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PLACE, SPACE, AND COMMUNITY IN THE SPIRO REGION: A MULTI-SENSOR GEOPHYSICAL SURVEY OF THE BRACKETT SITE (34CK43) IN CHEROKEE COUNTY, OKLAHOMA

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PLACE, SPACE, AND COMMUNITY IN THE SPIRO REGION: A MULTISENSOR GEOPHYSICAL SURVEY OF THE BRACKETT SITE (34CK43) IN CHEROKEE COUNTY, OKLAHOMA

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BY THE COMMITTEE CONSISTING OF

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Abstract

The Brackett site (34CK43) is a Harlan Phase (A.D. 1050-1250) single mound site located at the confluence of the Illinois River and Baron Fork Creek in Cherokee County, Oklahoma. The site also had seven house-like structures and a burial area. For this project, a geophysical survey was conducted at Brackett over three weeks during Summer 2019 and one day in February 2020. A total of 115 gradiometry, 10 electrical resistance, and four ground-penetrating radar grids were collected, covering 4.48 hectares of the site. This survey resulted in the recording of anomalies consistent with WPA excavation remnants, historic debris, and possible Spiroan features. The results of this survey do not show any anomalies consistent with features associated with large groups of people occupying the site for a long period of time. In order to gain a better understanding of what these results mean in a larger context, I applied theoretical approaches influenced by landscape archaeology, an archaeology of community, and ritual symbolism to analyze Brackett's role in the Spiro region. I used the data collected for this project along with new information about Spiro-related mound sites in eastern Oklahoma provided by Regnier et al. (2019) to compare Brackett to other mound sites in the region. After its excavation, the site was initially interpreted as a permanently occupied village center. However, the results of this survey do not support this interpretation. The results confirm Kusnierz's (2016) interpretation that the site was occupied by ritual specialists. This thesis concludes that the site's usage was restricted to ritual activities and any activities that brought people within the community to the site did either did not frequently occur or the visiting groups did not stay for long periods of time.

Chapter One: Introduction

Over the past few decades archaeology has expanded beyond just digging holes in the ground. As technology advanced, archaeology has started to integrate new technological methods into the field, which has resulted in new questions and research opportunities. One such example is remote sensing. Remote sensing techniques include LiDAR, photogrammetry, and archaeogeophysics (also referred to as archaeological geophysics or simply geophysics). The purpose of this thesis is to explore how a geophysical survey can provide new insight into site organization at a Mississippi Period (circa A.D. 1000-1500) mound site in eastern Oklahoma.

Archaeological geophysics can be best defined as "the examination of the earth's physical properties using non-invasive ground survey techniques to reveal buried archaeological features, sites, and landscapes" (Gaffney and Gater 2003:12). This definition simplifies geophysics into its most basic principle of measuring earth's properties and what that can tell us about buried archaeological sites. The three most commonly used geophysical techniques in archaeology are magnetometry, electrical resistance, and ground-penetrating radar (GPR). Magnetometry measures the strength of the magnetic variation in soils, electrical resistance measures resistance of soil to electrical current, and GPR records the two-way travel time and amplitude of a radar pulse reflecting off anomalies in the soil (this includes both features and soil changes).

Geophysical surveys have been applied to various regions in archaeology. However, in eastern Oklahoma there have been only two geophysical survey conducted in the Arkansas River drainage in Oklahoma for research purposes (Leith 2011; Hammerstedt et al. 2017). The latter, a multi-sensor survey at the Spiro Mounds in Le Flore County, is just one example showing that geophysical surveys can be successfully conducted in the region (see Chapter 2 for more examples). While Spiro is the largest mound site in eastern Oklahoma, there are various smaller mound sites scattered throughout the Spiro Region. One such site is the Brackett site in Cherokee County, Oklahoma. This site was originally excavated by the Works Progress Administration (WPA) in the late 1930s-1940s, and then became the focus of several master's theses (Bareis 1955a; Kusnierz 2016). Along with Spiro, Brackett is the only Spiro-related mound site in eastern Oklahoma that is easily accessible for archaeologists to conduct field work. This is because a majority of the other sites are either inundated or have been affected by residential activities (Regnier et al. 2019).

The Brackett site is located about 64 km northwest of Spiro Mounds (Figure 1.1). The site itself consists of a platform mound that was capped off at some point during the site's occupation, a burial area, and seven known house structures. Brackett has been the subject of two University of Oklahoma Master's theses, one by Charles Bareis (1955a) looking at the artifacts from the site, and another by Nicole Kusnierz (2016) focusing on re-analyzing the artifacts and looking at community leadership at the Brackett. Based on her analysis of the architecture and artifacts at the site, Kusnierz (2016) interprets Brackett to have been a small village of ritual specialists. Both of these works were based on the WPA excavations, which only focused on a small portion of the site (Regnier et al. 2019).

