3*) or *345-105 BC* (*95% probability*; Fig. 34; *R_Date Ditch 3*) and Ditch Date 2 (125-130 cmbs) modeling to *345-165 BC* (*68% probability*; Fig. 34; *R_Date Ditch 2*) or *350-110 BC* (*95% probability*; Fig. 34; *R_Date Ditch 2*). Ditch Date 1 (100-110 cmbs) models to be later at 4*0 BC-AD 30* (*68% probability*; Fig. 34;) or *45 BC-AD 60* (*probability 95%*; Fig. 34;), and likely are from the end of use at the site because the ditch was being refilled.

Therefore, it appears that in this ritual landscape there was a shift in use from an earlier, large, and non-geometric enclosure (Peter Village) to a small, geometric, and later enclosure (Winchester Farm). This shift may reflect social transformations involving a decrease in population from the time when Peter Village was constructed, to the construction of Winchester Farm. The purpose of the two enclosures were likely vastly different; Peter Village is an enclosure meant to be an inclusive space for a general population and Winchester Farm's enclosure is only meant for certain people. There could have been the same number of people using both enclosures, or perhaps smaller groups over a larger period of time used Winchester Farm. With the range of possible explanations for why the two enclosures were so different, it is important to keep an open mind to the importance of how a shift of use over time between the two enclosures within the Mt. Horeb complex could have impacted the interactions between groups of people within this ritual landscape.

Peter Village & the Delineation of Space

In Chapter 2, I proposed this research question: How did Adena societies delineate space at Peter Village? In this research, I provide evidence for an earthen enclosure that matches previously estimated sizes proposed by scholars, with a ditch with an embankment on either side, and more data to support an early occupation. With a non-geometric, massive, early, and abnormally delineated enclosure in mind, this makes Peter Village not only one of the largest enclosures associated with the Adena constructed in the Middle Ohio Valley, but also one of the earliest.

The data in this research highlights the intense amount of labor that was needed to construct such a monument as different from the labor input into the typically much smaller earthen enclosures constructed within Adena societies. It was an *enormous* structure that required immense amounts of labor, resources, and time from multiple "households," across a greater regional landscape. It was very *visible* to the people using it, and both *unique* and *ubiquitous*; it is abnormal in shape and size; however, it is also common for people of this regional time period to construct earthen monuments, more generally. It has many of the traits of monumentality as have been discussed with some traditional definitions and interpretations of the concept.

However, thinking back to Osborne (2014)'s definition which defines monumentality as "an ongoing, constantly renegotiated relationship between thing and person, between monument/s and person/s experiencing the monument," (3), I believe that the Peter Village enclosure's unique and early form supports the notion that the people who occupied this site would have had an important relationship with the enclosure that influenced their everyday lives. However, it does not mean that the final form of Peter Village is the only experienced monumentality at the site. The earlier post enclosure, too, may have been experienced in a similar fashion. Both the post structure and the earthen enclosure required specialized knowledge, engineering, and immense amounts of labor with organized construction events that would have brought together dispersed populations to participate under a common social identity.

In this research, I provide an example of an alternative expression of monumentality that can be included to broaden and expand the Adena narrative. Throughout this discussion, I identify Peter Village as an Adena enclosure. However, it is important to remember that "Adena" is a cultural unit constructed by archaeologists. In the past, it has provided a somewhat "monothetic" perspective of the groups of people making up the Adena by providing a list of characteristics that all those within this cultural phenomenon should adhere to (e.g., small, geometric enclosures, the importance of mortuary ritual, etc.). However, as the Adena is a label created by archaeologists to better understand the past, it does not consist of peoples who conformed to exact social norms, but instead were a dynamic population that changed over space and time. As this might be one of the earliest examples of an Adena earthen enclosure, Peter Village therefore expands the possibilities of the Adena timeline. Peter Village also challenges current notions of what activity areas developing at the time looked like. With Peter Village's early occupation, it is possible that this enclosure helped to shape the development of earthen monument construction as a way for people to organize and come together across the larger regional landscape to create and maintain common social identities for those defined by scholars as Adena.

This research demonstrates the usefulness of a multiple method approach when studying small-scale societies of the past. Being able to observe landscape-scale patterning of the built environment enables my research, and others like it, to explore previously elusive questions. In this study, I use a multi-scalar approach to observe a monumental landscape with a unique form. From there, I built on this simple notion to explore the details of how space was delineated at the Peter Village site. Then, with the addition of temporal data from modeled radiocarbon dates, I was able to locate the unique space of Peter Village in time. With Peter Village situated both spatially and temporally, I am able to discuss more profoundly the meaning of this monument, as well as how it was experienced by peoples of the past through its monumentality. By applying a multi-scalar approach more frequently across archaeology, small-scale societies have the potential to become more archaeological visible.

Future Research: The Use of Peter Village

Though much information was collected and understood about the Peter Village site, there is still much to explore and understand about the nature of this past. Finer resolution surface geophysical surveys employed over a larger area would provide clearer evidence and information regarding many of the features discussed in this research. Areas of particular interest include the entrance, inside of the enclosure, and the missing portions of the enclosure. Beyond further geophysical investigations, more data collected in the form of artifacts and materials to be radiocarbon dated would also enable a further evaluation of not only how, but *when* people were using space across the Peter Village site more concretely. It is also important to acknowledge possibly limitations of future research, such as landowner permission, which has been a problem in the past.

Further geoarchaeological investigations into the entrance could be applied to confirm or refute the area as the location of an entrance, as well as the linear feature(s) relation to the entrance. By better understanding these features, how people were able to interact and move through the internal portion of the enclosure can be better understood. This is also why the inside of the enclosure is important for future research. Other than the work done in the 1980s, as well as small portions described in this research, very little of the inside of the enclosure has been explored. Further geophysical investigations can explore any potential spatial patterning that may exist. Another important area of study would be both further explorations of the parts of the enclosure that have not yet been explored. With further exploration of the nature of how the site is delineated, especially given the abnormal shape and size of the enclosure, this can contribute significantly to understanding the produced monumentality of the earthen monument with a better idea of how people used it to enclose space, as well as construction patterns.

It is important to note that though there may be the desire to further investigate Peter Village, limitations may exist in the form of permission from landowners. In the past, this served as a problem and limited the studies that took place. Other limiting factors are that this area has been heavily used in more recent years with the mentioned residences and businesses. This had led to not only historic debris, but also the disturbance of certain areas of the site with farming activity.

Chapter 7: Conclusion

The Peter Village enclosure is likely one of the earliest examples of earth-moving in the Middle Ohio Valley. However, it is not a traditional mound, but instead a strikingly large enclosure that is non-geometric, it is now understood to be delineated by a ditch with two embankments, one on either side. This unique delineation of space, a phenomenon not seen anywhere else in this region during the Early and Middle Woodland Period, sets the Peter Village enclosure apart from other earthen monuments constructed at the time.

The methodological approach in this investigation relied heavily on its multiplicity; with so many archaeological methods applied, I collected data at a variety of scales. The multi-scalar data produced in this research allowed for the observation of an entrance and a dual embankment, previously proposed by researchers. Also discovered were linear features in the southern portion of the site which may have altered people's movement within the enclosure, which were previously unknown. These features, both newly discovered and reevaluated, provide a better notion of how people of the past delineated space at Peter Village. These features would have all required immense labor efforts, and therefore populations typically dispersed across the regional landscape would have to come together to construct these monuments. These labor events would have been carefully planned, with experts having specialized construction and engineering knowledge to be able to construct these impressive earthen structures (Kidder and Sherwood 2017; Sherwood and Kidder 2011). Over the course of time that the earthen enclosure, and perhaps also the earlier post structure, were built, people would interact with one another to create and maintain common social identities. The memories of formation of their common identities would become associated with Peter Village, therefore establishing the lived experience of monumentality between themselves and the enclosure.

I interpret Peter Village as part of the archaeological cultural unit of “Adena.” Peter Village expands the notion of Adena towards an earlier start date, as well towards a more polythetic perspective of possible cultural practices they would have potentially participated in. Though Peter Village still represents an earthen enclosure, it is an unusual expression of one. Therefore, the lived experiences associated with this monument would not have been the same as those with the more common earthen monuments at the time.

There is still much about Peter Village that remains incomplete or unknown. However, pursuing research with sites like Peter Village enables a development in research of small-scale societies and the possible datasets that archaeologists can collect to better explore theoretical questions. Peter Village is an early and unique expression of monumentality within the larger regional context of the Middle Ohio Valley, as well as within the Adena cultural unit. Without the vast multi-scalar dataset collected and analyzed as part of this research, our understanding of this site would have been greatly limited. Therefore, in future research regarding small-scale societies, researchers should look to multi-scalar approaches to research, as demonstrated in this thesis.

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APPENDIX A: SOIL CORE ANALYSIS, MAGNETIC SUSCEPTIBILITY & LOSS-ON-IGNITION

Soil core analysis including soil core description, magnetic susceptibility, and loss-in-on-ignition of the eight soil cores from the Peter Village site.

Table A1: All cores detailed soil core descriptions.