Research Questions

The purpose of the survey is to further study Brackett by conducting a geophysical survey to see if new data can provide more insight into the site's organization. The relationship that this site has with the other mound sites in the region could also provide useful insight into why the site might have been organized in a particular way and what that might represent. The research questions for this project are: 1) Can a geophysical survey successfully be conducted at the

Brackett site?; 2) Does a geophysical survey of the site reveal the presence of previously unknown features? If so, what might they be?; 3) Does the use of a geophysical survey affect our understanding of the role that Brackett has within the Spiro Region? To answer these questions, this thesis focuses on the social and locational context of Brackett and the application of a theoretical perspective that concentrates on the relationship between community and site organization. Recently, new information has been synthesized and published regarding the site organization of a number of the single mound sites in eastern Oklahoma (Regnier et al. 2019). By using this new information, I plan to further explore Brackett's role within the Spiro Region and its relationship with the other mound sites.

Brief History and Theoretical Perspectives

The presence of platform mounds in the region is one indication that the Spiro Region has some connection to the greater Mississippian phenomenon. While there is evidence of interaction with Mississippian peoples and even ideology, the Spiro Region is distinctly its own phenomenon (Brown 2012). Brackett has been dated to the Harlan phase (A.D. 1050-1250) of the Arkansas River valley in eastern Oklahoma. This phase is characterized by the presence of burial, platform, and house mounds, along with square houses with four center posts. There are multiple mound sites dated to this time scattered throughout the region (see Chapter 2). Unfortunately, many of these sites are inundated or destroyed by residential activities. Luckily Brackett is currently owned by the U.S. Army Corps of Engineers and is under hay lease, which means that the site has been left relatively undisturbed.

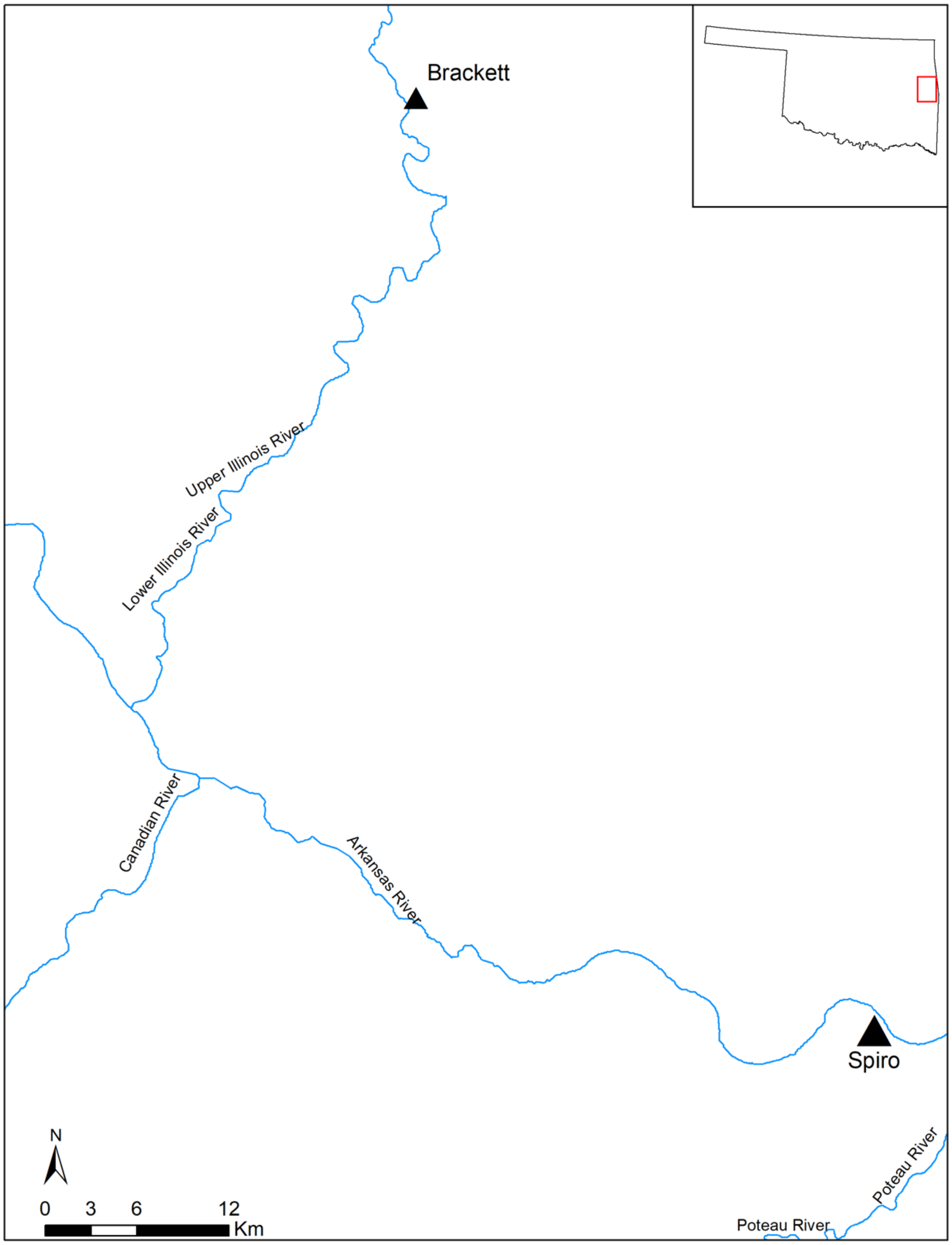

Figure 1.1 Locational Map of Brackett

Geophysical surveys have successfully been conducted in the greater Caddo Region and have been used to shed new light onto how we understand Caddo occupations (see Chapters 2 and 3). Geophysical surveys allow archaeologists to use site-wide datasets to make inferences on a community level without relying solely on the Terán Map to understand Caddo site organization. This map depicts an upper Nasoni village along the Red River that was mapped during Domingo Terán de los Rios' 1691-1962 exploration of eastern Texas (see Chapter 3). The collection of site-wide data in a relatively short amount of time compared to traditional excavation methods provides archaeologists with the opportunity to ask broader questions about topics such as site organization or landscape usage (Kvamme 2003). Since there is new information available about site organization at mound sites within the Spiro region, an archaeology of communities becomes relevant to think about how these mound sites within the Arkansas River Valley interacted with each other and how that might affect our understanding of site organization.

Summary of Chapters

Chapter two focuses on providing background information relevant to understanding the Brackett Site. This chapter starts off with a brief discussion of the Mississippian as a way to provide context for the general southeast at the time during Brackett's occupation. Then, there is an introduction to the Caddo Region to provide more contextual information regarding Brackett. A summary of the archaeology of the Arkansas River valley is then provided. A brief summary of the region's chronology is presented along with descriptions of major sites related to Brackett. Once the context has been introduced, the Brackett site itself will be discussed in detail. The history of research at the site is summarized and previous interpretations will be presented. Finally, a brief review of the uses and results of geophysical surveys within the Caddo Region will take place. In addition to summarizing how the different technologies have been used, specific examples will be explored. This will lead into a short discussion of why conduction a geophysical survey at Brackett is important and what types of information can be revealed.

Chapter three reviews the theory that will be applied to our discussion of Brackett and its relationship to other sites within the region. By using the results of this geophysical survey alongside the results of excavation data at other sites, we will be looking at trying to understand how Brackett and contemporaneous site in the region might have been associated with a similar community of ritual specialists. To start, this chapter summarizes theories relating to platform mounds within the greater Mississippian Period. It is then expanded to include theories relating to settlement patterns and site organization within the southeast and, specifically, the Caddo Region. There will also be a brief exploration of how ritual specialists might have used these sites and whether or not there might be some connection between the mound sites. To build off of previous explorations of site organization and leadership at Brackett (Kusnierz 2016), I will introduce a community perspective to understanding the site and how site organization might be utilized to understand relationships between occupants at different sites. By discussing an archaeology of communities, I hope to get a better understanding of the connection Brackett might have had to the nearby multi-mound ceremonial centers.

Chapter four introduces the geophysical survey methods utilized in this project. A definition of geophysics is presented, along with a summary of the instrumentations used for this project. The three technologies discussed are magnetometry, electrical resistance, and ground-penetrating radar (GPR). The data collection and processing steps are detailed for each technique. The magnetometry data was collected with a Bartington Grad 601 gradiometer and the data was processed in TerraSurveyor 3. The electrical resistance data was collected with a

GeoScan RM15 and the data was processes in GeoPlot 4. Finally, the GPR data was collected with a GSSI UtilityScan with a 350 MHz antenna, and the data was processed in RADAN 7. The site was surveyed with 20x20 meter grids and 50cm transects for each instrument. In total, 115 gradiometer grids, 10 resistance, and 4 GPR grids were collected, totaling 4.48 hectares. The gradiometer was used to survey the whole site and any anomalies of interest were targeted by the other instruments. Unfortunately, the fieldwork for this project was delayed a month and a half due to harsh weather and flooding, which meant that the height of the grass impeded our ability to survey all of the grids of interest.

Chapter five presents the results of this geophysical survey. This project revealed anomalies consistent with both historic and pre-contact activities. With the exception of one faint anomaly, there are no additional structures present at Brackett other than those excavated by the WPA. There are some anomalies consistent with digging activities, such as borrow pits. However, it is unclear as to whether these anomalies are associated with WPA activities or pre-contact occupation of the site. There are also anomalies that potentially represent the remnants from the WPA's trench excavations of the mound. These linear anomalies run perpendicular to the north-south direction and are characterized by a dipolar signature. In an attempt to correlate anomalies with the WPA work, maps were overlaid on the survey data. This confirmed that at least two anomalies of interest are related to WPA excavation activities at the site. The general location of the burial area was also estimated based on overlays of WPA maps. After confirming the lack of additional structures in the survey area, it is possible to discuss how site organization at Brackett compares to the other mound sites in the region. Using the results of this survey, this chapter provides a summary of site organization at Brackett that we know so far and how it relates to other sites within the region.