Cores	*Horizon*	*Depth cmbs*	*Start elevation (m)*	*End elevation (m)*	*Wet Color*	*Dry Color*	*Texture*
Core 1							
	Ap	0-20	276.68	276.48	10YR3/4	10YR5/3	silty loam
	B1a	20-45	276.48	276.23	10YR4/4	10YR5/4	silty clay loam
	B1b	45-96	276.23	275.72	10YR4/6	7.5YR5/4	silty clay loam
	B1c	96-121	275.72	275.47	7.5YR3/4	10YR4/3	silty clay loam
	Bt1	121-147	275.47	275.21	10YR4/4	10YR4/4	silty clay loam to silty clay
	Bt2a	147-198	275.21	275.01	7.5YR2.5/3	10YR4/3	silty clay
	Bt2b	198-225	275.01	274.47	7.5YR3/3	10YR4/4	silty clay
	BC/C	225-243	274.47	274.24	7.5YR2.5/3	10YR4/2	silty clay to clay
Core 2							
	Ap	0-23 cm	276.74	276.51	10YR3/4	10YR5/3	silty loam
	B1a	23-46 cm	276.51	276.28	10YR4/4	10YR5/4	silty clay loam
	B1b	46-72 cm	276.28	276.02	10YR3/6	10YR6/3	silty clay loam
	Bt1a	72-98 cm	276.02	275.76	7.5YR4/6	10YR5/4	silty clay loam-silty clay
	Bt1b	98-118 cm	275.76	275.56	7.5YR3/4	10YR5/3	silty clay loam-silty clay
	Bt2a	118-156 cm	275.56	275.18	7.5YR3/4	10YR4/4	silty clay
	Bt2b	156-177 cm	275.18	274.97	10YR3/6	10YR4/3	silty clay
	B2a	177-185 cm	274.97	274.89	10YR3/3	10YR4/4	silty clay loam
	B2b	185-191 cm	274.89	276.51	10YR4/6	10YR5/4	sandy clay loam

	Bt2c	191-219 cm	274.83	276.28	10YR4/6	10YR4/3	silty clay
	BC/C	219-240 cm	274.55	276.02	10YR2/2	10YR3/3	silty clay
Core 3							
	Ap	0-24 cm	277.02	276.78	10YR3/3	10YR5/3	silty loam
	B1a	24-45 cm	276.78	276.57	10YR3/6	10YR5/4	silty clay loam
	B1b	45-76 cm	276.57	276.26	10YR5/6	10YR6/4	silty clay loam
	BC	76-120 cm	276.26	275.82	10YR4/6	10YR6/4	silty clay to clay
	B1c	120-138 cm	275.82	275.64	10YR4/6	10YR5/4	silty clay loam
	B1d	138-200 cm	275.64	275.02	10YR3/4	10YR4/4	silty clay loam
	Bt	200-235 cm	275.02	274.67	10YR4/4	10YR4/3	silty clay
Core 4							
	Ap	0-13 cm	276.7	276.57	10YR3/2	10YR5/3	silty loam
	B1a	13-39 cm	276.57	276.31	10YR3/3	10YR5/4	silty clay loam
	B1b	39-63 cm	276.31	276.07	10YR3/6	10YR5/4	silty clay loam
	B2	63-68 cm	276.07	276.02	10YR3/2	10YR5/3	silty clay loam (sandier)
	Bt1	68-117 cm	276.02	275.53	10YR3/6	10YR4.5/4	silty clay
	B3	117-136 cm	275.53	275.34	10YR4/4	10YR4.5/4	silty clay to silty clay loam
	B4	136-143 cm	275.34	275.27	10YR3/6	10YR4/3	silty clay loam to sandy clay loam
Core 5							
	Ap	0-21 cm	277.02	276.81	10YR3/3	10YR5/3	silty loam
	B1	21-53 cm	276.81	276.59	10YR3/6	10YR5/4	silty clay loam
	Bt1	53-85 cm	276.59	276.27	10YR4/4	10YR6/4	silty clay loam to silty clay
	Bt2a	85-120 cm	276.27	275.92	10YR4/6	10YR5/4-5/6	silty clay
	Bt2b	120-152 cm	275.92	275.6	10YR4/6	10YR6/4	silty clay
	BC1	152-221 cm	275.6	274.91	10YR4/4	10YR5/4	silty clay to clay
	BC2	221-243 m	274.91	274.69	10YR3/6	10YR5/3	silty clay to clay
Core 6							
	Ap	0-22 cm	276.76	276.54	10YR3/1	10YR5/3	silty loam
	B1	22-35 cm	276.54	276.4	10YR3/3.	10YR5/4	silty clay loam

	Bt1	35-50 cm	276.4	276.16	10YR3/3.5	10YR5/3.5	silty clay loam to silty clay
	Bt2a	50-60 cm	276.16	276.06	10YR4/4	10YR6/3.5	silty clay
	Bt2b	60-77 cm	276.06	275.89	10YR4/6	10YR6/4	silty clay
	Bt2c	77-119 cm	275.89	275.47	10YR3/6	10YR5/4-5/6	silty clay
	Bt2d	120-143 cm	275.47	275.23	10YR3/6	10YR5/4	silty clay
	BC1	143-194 cm	275.23	274.72	10YR3/3	10YR4/3	silty clay to clay
	BC2	194-234 cm	274.72	274.32	10YR3/2	10YR5/3	silty clay to clay
Core 7							
	Ap	0-19 cm	276.76	276.57	10YR3/3	10YR5/3	silty loam
	B1a	19-110 cm	276.57	275.66	10YR3/3	10YR5/4	silty clay loam
	B1b	110-142 cm	275.66	275.34	10YR3/3	10YR5/4	silty clay loam
	B1c	142-189 cm	275.34	274.97	10YR3/6	10YR5/3.5	silty clay loam to silty clay
	BC	189-215 cm	274.97	274.71	10YR4/4	10YR5/4	silt clay to clay
Core 8							
	Ap	0-24 cm	276.7	276.46	10YR4/2	10YR5/3	silty loam
	B1	24-41 cm	276.46	276.29	10YR3/4	10YR5/4	silty clay loam
	Bt1a	41-109 cm	276.29	275.61	7.5YR3/3.5	10YR6/4	silty clay loam to silty clay
	Bt1b	109-118 cm	275.61	275.52	10YR4/6	10YR5/4	silty clay loam to silty clay
	Bt2a	118-131 cm	275.52	275.39	10YR4/6	10YR5/4	silty clay
	Bt2b	131-152 cm	275.39	275.18	10YR4/4	10YR4.5/3	silty clay
	Bt2c	152-177 cm	275.18	274.93	10YR4/4	10YR5/3	silty clay
	Bt2d	177-215 cm	274.93	274.58	10YR3/6	10YR5/3.5	silty clay
	BC	215-240 cm	274.58	274.33	10YR2/1	10YR3/2	sandy clay to silty clay

Table A2. Core analysis data (5 cm intervals).

Core	Sample (cmbs)	Elevation (m)	XLF (10-6 m3/kg)	XHF (10-6 m3/kg)	Xfd (%)	LOI_{550}	LOI_{1000}
Core 1							
	0-5	276.68	1.73E-06	1.56E-06	9.6745	10.4724	1.9941
	5-10	276.73	1.96E-06	1.77E-06	9.686	6.9079	1.9467
	10-15	276.78	2.25E-06	2.04E-06	9.1309	5.7649	1.8705
	15-20	276.83	1.94E-06	1.74E-06	10.0131	5.1077	1.7984
	20-25	276.88	1.97E-06	1.78E-06	9.7318	4.6556	1.7098
	25-30	276.93	2.11E-06	1.90E-06	9.638	4.2798	1.6403
	30-35	276.98	2.06E-06	1.86E-06	9.7298	4.0611	1.5997
	35-40	277.03	2.04E-06	1.84E-06	10.03	4.1973	1.5579
	40-45	277.08	2.09E-06	1.88E-06	9.9622	3.6102	1.5836
	45-50	277.13	2.09E-06	1.89E-06	9.7715	3.7435	1.6303
	50-55	277.18	1.96E-06	1.77E-06	9.8693	3.7447	1.6012
	55-60	277.23	1.90E-06	1.70E-06	10.2962	3.7005	1.6685
	60-65	277.28	1.85E-06	1.66E-06	9.9788	3.9266	1.6698
	65-70	277.33	1.71E-06	1.54E-06	9.8827	4.1351	1.7448
	70-75	277.38	1.64E-06	1.48E-06	9.6123	4.3655	1.8898
	75-80	277.43	1.74E-06	1.57E-06	9.5156	4.5258	2.0356
	80-85	277.48	1.80E-06	1.62E-06	9.7921	4.7167	2.0517
	85-90	277.53	2.11E-06	1.91E-06	9.4962	4.7564	2.1265
	90-95	277.58	2.34E-06	2.12E-06	9.3059	4.9150	2.3179
	95-100	277.63	2.21E-06	1.99E-06	9.9632	6.2386	3.2505
	100-105	277.68	2.25E-06	2.04E-06	9.3536	5.0364	2.5652
	105-110	277.73	2.27E-06	2.04E-06	10.1575	5.1229	2.5329
	110-115	277.78	2.27E-06	2.04E-06	9.8995	5.2162	2.5097
	115-120	277.83	2.28E-06	2.07E-06	9.3754	5.3749	2.7182
	120-125	277.88	2.03E-06	1.80E-06	11.0244	5.8917	2.9665
	125-130	277.93	1.91E-06	1.69E-06	11.4998	6.5181	3.1437
	130-135	277.98	1.56E-06	1.36E-06	12.421	6.5333	3.0110
	135-140	278.03	1.63E-06	1.42E-06	13.1037	7.4932	3.2468

	140-145	278.08	1.74E-06	1.51E-06	13.1997	7.4623	3.3065
	145-150	278.13	1.58E-06	1.36E-06	13.416	7.0360	3.4645
	150-155	278.18	1.64E-06	1.43E-06	13.0199	7.4908	3.6122
	155-160	278.23	1.66E-06	1.43E-06	13.9916	7.6193	3.4753
	160-165	278.28	1.80E-06	1.58E-06	12.343	7.5391	3.5665
	165-170	278.33	1.46E-06	1.26E-06	13.5898	7.3941	3.5725
	170-175	278.38	1.43E-06	1.19E-06	17.0908	7.4419	3.6703
	175-180	278.43	1.59E-06	1.36E-06	14.2177	7.6160	3.7544
	180-185	278.48	1.65E-06	1.43E-06	13.2834	7.8560	3.4459
	185-190	278.53	1.76E-06	1.48E-06	15.6484	8.0608	3.5116
	190-195	278.58	1.72E-06	1.43E-06	16.819	8.3947	3.5742
	195-200	278.63	1.71E-06	1.46E-06	14.3173	8.3969	3.6929
	200-205	278.68	1.55E-06	1.34E-06	13.4982	7.9961	3.7538
	205-210	278.73	1.37E-06	1.18E-06	13.8596	7.3702	4.0159
	210-215	278.78	1.09E-06	9.28E-07	14.6195	6.1472	3.5081
	215-220	278.83	7.98E-08	6.86E-08	14.0838	7.2459	4.2907
	220-225	278.88	1.55E-06	1.31E-06	15.3977	7.4054	4.0337
	225-230	278.93	1.52E-06	1.30E-06	14.5157	7.7041	4.2875
	230-235	278.98	1.25E-06	1.07E-06	14.4888	7.6450	3.4170
	235-240	279.03	1.19E-06	1.02E-06	14.4232	9.5473	2.8084
	240-243	279.08	1.85E-06	1.58E-06	14.8032	9.5846	3.4963
Core 2							
	0-5	276.74	1.66E-06	1.49E-02	10.2729	10.4607	3.0371
	5-10	276.79	1.97E-06	1.78E-02	9.8822	7.7330	1.9054
	10-15	276.84	1.90E-06	1.70E-02	10.1455	6.2267	1.9190
	15-20	276.89	2.05E-06	1.85E-02	10.0848	5.7523	1.8696
	20-25	276.94	2.02E-06	1.81E-02	10.0826	5.3912	1.8612
	25-30	276.99	1.96E-06	1.76E-02	10.2323	5.3549	1.8775
	30-35	277.04	1.99E-06	1.79E-02	10.1125	5.4123	1.9038
	35-40	277.09	2.00E-06	1.79E-02	10.4154	5.6161	2.3834
	40-45	277.14	2.01E-06	1.80E-02	10.4136	5.6622	1.8267
	45-50	277.19	1.89E-06	1.69E-02	10.656	5.7178	1.7814
	50-55	277.24	1.92E-06	1.72E-02	10.3535	5.6622	1.7132

55-60	277.29	2.13E-06	1.93E-02	9.6858	5.3692	1.7234
60-65	277.34	2.01E-06	1.81E-02	10.1512	5.2161	1.6188
65-70	277.39	1.96E-06	1.77E-02	9.8501	4.7498	1.5637
70-75	277.44	1.95E-06	1.76E-02	9.9033	4.5276	1.5107
75-80	277.49	2.09E-06	1.88E-02	9.8588	4.4776	1.6450
80-85	277.54	1.95E-06	1.75E-02	10.2166	4.5416	1.8008
85-90	277.59	2.01E-06	1.80E-02	10.1897	4.6286	1.6483
90-95	277.64	2.00E-06	1.80E-02	10.2158	4.9409	1.7885
95-100	277.69	2.37E-06	2.15E-02	9.0908	5.0697	1.9628
100-105	277.74	2.37E-06	2.13E-02	9.8407	5.3478	2.2462
105-110	277.79	1.97E-06	1.77E-02	10.2645	5.5859	2.2113
110-115	277.84	2.21E-06	2.01E-02	9.091	6.1796	2.4790
115-120	277.89	1.78E-06	1.59E-02	10.3978	6.0773	2.7580
120-125	277.94	1.46E-06	1.28E-02	12.4978	6.8202	3.1673
125-130	277.99	1.41E-06	1.22E-02	13.2006	6.2505	3.0025
130-135	278.04	1.34E-06	1.15E-02	13.9537	6.6366	3.2833
135-140	278.09	1.31E-06	1.13E-02	13.6747	6.5356	3.0744
140-145	278.14	1.36E-06	1.16E-02	14.1384	6.5968	3.0361
145-150	278.19	1.30E-06	1.11E-02	14.2076	6.4910	3.2249
150-155	278.24	1.06E-06	9.12E-03	14.0133	5.8050	3.2747
155-160	278.29	7.99E-07	6.87E-03	14.0566	5.1955	3.0471
160-165	278.34	1.01E-06	8.67E-03	13.8414	7.1835	3.2660
165-170	278.39	7.78E-07	6.69E-03	13.9398	5.5708	3.8572
170-175	278.44	7.05E-07	6.09E-03	13.6016	5.5311	3.7651
175-180	278.49	8.90E-07	6.51E-03	13.8384	5.9220	3.7651
180-185	278.54	7.56E-07	5.55E-03	13.8191	5.4325	4.3845
185-190	278.59	6.41E-07	5.33E-03	13.5277	4.0133	4.8266
190-195	278.64	6.21E-07	5.54E-03	14.2726	4.4753	3.9592
195-200	278.69	6.48E-07	6.51E-03	14.4549	5.6127	3.5820
200-205	278.74	7.66E-07	1.10E-02	14.9643	4.3553	5.0155
205-210	278.79	1.30E-06	1.39E-02	15.0539	5.1075	4.1247
210-215	278.84	1.65E-06	8.63E-03	15.3456	6.1128	3.8495
215-220	278.89	1.01E-06	4.89E-03	14.5359	4.9570	4.8653

	220-225	278.94	5.72E-07	1.03E-02	14.4722	4.4141	4.8286
	225-230	278.99	1.22E-06	1.51E-02	15.2744	5.9071	3.8472
	230-235	279.04	1.77E-06	1.54E-02	14.8119	8.0598	4.2458
	235-240	279.09	1.80E-06	1.49E-02	14.5200	8.3805	3.1909
Core 3							
	0-5	277.02	2.0482E-06		9.939	9.9166	1.3348
	5-10	277.07	2.2261E-06	1.84E-02	9.7336	7.5198	1.3237
	10-15	277.12	2.3446E-06	2.01E-02	9.8312	6.2595	1.3150
	15-20	277.17	2.4899E-06	2.11E-02	9.7925	5.6585	1.2974
	20-25	277.22	2.2831E-06	2.25E-02	10.232	4.9582	1.2547
	25-30	277.27	2.1634E-06	2.05E-02	10.2271	4.5188	1.1653
	30-35	277.32	2.1194E-06	1.94E-02	10.4813	4.2636	1.1718
	35-40	277.37	1.9758E-06	1.90E-02	10.0696	4.3363	1.2090
	40-45	277.42	1.9201E-06	1.78E-02	9.4655	4.1363	1.2221
	45-50	277.47	1.6525E-06	1.74E-02	9.5495	4.3174	1.2697
	50-55	277.52	1.5938E-06	1.49E-02	9.5064	4.3070	1.3439
	55-60	277.57	1.45E-06	1.44E-02	9.7685	4.0889	1.2210
	60-65	277.62	1.529E-06	1.31E-02	9.0554	4.3255	1.3846
	65-70	277.67	1.5342E-06	1.39E-02	8.8109	4.4403	1.3792
	70-75	277.72	1.6074E-06	1.40E-02	8.7671	4.4940	1.4255
	75-80	277.77	1.8649E-06	1.47E-02	9.0099	4.7496	3.0727
	80-85	277.82	1.746E-06	1.70E-02	8.4231	4.6335	1.5566
	85-90	277.87	1.8706E-06	1.60E-02	9.3593	4.7939	1.5993
	90-95	277.92	2.1235E-06	1.70E-02	9.14	4.9589	1.6820
	95-100	277.97	1.9322E-06	1.93E-02	9.686	5.0168	1.7531
	100-105	278.02	1.9856E-06	1.75E-02	9.6377	5.0357	1.9155
	105-110	278.07	2.1495E-06	1.79E-02	8.9986	4.9955	1.8840
	110-115	278.12	2.2041E-06	1.96E-02	9.4636	5.0794	2.0406
	115-120	278.17	1.9462E-06	2.00E-02	9.1527	5.3827	2.1396
	120-125	278.22	1.9289E-06	1.77E-02	9.841	5.4798	2.3037
	125-130	278.27	1.9566E-06	1.74E-02	9.8935	5.3206	2.1696
	130-135	278.32	1.6371E-06	1.76E-02	11.2708	5.4283	2.2428
	135-140	278.37	1.5306E-06	1.45E-02	11.8754	5.8902	2.3251

	140-145	278.42	1.421E-06	1.35E-02	12.3551	6.1706	2.6062
	145-150	278.47	1.2547E-06	1.25E-02	12.7891	6.2728	2.7240
	150-155	278.52	1.2214E-06	1.09E-02	13.3605	6.5834	2.8021
	155-160	278.57	1.2457E-06	1.06E-02	13.6039	6.7134	2.6963
	160-165	278.62	1.1731E-06	1.08E-02	13.6992	6.4185	2.8660
	165-170	278.67	1.0653E-06	1.01E-02	13.4492	6.3339	2.6615
	170-175	278.72	9.883E-07	9.22E-03	12.9884	6.0032	2.6839
	175-180	278.77	9.841E-07	8.60E-03	13.3265	6.1437	2.6985
	180-185	278.82	8.899E-07	8.53E-03	13.5072	6.0338	2.5117
	185-190	278.87	9.363E-07	7.70E-03	11.8419	5.8097	2.7299
	190-195	278.92	8.637E-07	8.25E-03	13.4795	5.6435	2.7944
	195-200	278.97	8.444E-07	7.47E-03	14.164	5.4687	2.8108
	200-205	279.02	8.173E-07	7.25E-03	13.617	5.2962	2.7244
	205-210	279.07	6.949E-07	7.06E-03	13.4879	5.1454	2.7140
	210-215	279.12	7.218E-07	6.01E-03	13.3195	5.2136	2.8351
	215-220	279.17	7.419E-07	6.26E-03	13.9717	5.2236	2.7178
	220-225	279.22	8.061E-07	6.38E-03	13.146	5.2700	2.7899
	225-230	279.27	7.794E-07	7.00E-03	13.4168	5.3884	2.9612
	230-235	279.32	8.596E-07	6.75E-03	14.2103	6.0218	2.4777
Core 4							
	0-5	276.7	1.7291E-06	1.55E-02	10.1985	10.9986	1.9113
	5-10	276.75	1.8623E-06	1.67E-02	10.0845	7.6459	1.9346
	10-15	276.8	1.9827E-06	1.79E-02	9.8923	6.2794	1.8564
	15-20	276.85	1.9588E-06	1.76E-02	10.0857	5.8764	1.8454
	20-25	276.9	1.9819E-06	1.77E-02	10.5154	5.8461	1.9299
	25-30	276.95	1.921E-06	1.73E-02	9.8968	6.0147	1.9458
	30-35	277	2.0925E-06	1.88E-02	10.1919	5.9742	2.4479
	35-40	277.05	1.892E-06	1.68E-02	11.06	5.9499	1.9381
	40-45	277.1	2.2576E-06	2.05E-02	9.3031	6.0908	1.8140
	45-50	277.15	2.0422E-06	1.85E-02	9.2157	6.3321	1.9857
	50-55	277.2	2.0092E-06	1.81E-02	9.8108	6.5451	2.0082
	55-60	277.25	1.9123E-06	1.70E-02	11.0833	6.6590	3.3174
	60-65	277.3	2.192E-06	2.01E-02	11.5918	6.6916	1.8735