The final chapter provides a summary of this project and discusses the broader implications of these results. This chapter also discusses my interpretations and how they provide answers to the research questions. By focusing on site organization and how it is influenced by community, I answer the research question relating to Brackett's role in the Spiro Region. Finally, recommendations for future research at Brackett are provided. In addition to ground-truthing these anomalies, more geophysics should take place to the west and north of the surveyed area and there should be more investigations into creating a model of site organization at Spiro-related mound sites in the region.

Chapter Two: Background

This chapter introduces the locational and social context through which Brackett is understood. First there will be a summary of important characteristics of Mississippian societies, including the importance of platform mounds and architectural organization within a site. Since Brackett is located in what is referred to as the northern Caddo Region, I will provide a brief summary of the region and how it relates to the southern Caddo Region and why the distinction is important. Then, there will be an introduction to the Spiro Region in eastern Oklahoma, wherein I will summarize the local chronology and describe relevant sites within the area. This chapter will end with a review of geophysical surveys within the Caddo region to get a better sense of the type of research questions being asked and the types of information that can be learned.

The Mississippian

The intensification of agriculture brought about the Mississippi period starting around A.D 1000 in the southeastern U.S. and lasting until around A.D. 1500 (Figure 2.1). This period refers to local adaptations within the Southeast and Midwest that result in intensified maize agriculture, new ideology, formalized ranking, hierarchies, and the construction of earthen mounds (Anderson 1994; Blitz and Lorenz 2006). The Mississippian is broadly defined by its reliance on maize agriculture, complex social relations, and mortuary practices. Specifically, Mississippian societies are based on the presence of platform mounds, plazas, shell-tempered pottery, maize agriculture, intense religious/ ritual practices, and a chiefdom organization (Alt 2007). The term 'chiefdom' is typically used to describe Mississippian social organization (Beck 2003). However, there has been questioning about whether chiefdoms are a valid description of social structures within the Mississippian (Muller 1997; Pauketat 2007).

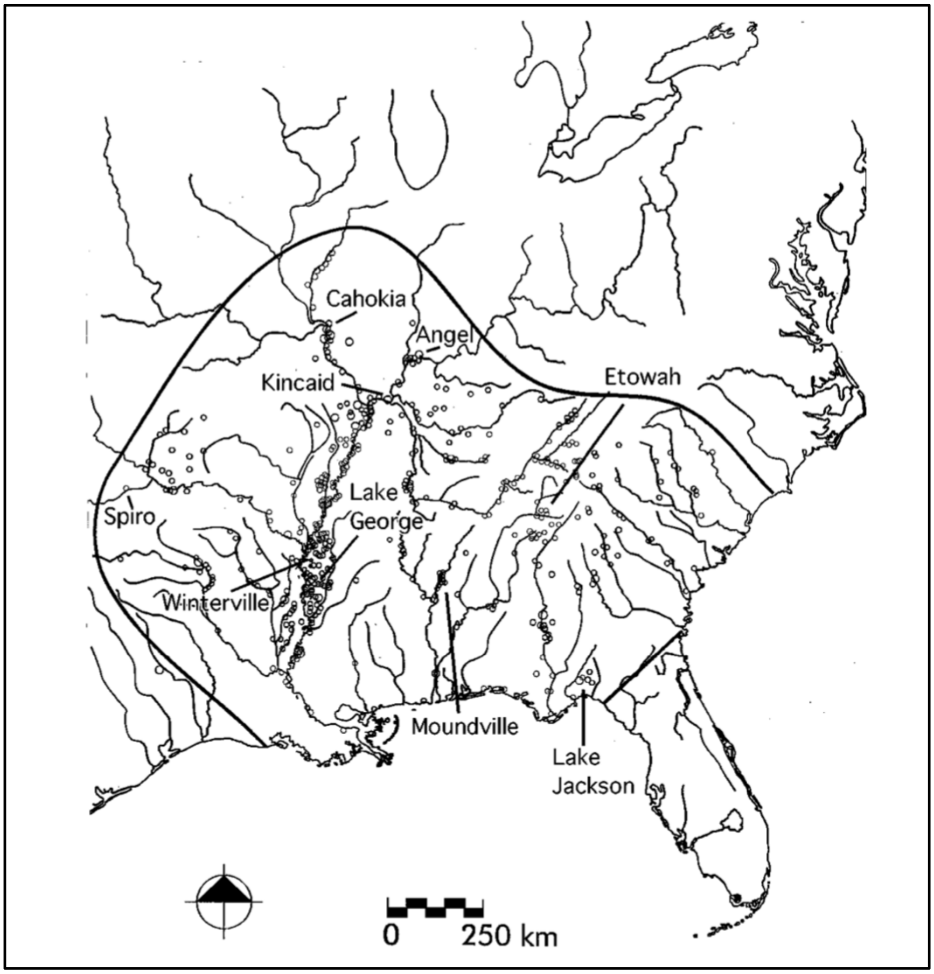

Figure 2.1 Distribution of significant Mississippian sites in the United States (Cobb 2003:Figure 1)

The term "Mississippianization" was applied to the transitional process that people might have experienced while these features were becoming major components of everyday life (Cobb and Garrow 1996; Pauketat 2003, 2004, 2007). This process is evident in the site organizational pattern of the plaza-mound complex (see Chapter 3). Some sites, such as Washausen in Illinois, have evidence that suggests a clear shift in populations and site organization at the Woodland-Mississippian boundary that indicates there was some shared influence spread throughout the general southeast (i.e. Barrier and Horsley 2014; Peregrine 1992). Despite its extensive presence in the southeast, various regions did not completely conform to the Mississippian influences. Blitz (2010) argues that Mississippian research should switch from a more generalized view of Mississippian to focusing on more scaled approaches. One region that has shown evidence of connections with the Mississippian world but is not considered classic "Mississippian" is the Caddo region along the Red River and the Spiro Region within the Arkansas River valley.