	65-70	277.35	1.9546E-06	2.03E-02	10.4873	6.6738	1.8942
	70-75	277.4	2.0933E-06	2.05E-02	10.042	6.4383	4.6134
	75-80	277.45	2.1254E-06	1.88E-02	9.1109	6.5681	2.0383
	80-85	277.5	2.2337E-06	2.04E-02	8.6976	6.4799	1.9952
	85-90	277.55	2.17E-06	1.90E-02	9.43635	6.5240	2.0069
	90-95	277.6	2.14E-06	1.89E-02	9.805725	6.4875	2.0128
	95-100	277.65	2.114E-06	1.81E-02	10.1751	6.4510	2.0187
	100-105	277.7	2.098E-06	1.88E-02	10.1549	6.3587	2.0455
	105-110	277.75	1.9841E-06	1.71E-02	8.7535	5.9618	1.9926
	110-115	277.8	2.0952E-06	1.73E-02	10.0543	5.9882	2.1536
	115-120	277.85	1.9219E-06	1.77E-02	10.9303	5.7738	2.7737
	120-125	277.9	1.9335E-06	1.52E-02	10.6028	6.3249	2.2119
	125-130	277.95	1.9461E-06	1.66E-02	9.2191	5.8090	2.3164
	130-135	278	1.706E-06	1.42E-02	11.057	5.6927	2.3052
	135-140	278.05	1.8544E-06	1.55E-02	10.4082	6.0827	7.7994
Core 5							
	0-5	277.02	2.2348E-06	2.01E-02	10.0937	10.0413	2.1105
	5-10	277.07	2.6473E-06	2.41E-02	9.0478	7.3336	1.9561
	10-15	277.12	3.4469E-06	3.17E-02	7.9724	6.4748	1.8238
	15-20	277.17	2.7089E-06	2.45E-02	9.5227	5.7646	1.7145
	20-25	277.22	3.0397E-06	2.76E-02	9.2319	5.4790	1.7425
	25-30	277.27	2.7416E-06	2.46E-02	10.0926	5.1789	1.6888
	30-35	277.32	2.6987E-06	2.44E-02	9.5421	4.8971	1.6951
	35-40	277.37	2.6214E-06	2.37E-02	9.6317	4.7044	1.7437
	40-45	277.42	2.5639E-06	2.30E-02	10.4578	4.6170	1.8013
	45-50	277.47	2.3703E-06	2.12E-02	10.4036	4.4256	1.7323
	50-55	277.52	2.141E-06	1.92E-02	10.4602	4.2767	1.7461
	55-60	277.57	2.111E-06	1.89E-02	10.3985	4.3095	1.7582
	60-65	277.62	1.7835E-06	1.62E-02	8.9063	4.2944	1.8299
	65-70	277.67	1.652E-06	1.49E-02	9.8225	4.4323	1.7985
	70-75	277.72	1.6825E-06	1.54E-02	8.7266	4.5233	1.7650
	75-80	277.77	1.4925E-06	1.31E-02	12.0838	4.7170	1.8519
	80-85	277.82	1.5459E-06	1.41E-02	8.9525	4.8655	1.9104

85-90	277.87	1.4739E-06	1.35E-02	8.4252	4.8629	1.9576
90-95	277.92	1.5868E-06	1.48E-02	6.7815	4.8280	1.9334
95-100	277.97	1.6654E-06	1.52E-02	8.674	4.9673	1.9413
100-105	278.02	1.9358E-06	1.76E-02	8.9056	5.0283	1.9263
105-110	278.07	2.3266E-06	2.16E-02	7.2161	4.9956	1.9155
110-115	278.12	2.6964E-06	2.26E-02	8.8657	5.1475	1.9559
115-120	278.17	2.1068E-06	2.50E-02	10.6249	8.8988	1.8805
120-125	278.22	2.4389E-06	2.22E-02	8.9424	4.8746	2.8405
125-130	278.27	2.1068E-06	1.91E-02	9.259	4.9679	3.2955
130-135	278.32	2.0208E-06	1.83E-02	9.6032	5.1957	2.1017
135-140	278.37	2.0116E-06	1.84E-02	8.6219	5.0404	2.1310
140-145	278.42	1.7651E-06	1.60E-02	9.2073	5.1779	2.1903
145-150	278.47	1.7712E-06	1.60E-02	9.4071	5.4761	2.3962
150-155	278.52	2.1077E-06	1.92E-02	9.0976	5.6842	2.5619
155-160	278.57	2.044E-06	1.86E-02	8.9852	6.5355	2.8241
160-165	278.62	1.8294E-06	1.67E-02	8.7096	6.5825	2.8103
165-170	278.67	1.3111E-06	1.17E-02	10.883	6.6915	2.9531
170-175	278.72	1.1929E-06	1.05E-02	11.6314	6.6285	3.0729
175-180	278.77	1.1598E-06	1.02E-02	11.785	6.8214	3.2154
180-185	278.82	1.0841E-06	9.41E-03	13.2332	7.3126	3.4836
185-190	278.87	1.0748E-06	9.31E-03	13.4255	7.0885	3.8576
190-195	278.92	1.029E-06	8.98E-03	12.7764	7.1520	3.4486
195-200	278.97	1.087E-06	9.60E-03	11.6518	7.6738	3.4886
200-205	279.02	1.155E-06	9.72E-03	15.8369	7.1662	3.5784
205-210	279.07	1.089E-06	9.83E-03	9.7537	6.9623	3.7178
210-215	279.12	1.2061E-06	1.11E-02	8.2956	6.8802	3.8555
215-220	279.17	1.2023E-06	1.02E-02	15.2736	7.7372	3.7556
220-225	279.22	9.871E-07	8.45E-03	14.4256	7.0849	3.6370
225-230	279.27	9.699E-07	8.26E-03	14.7935	7.0409	3.9812
230-235	279.32	8.688E-07	7.44E-03	14.4014	7.6301	3.8075
235-240	279.37	8.002E-07	6.85E-03	14.4326	6.2591	3.8846
240-243	279.42	9.616E-07	8.25E-03	14.2622	6.8235	3.5307
Core 6						

0-5	276.76	2.0372E-06	1.84E-02	9.6826	11.7690	1.6622
5-10	276.81	2.3869E-06	2.15E-02	9.8947	7.9898	1.6305
10-15	276.86	2.5945E-06	2.36E-02	9.0273	6.4088	1.6885
15-20	276.91	2.3705E-06	2.14E-02	9.6109	6.0058	1.6856
20-25	276.96	2.5261E-06	2.28E-02	9.7019	5.8634	2.1691
25-30	277.01	2.4677E-06	2.22E-02	9.848	6.0038	1.8558
30-35	277.06	2.4765E-06	2.23E-02	9.9875	5.0347	1.5004
35-40	277.11	2.3672E-06	2.13E-02	10.0381	4.7458	1.4674
40-45	277.16	2.3178E-06	2.09E-02	9.9754	4.3499	1.3267
45-50	277.21	2.149E-06	1.94E-02	9.6457	4.1588	1.3599
50-55	277.26	1.9821E-06	1.79E-02	9.8558	4.0907	1.3830
55-60	277.31	1.7824E-06	1.61E-02	9.6834	4.1483	1.3973
60-65	277.36	1.6667E-06	1.51E-02	9.2313	4.3024	1.4322
65-70	277.41	1.6003E-06	1.45E-02	9.1474	4.4608	1.4242
70-75	277.46	1.7657E-06	1.61E-02	8.9185	4.5763	1.6482
75-80	277.51	1.7959E-06	1.64E-02	8.7246	4.7073	1.6371
80-85	277.56	1.857E-06	1.69E-02	8.7669	4.7987	1.6918
85-90	277.61	1.7757E-06	1.62E-02	8.8612	4.7352	1.7375
90-95	277.66	2.2033E-06	2.00E-02	9.3471	4.9714	1.8219
95-100	277.71	2.0312E-06	1.85E-02	8.9317	5.0073	1.7777
100-105	277.76	2.2392E-06	2.04E-02	8.8595	5.0330	1.9393
105-110	277.81	2.499E-06	2.28E-02	8.7661	5.1764	2.0417
110-115	277.86	2.1223E-06	1.93E-02	9.1711	5.2784	2.1149
115-120	277.91	2.2308E-06	2.04E-02	8.7211	5.4945	2.2692
120-125	277.96	2.2661E-06	2.07E-02	8.6684	5.5252	2.1454
125-130	278.01	2.1101E-06	1.90E-02	9.8959	5.1034	2.1111
130-135	278.06	1.893E-06	1.70E-02	9.9959	5.9946	1.9954
135-140	278.11	1.7888E-06	1.61E-02	10.171	5.6449	2.2966
140-145	278.16	1.799E-06	1.61E-02	10.2906	5.2026	2.0624
145-150	278.21	1.5052E-06	1.35E-02	10.0335	5.2259	2.1889
150-155	278.26	1.7278E-06	1.55E-02	10.1443	4.8608	2.0849
155-160	278.31	1.4413E-06	1.28E-02	10.9766	5.7540	2.0962
160-165	278.36	1.3329E-06	1.18E-02	11.4755	5.9831	2.4149

	165-170	278.41	1.3295E-06	1.17E-02	11.6421	6.2336	2.4865
	170-175	278.46	1.17E-06	1.02E-02	12.5527	6.3878	2.6415
	175-180	278.51	1.1089E-06	9.77E-03	11.9331	6.5410	2.7324
	180-185	278.56	9.922E-07	8.67E-03	12.6746	6.5232	2.8342
	185-190	278.61	9.979E-07	8.68E-03	13.0652	6.7862	3.0638
	190-195	278.66	9.572E-07	8.30E-03	13.2501	6.8039	3.2002
	195-200	278.71	8.931E-07	7.75E-03	13.2411	6.9862	3.0932
	200-205	278.76	8.382E-07	7.21E-03	13.9723	6.7328	3.1611
	205-210	278.81	7.613E-07	6.60E-03	13.3404	6.8573	3.1155
	210-215	278.86	7.925E-07	6.89E-03	13.0167	6.3401	1.1902
	215-220	278.91	7.268E-07	6.24E-03	14.1166	5.8860	3.4018
	220-225	278.96	7.195E-07	6.22E-03	13.498	6.0950	3.2284
	225-230	279.01	7.95E-07	6.91E-03	13.128	5.5599	3.7250
	230-235	279.06	8.048E-07	6.90E-03	14.327	5.5718	4.1073
Core 7							
	0-5	276.76	1.7364E-06	1.44E-02	17.1807	10.4927	2.5068
	5-10	276.81	1.8637E-06	1.68E-02	9.7641	7.7074	2.4502
	10-15	276.86	1.8482E-06	1.68E-02	8.9497	5.9880	2.4367
	15-20	276.91	1.9496E-06	1.76E-02	9.8182	5.5232	2.4309
	20-25	276.96	1.9008E-06	1.71E-02	10.1981	5.2856	2.5207
	25-30	277.01	1.8356E-06	1.80E-02	2.1028	5.1914	2.6965
	30-35	277.06	2.1248E-06	1.80E-02	9.0345	5.1876	1.7535
	35-40	277.11	1.9279E-06	1.71E-02	11.1376	8.3964	2.3653
	40-45	277.16	1.9512E-06	1.74E-02	10.5716	5.1124	2.4189
	45-50	277.21	1.9977E-06	1.79E-02	10.3775	5.3231	2.5112
	50-55	277.26	1.8679E-06	1.66E-02	10.9629	5.4801	2.4322
	55-60	277.31	2.0164E-06	1.81E-02	10.1718	5.9136	2.3286
	60-65	277.36	2.004E-06	1.80E-02	10.1813	6.2565	2.2968
	65-70	277.41	1.9587E-06	1.76E-02	10.3986	6.1079	2.3035
	70-75	277.46	2.0296E-06	1.83E-02	9.7394	5.4487	2.2286
	75-80	277.51	1.9893E-06	1.79E-02	10.2523	5.2214	2.3136
	80-85	277.56	2.1586E-06	1.96E-02	9.3754	5.3870	2.2936
	85-90	277.61	2.0469E-06	1.84E-02	10.0971	5.1259	2.3491

	90-95	277.66	2.0485E-06	1.84E-02	10.1597	5.0206	2.3461
	95-100	277.71	2.1827E-06	1.97E-02	9.5588	5.0574	2.4546
	100-105	277.76	2.0194E-06	1.81E-02	10.2091	5.0386	2.4774
	105-110	277.81	1.9588E-06	1.76E-02	10.3906	5.0216	2.5532
	110-115	277.86	2.0747E-06	1.86E-02	10.1921	4.9767	2.6206
	115-120	277.91	2.1404E-06	1.93E-02	9.7491	4.9608	2.7046
	120-125	277.96	2.1959E-06	1.98E-02	9.6923	5.0808	2.6415
	125-130	278.01	1.9141E-06	1.72E-02	10.2359	5.1799	1.8303
	130-135	278.06	1.8299E-06	1.76E-02	9.5323	4.7868	1.8119
	135-140	278.11	1.7961E-06	1.61E-02	10.6118	5.5236	1.9518
	140-145	278.16	1.9151E-06	1.61E-02	10.2571	5.0730	2.0518
	145-150	278.21	1.9514E-06	1.61E-02	9.8999	5.1880	1.7942
	150-155	278.26	1.7958E-06	1.62E-02	10.4264	5.2989	1.8970
	155-160	278.31	1.8016E-06	1.47E-02	10.5079	5.4961	2.0152
	160-165	278.36	1.7927E-06	1.48E-02	10.3988	4.9769	2.1339
	165-170	278.41	1.8099E-06	1.40E-02	10.7032	4.9512	2.0336
	170-175	278.46	1.6626E-06	1.14E-02	11.4163	4.8870	2.0851
	175-180	278.51	1.6838E-06	8.18E-03	11.8441	4.8235	2.1058
	180-185	278.56	1.5947E-06	8.40E-03	12.0382	4.9985	2.1299
	185-190	278.61	1.297E-06	7.46E-03	11.8803	5.4059	2.3331
	190-195	278.66	9.343E-07	6.92E-03	12.4705	5.7904	2.5222
	195-200	278.71	9.641E-07	7.25E-03	12.8399	5.4170	2.3784
	200-205	278.76	8.556E-07	1.44E-02	12.8095	6.0143	2.6670
	205-210	278.81	7.917E-07	1.68E-02	12.6241	6.1964	2.5467
	210-215	278.86	8.315E-07	1.68E-02	12.8542	6.4864	2.5834
Core 8							
	0-5	276.7	1.6041E-06	1.45E-02	9.4676	11.7181	1.5923
	5-10	276.75	1.7169E-06	1.57E-02	8.5672	8.1174	1.5288
	10-15	276.8	1.8106E-06	1.65E-02	9.0643	6.5674	1.6028
	15-20	276.85	2.0185E-06	1.83E-02	9.4567	5.5732	1.8093
	20-25	276.9	1.8511E-06	1.66E-02	10.2202	5.2219	1.8556
	25-30	276.95	1.9697E-06	1.80E-02	8.6851	5.1871	1.7737
	30-35	277	2.1286E-06	1.94E-02	8.9289	4.8544	1.6684

35-40	277.05	2.0862E-06	1.88E-02	9.6942	4.4996	1.6394
40-45	277.1	1.9799E-06	1.76E-02	11.2791	4.2684	1.4334
45-50	277.15	1.905E-06	1.72E-02	9.9436	4.1553	1.5611
50-55	277.2	1.8996E-06	1.73E-02	8.9396	4.1908	1.5648
55-60	277.25	1.6858E-06	1.53E-02	9.2385	4.3246	1.5585
60-65	277.3	1.659E-06	1.49E-02	9.9665	3.6180	1.4871
65-70	277.35	1.8548E-06	1.67E-02	9.7986	4.3535	1.5860
70-75	277.4	1.7051E-06	1.54E-02	9.4223	4.5183	1.5502
75-80	277.45	1.6471E-06	1.50E-02	9.094	4.7183	1.7744
80-85	277.5	1.8855E-06	1.72E-02	8.5479	4.8782	1.7718
85-90	277.55	1.7202E-06	1.58E-02	8.3341	7.4749	1.8880
90-95	277.6	1.8826E-06	1.71E-02	9.2864	5.0078	1.8833
95-100	277.65	1.8018E-06	1.66E-02	7.9915	5.1014	1.8212
100-105	277.7	1.8675E-06	1.67E-02	10.4663	5.3179	1.6908
105-110	277.75	1.7305E-06	1.56E-02	9.7745	5.4067	2.4836
110-115	277.8	1.705E-06	1.53E-02	10.015	5.5635	2.7361
115-120	277.85	1.5563E-06	1.45E-02	7.1304	5.6726	2.8499
120-125	277.9	1.5571E-06	1.40E-02	10.1017	5.6535	2.5706
125-130	277.95	1.195E-06	1.05E-02	12.0513	6.2931	2.6785
130-135	278	1.0305E-06	9.00E-03	12.7066	6.2219	2.8453
135-140	278.05	1.0232E-06	8.95E-03	12.5228	6.3352	3.0617
140-145	278.1	9.443E-07	8.34E-03	11.6446	6.0396	3.0442
145-150	278.15	9.179E-07	8.05E-03	12.2775	6.0843	2.9101
150-155	278.2	9.337E-07	8.18E-03	12.3942	6.2221	2.7356
155-160	278.25	9.207E-07	8.30E-03	9.903	6.2997	2.6856
160-165	278.3	9.724E-07	8.46E-03	13.0389	6.7226	2.7692
165-170	278.35	8.958E-07	8.02E-03	10.5176	6.1719	3.0372
170-175	278.4	6.591E-07	5.68E-03	13.8629	5.7376	3.0596
175-180	278.45	9.111E-07	8.00E-03	12.2009	6.6751	2.9200
180-185	278.5	8.27E-07	7.14E-03	13.7056	6.0383	3.1348
185-190	278.55	7.805E-07	6.71E-03	14.0158	5.2870	3.3451
190-195	278.6	8.27E-07	7.12E-03	13.9203	4.8652	3.4185
195-200	278.65	8.361E-07	7.18E-03	14.1759	4.7892	3.7941

200-205	278.7	1.0726E-06	9.19E-03	14.3608	5.5017	3.8533
205-210	278.75	9.288E-07	7.94E-03	14.4913	5.2008	4.2874
210-215	278.8	9.556E-07	8.21E-03	14.1078	5.3987	3.2299
215-220	278.85	7.666E-07	6.82E-03	10.9982	4.9211	3.8608
220-225	278.9	9.003E-07	7.75E-03	13.882	5.5238	4.1363
225-230	278.95	9.17E-07	8.09E-03	11.7705	4.9402	2.0942
230-235	279	8.844E-07	7.66E-03	13.4069	4.8290	3.9723
235-240	279.05	1.1355E-06	1.02E-02	10.2338	6.1406	4.2063