Archaeology of the Caddo Region

The Caddo region is linked to the Mississippian, but it should be thought of at its own distinct entity (Blitz 2010:3). Formative Caddo populations arose from earlier Late Woodland groups inhabiting what is now eastern Oklahoma, north Texas and Louisiana, and southwest Arkansas (Lambert 2017:26). According to Perttula (2017), the increased use of platform and burial mounds may represent a new cosmological worldview emerging along with these populations. Caddo archaeology can be separated into two areas, consisting of the northern and the southern Caddo. There are clear archaeological distinctions between the areas. Recently, Lambert (2017) provided an analysis of Caddo fine wares in the region and found clear differences between the areas, such as depositional contexts and modes of production. The North and South Caddo can be thought of as two different communities of practice that developed separate ritual structures (Lambert 2017:283).

The Northern and Southern Caddo Regions

The Caddo region can be separated into two components: the northern and the southern Caddo, each with characteristics specific to that area. In Oklahoma, the northern Caddo settlements are limited to the Arkansas River Valley and Ozarks while the southern Caddo are located along the Red River and Ouachita Mountains (Figure 2.2). Similarities between the groups occupying these different areas include settlement patterns, mound-building, and iconography, while differences include burial practices, pottery styles, and architecture (Perttula 2009; Perttula et al. 2011; Lambert 2017). Research on dental anomalies suggests some degree of genetic differences (Rose et al. 1998). Recent analysis on Caddo pottery revealed that during the Early Caddo period the Arkansas Valley groups (North Caddo) did not produce their fine wares but rather imported them from the south for mortuary ceremonies, while the Southern Caddo groups produced their own fine wares and deposited them in both mortuary and ceremonial contexts (Lambert 2017).

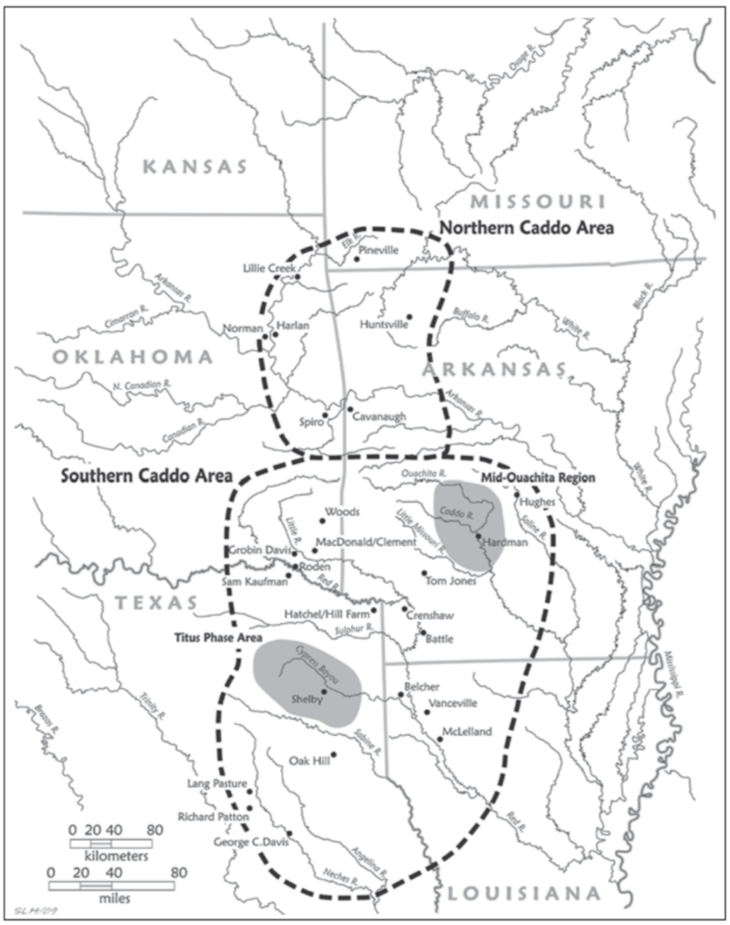

Figure 2.2 Map of the northern and southern Caddo Regions. (Perttula 2012:Figure 1-2).