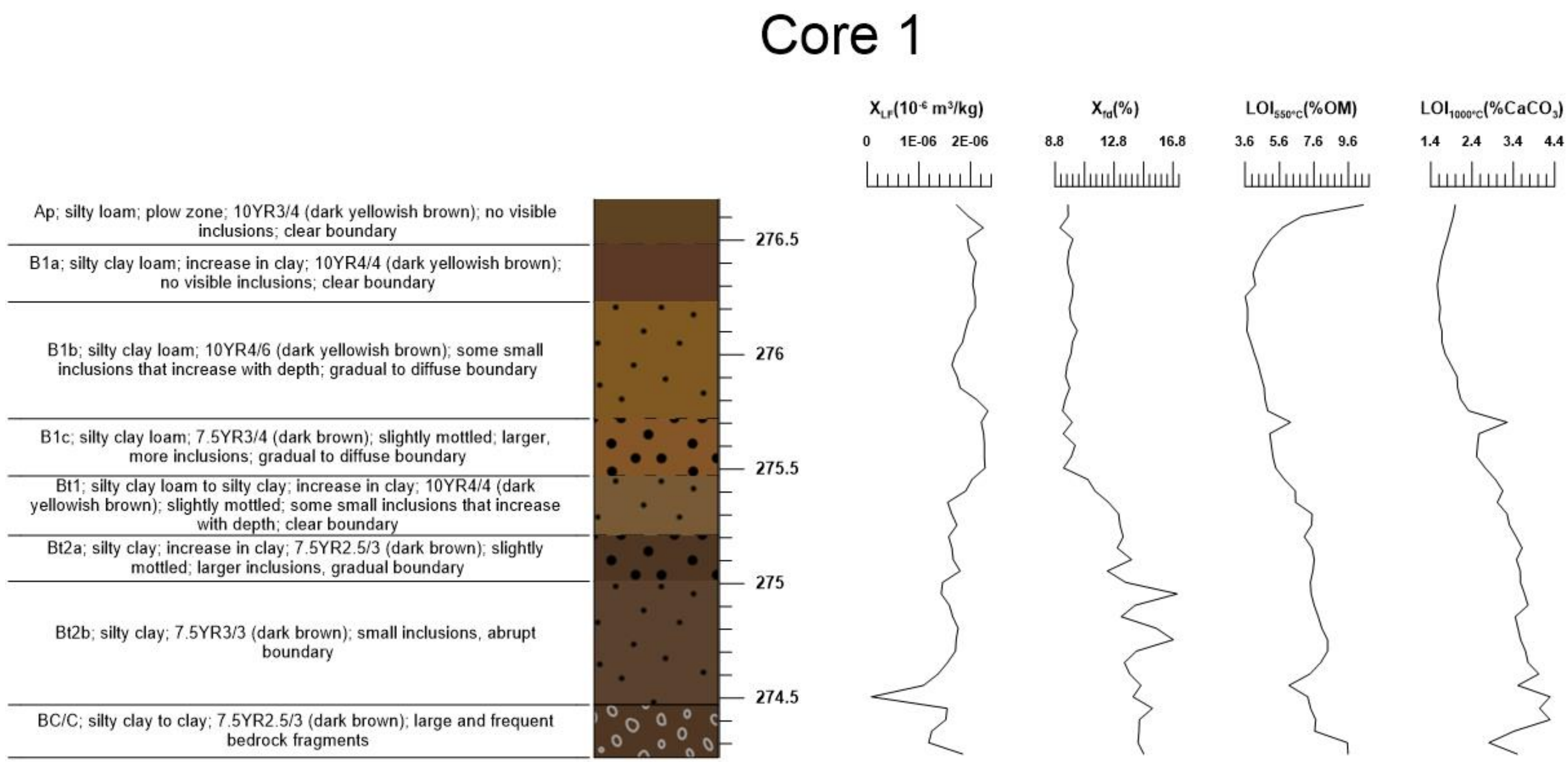

Figure A1. Results of Core 1 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

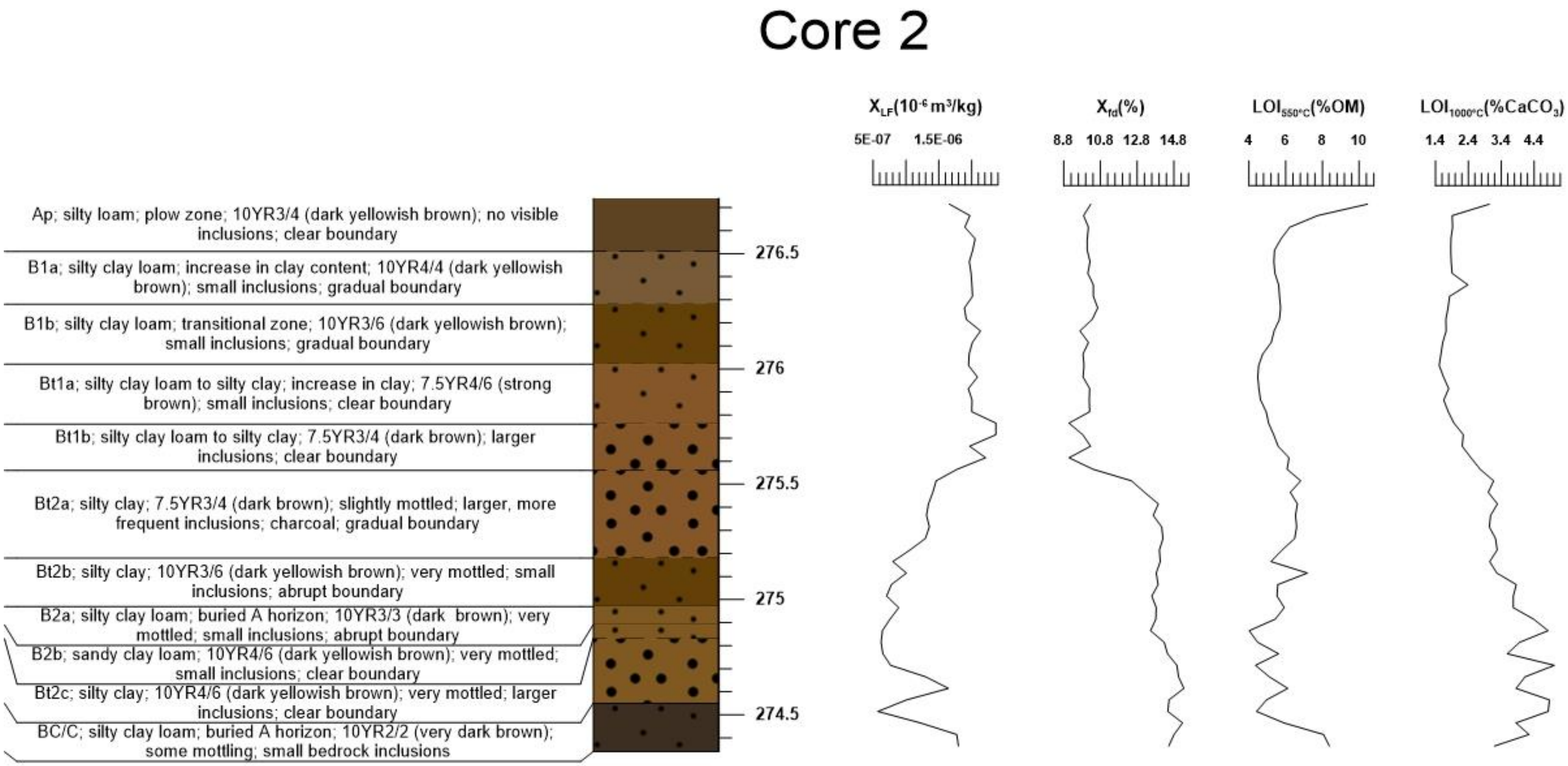

Figure A2. Results of Core 2 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

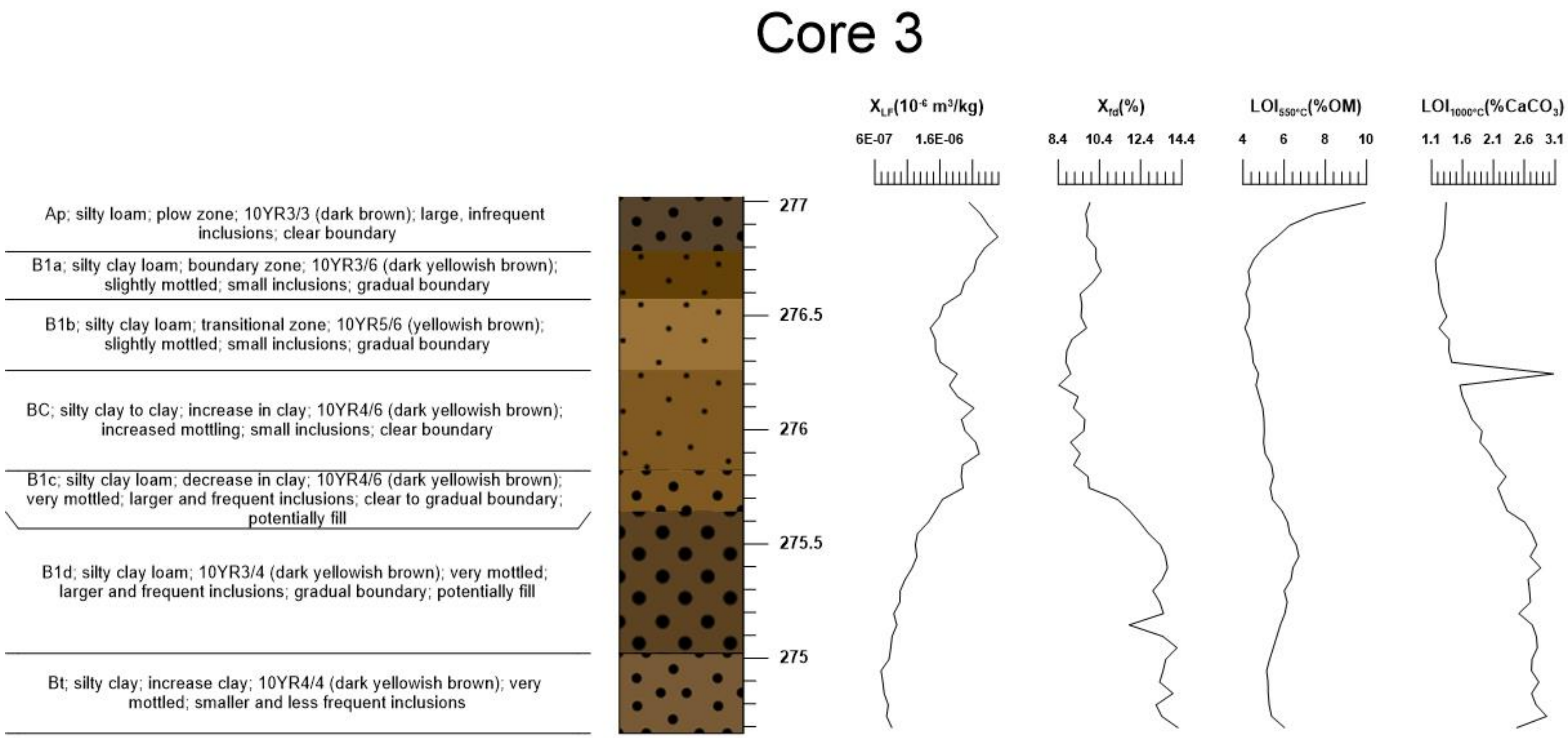

Figure A3. Results of Core 3 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

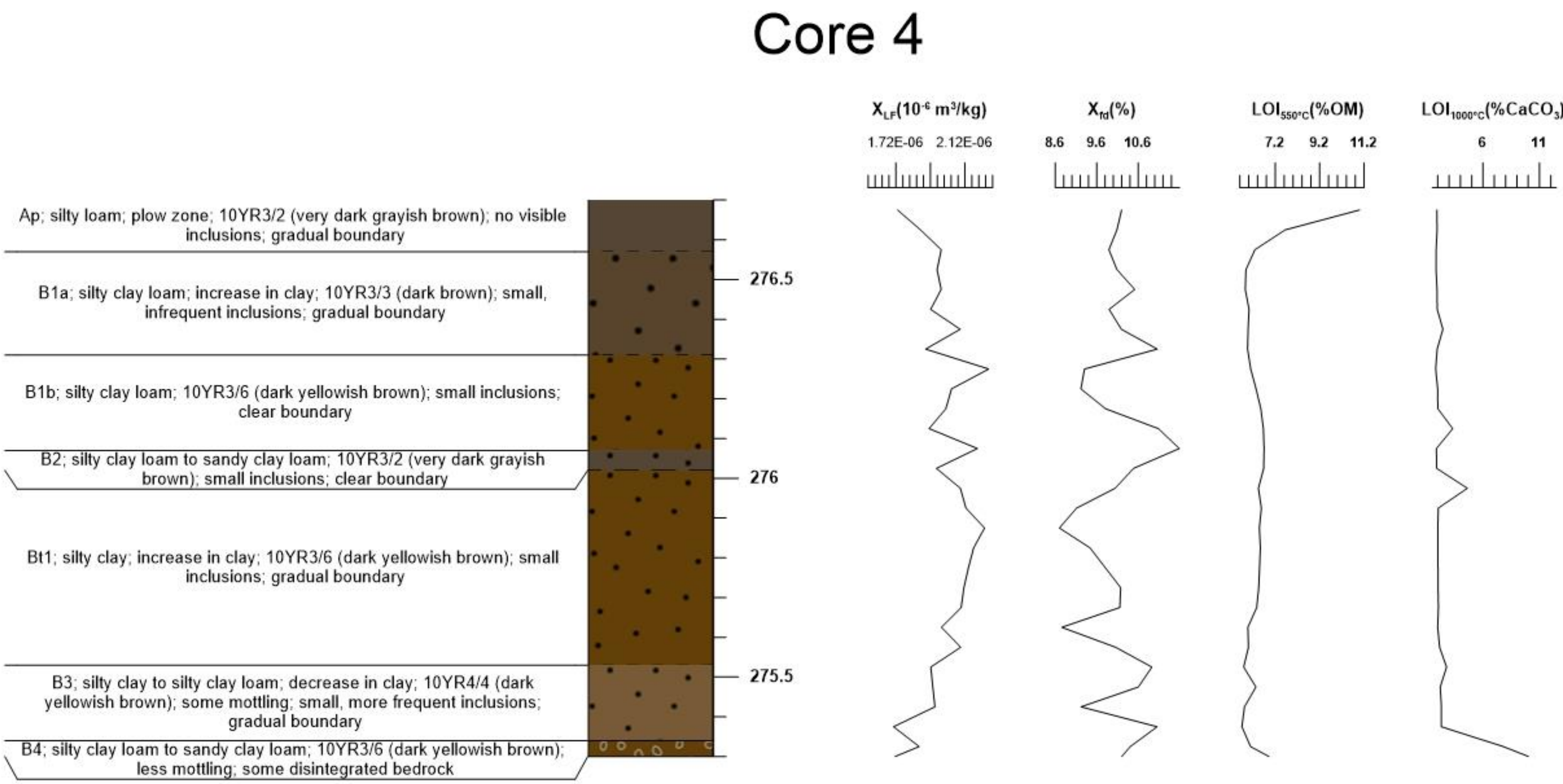

Figure A4. Results of Core 4 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

Core 5

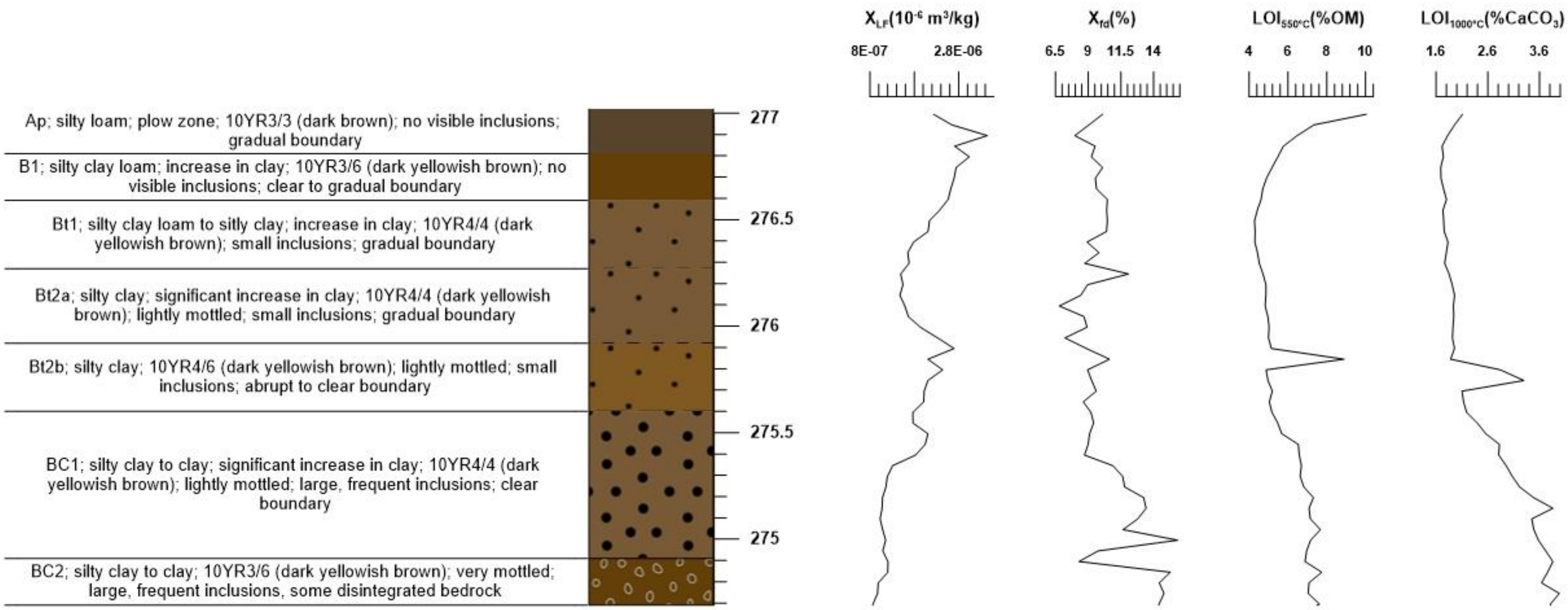

Figure A5. Results of Core 5 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