Since the focus of my thesis is site organization, the most relevant Caddo characteristics that differentiate the northern and southern Caddo regions include those related to settlement patterns and architecture. The area occupied by northern Caddo groups consisted of eastern Oklahoma and parts of Arkansas and Missouri, specifically in the Arkansas River valley. The houses in this area are square or rectangular in shape with central support posts (Figure 2.3). The orientations of the extended entryways of structures are thought to be associated with Caddo cosmological beliefs about life and death (Kay and Sabo 2006). Mounded sites included structure orientations associated with the winter solstice sunrise to the southeast, the sunrise to the east, and the winter solstice sunset to the southwest (Perttula 2009). The non-mounded sites consisted of structures whose orientations aligned with the winter solstice sunrise to the southeast and the winter solstice sunset to the southwest, with entryways facing plazas or courtyards (Perttula 2009).

The groups living within the southern Caddo area occupied areas associated with the Red River drainage, specifically of northeast Texas, northwest Louisiana, southwest Arkansas, and southeast Oklahoma. The southern houses are circular and also include central support posts (Figure 2.3). For non-mound sites, structure orientations within the southern Caddo region are towards plaza areas or specialized structures and the west (Perttula 2009). The structures at mounded sites are oriented to the south or northeast, which correspond to the summer solstice sunrise, the sunrise and sunsets of the winter solstice, and the setting sun to the west (Perttula 2009). The variation in orientation could be an indication of the use of the building.

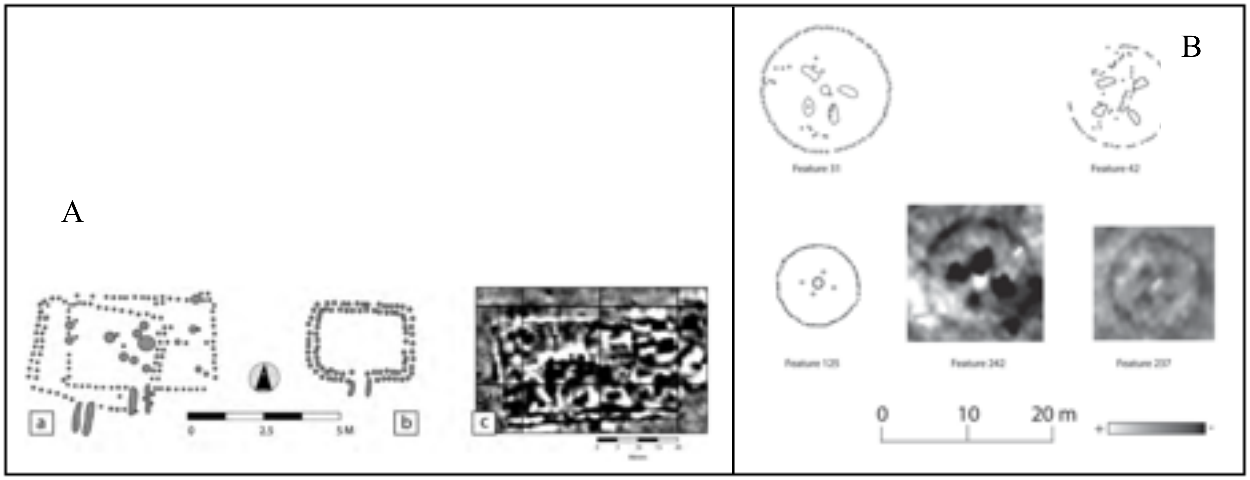

Figure 2.3 A) Examples of rectangular house structure in northern Caddo Region (Sullivan and McKinnon 2013:Figure 9) and B) Circular house in southern Caddo Region (Walker and McKinnon 2012:Figure 7-3)

The Arkansas River Valley

The northern Caddo occupied the Arkansas River Valley and its tributaries in eastern Oklahoma, northwest Arkansas, and southwest Missouri. A range of site types exist, including rock shelters, villages, and a variety of mound and non-mound settlements (Brown et al. 1978). Differences between the Arkansas River and the Red River valleys include house types, subsistence and storage techniques, pottery, mound types, art styles, burial patterns, social organization, and mortuary ceremonialism (Schambach 1990:68). Older studies have categorized the settlement patterns of Caddo sites within the Arkansas River valley. Brown et al. (1978) categorized three types of settlement patterns for Caddo sites within the Arkansas River valley: first-, second-, and third-echelon centers (see Chapter 3 for an in-depth discussion of these patterns). The first-echelon centers refer to sites with burial mounds and buried structure mounds. Second-echelon centers include those sites with platform mounds as well as mortuary structures. The third-echelon centers are those sites with multiple mounds. The latter includes sites such as Spiro, Harlan, and Norman. However, this is an outdated model based on ideas that Spiro was a Mississippian chiefdom and, while still broadly useful, is no longer utilized to categorize sites within the region.

The largest of these sites is Spiro, which was occupied from A.D. 900 to 1450. The site consists of two areas: the upper and lower terraces. The upper terrace consists of 11 mounds that closely resemble the typical mound-plaza complex characteristic of the Mississippian Period. The lower terrace is home to three mounds, including Craig Mound. Brown (2012) has challenged the interpretation that Spiro was a chiefdom within the region. The presence of exchanged ritually charged objects with iconographic elements has led to the idea that Spiro was a center for ritual activity (Brown 1996; Rogers 2011).