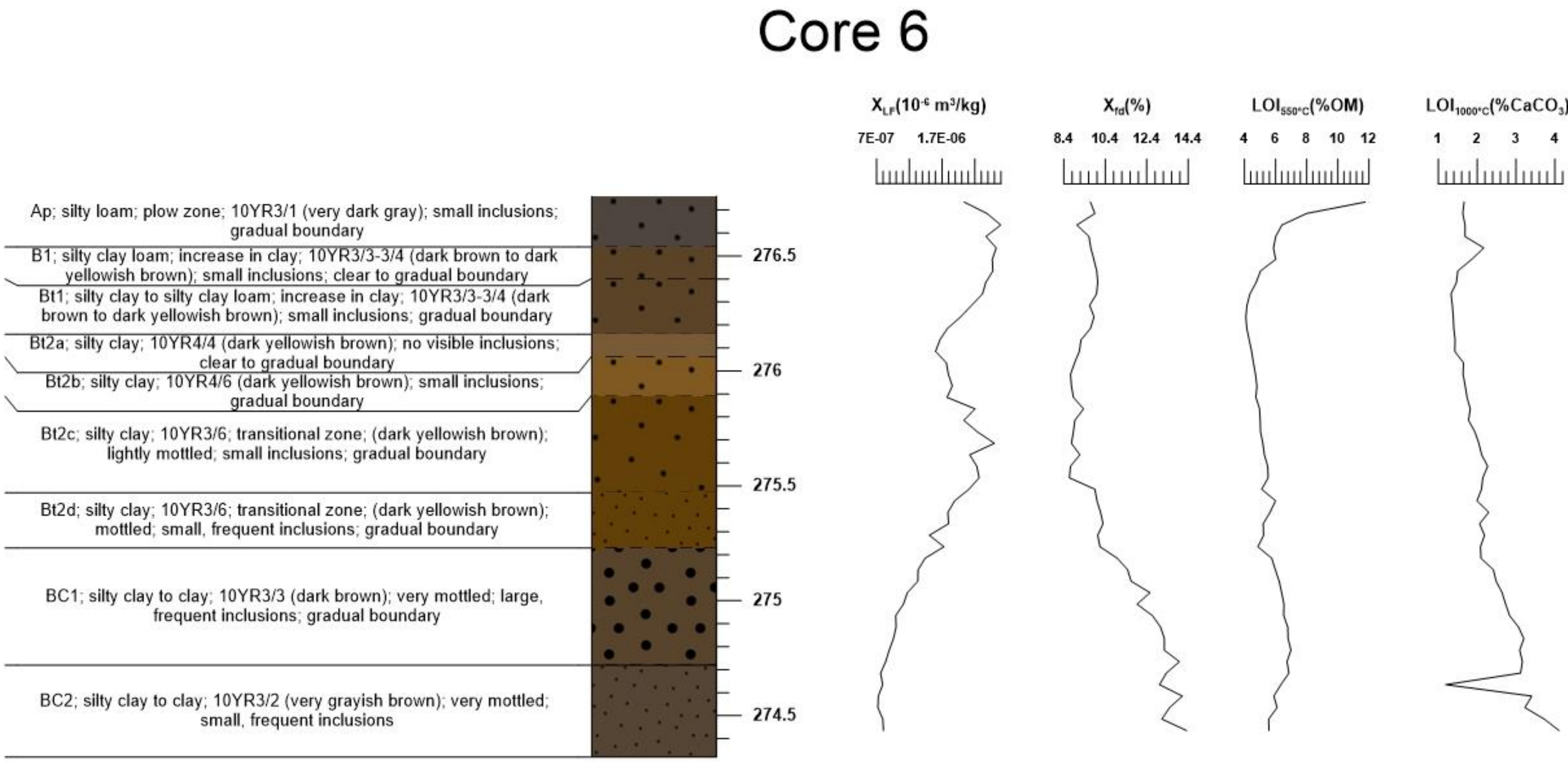

Figure A6. Results of Core 6 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

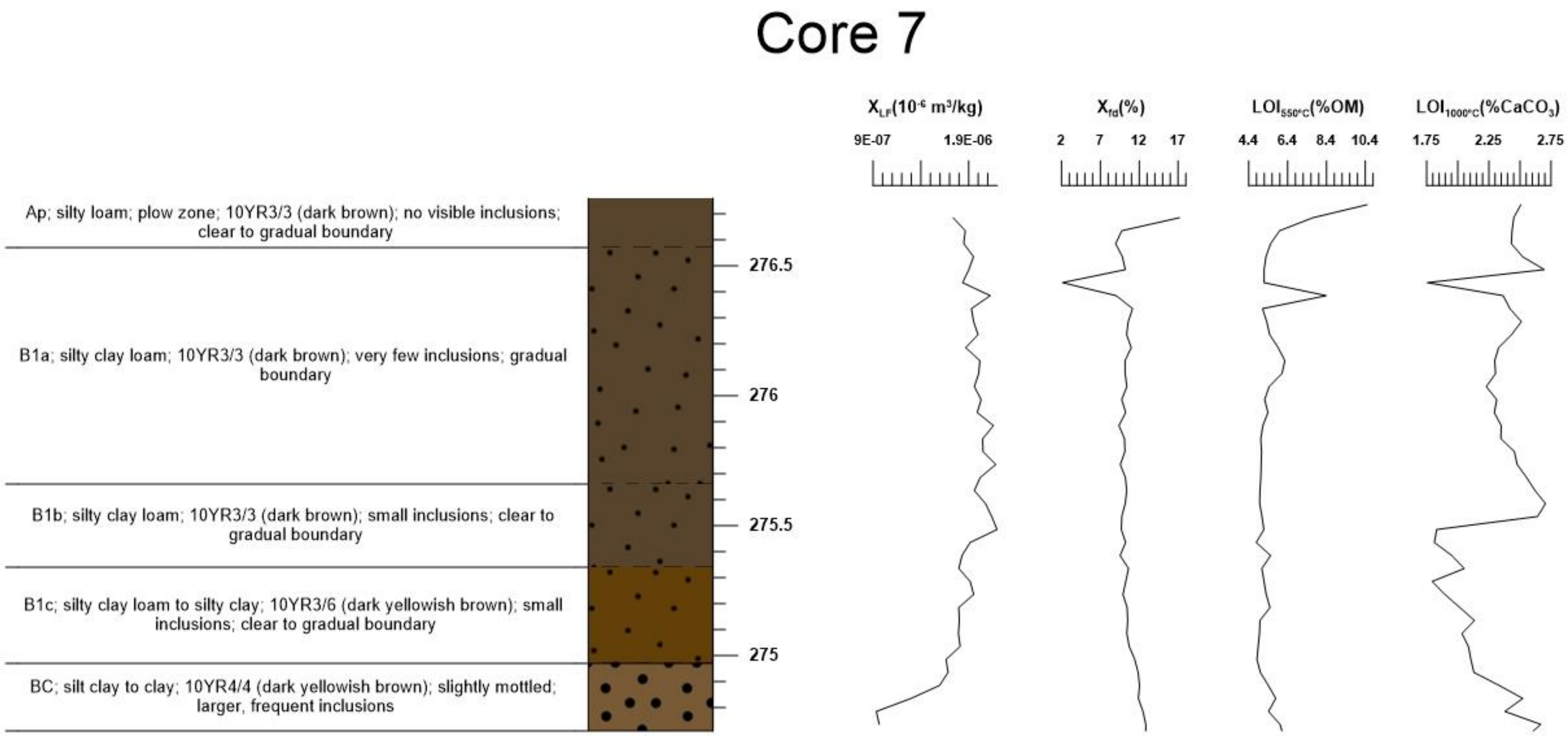

Figure A7. Results of Core 7 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

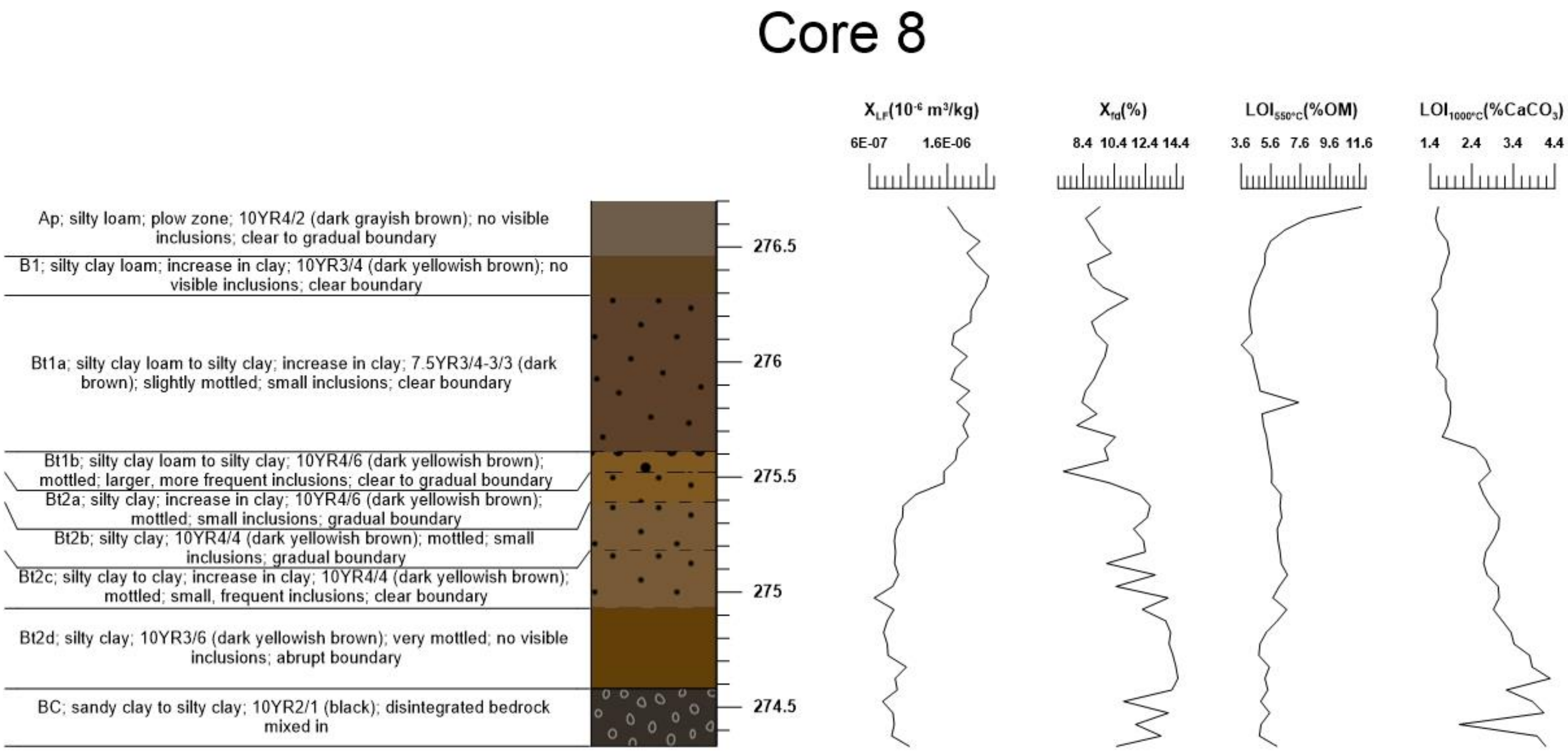

Figure A8. Results of Core 8 Analysis including soil core descriptions, low frequency magnetic susceptibility, magnetic susceptibility frequency dependent, loss-on-ignition measured at 550° C, and loss-on-ignition measured at 1000°C.

APPENDIX B: BAYESIAN CODE

Code from OxCal for Bayesian model *Peter Village*.

```
Plot()
 {
 Sequence("Peter Village")
 {
  Boundary("Start Peter Village");
  Phase("Occupation of Peter Village")
  {
  R_Date("Post 12", 2260, 60);
  R_Date("Post 4", 2465, 15);
  R_Date("Ditch3", 2140, 10);
  R_Date("Ditch2", 2155, 15);
  R_Date("Ditch1", 2000, 15);
  };
  Boundary("End Peter Village");
 };
 };
```