Chronology

There are five major cultural periods associated with sites within the Spiro region in the Arkansas River Valley that have been defined by Bell (1972, 1984). These phases overlap with Brown's (1984, 1996) seriation of the Spiro gravelots. Bell (1984) formalized these phases as the Evans, Harlan, Norman, Spiro Phase and Fort Coffee (Figure 2.4). The Evans phase (A.D. 950-1050/1100) is defined by the grave lots in the pre-mound burials at Spiro. The Harlan phase (A.D. 1050-1250) is characterized by burial, platform, and house mounds, as well as four post square houses. The Norman phase (A.D. 1250-1350) is similar to Harlan but included more elaborate burial goods. The Spiro phase (A.D. 1350-1450) reflects the peak occupation at Spiro, with two post houses and structures associated with Spiro's main complex. Finally, the Fort Coffee (A.D. 1450-contact) is characterized by a shift to a Plains adaptation. A detailed summary of these phases has already been provided by Kusnierz (2016) (see Bell 1984, Brown 1984, Rohrbaugh 1984 for specific details). For brevity and relevance, only the Harlan phase will be further explored in this chapter because Brackett has been firmly dated to it (see Kusnierz 2016).

The Harlan Phase was first introduced by Robert Bell (1984) in his analysis of the Harlan site (see next section). The Harlan phase consisted of larger households than previous phases, consisting of rectangular shapes, extended entryways, and four center posts. Harlan phase houses were generally oriented to the south or southeast and widely scattered (Rogers 1998). Some Harlan-style houses also have extended entryways, which are associated with ritual purposes (Rogers 1982; Kay and Sabo 2006; Perttula 2009; Hammerstedt and Savage 2016; Regnier et al. 2019). Kay and Sabo (2006) provide a summary of Harlan-style charnel houses, which are one example of a special purpose house. Charnel houses are oriented to the southwest, do not have a hearth, are built on a previous structure's location, and have entryways blocked with clay during closing events. Kay and Sabo (2006) argue that these houses are associated with renewal activities. The most common orientation of Harlan-style structures is to the southeast, which is associated with the summer full moonrise and the color red (Hammerstedt and Savage 2016). There is also an increased use of white and black in mortuary ritual contexts during the Harlan phase in the Arkansas River valley (Hammerstedt and Savage 2019, unpublished manuscript).

Important Sites

The largest and most well-known archaeological site in the Arkansas River valley is Spiro located in Le Flore County. With 11 mounds and a village and mortuary area, this site falls under Brown et al.'s (1978) category of a third-echelon center. However, there are multiple mound sites of various sizes located throughout the Arkansas River valley (Figure 2.5). This includes both single mound and multi-mound ceremonial centers. In addition to Brackett, six other mounds sites will be explored as part of the exploration of community within the Spiro

Region (see Chapter 3). These sites were chosen because they were the largest ceremonial centers behind Spiro (Harlan, Norman, Reed), or they were also single mound sites near Brackett (Eufaula, Hughes, Lillie Creek). All of these sites had overlapping occupations with Brackett and some (Hughes and Eufaula) were abandoned at around the same time (Regnier et al. 2019). This is not an exhaustive summary of mound sites in eastern Oklahoma; for a detailed summary of other mounds sites in the region, see discussions in Kusnierz (2016), Regnier et al. (2019), and Vogel (2005).

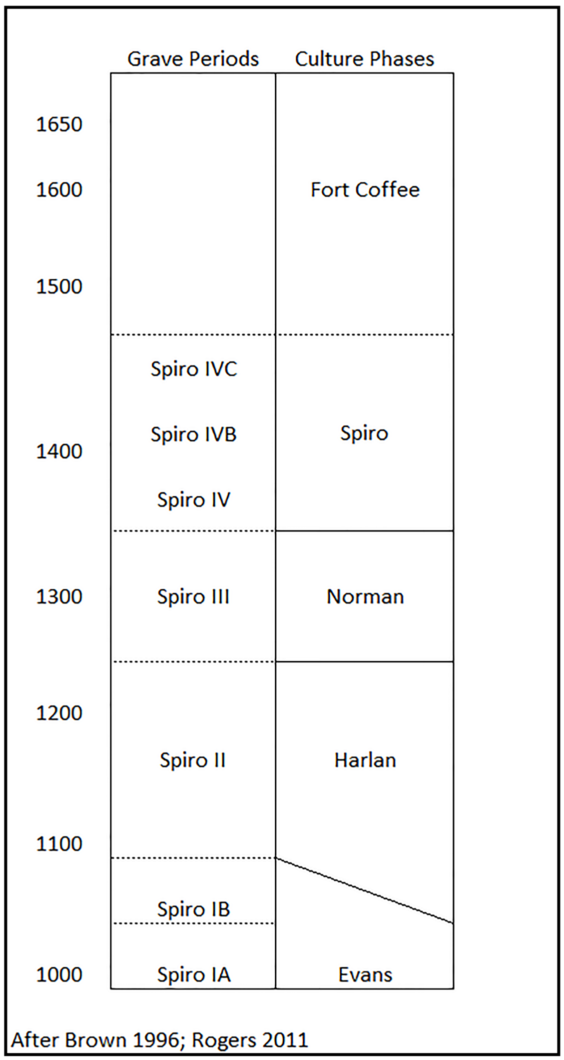

Figure 2.4 Spiro Regional Chronology (Regnier et al. 2019:19)

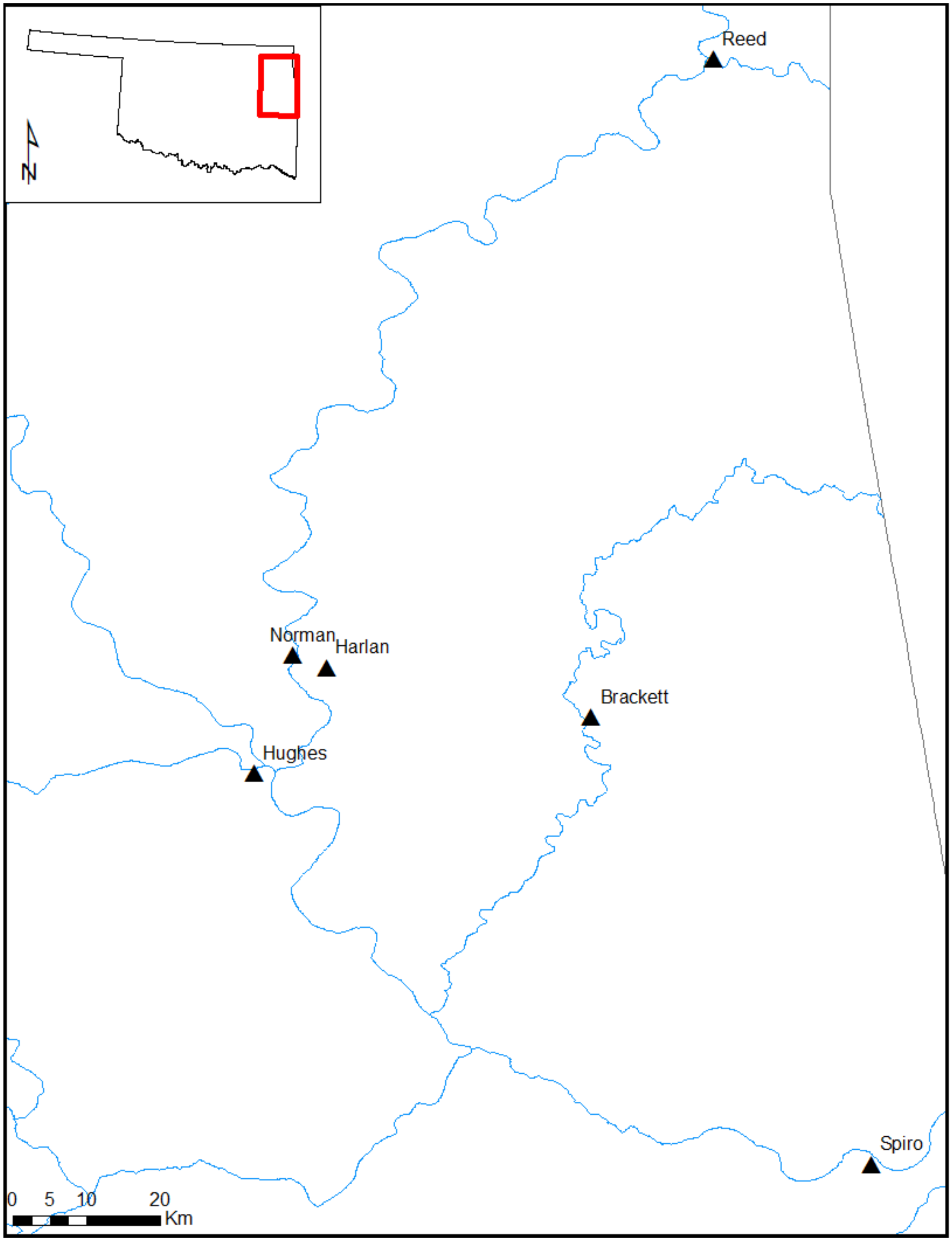

Figure 2.5 Locations of selected mound sites in Eastern Oklahoma.

Harlan (34CK6): This site was occupied around A.D. 1000-1200 and is located along Fourteen Mile Creek. Harlan consists of five mounds surrounding a plaza area, in addition to a village (Cranford 2007) (Figure 2.6). Mound Unit 1 is 3-lobed and includes burials. Bell (1972) reported his 1950-60s excavations and analyzed the structure patterns of the village area. Bell's excavations revealed seven structures, six of which are interpreted by Kay and Sabo (2006) to be charnel houses associated with mortuary ritual. Structure orientations at Harlan include southwest, northeast, and east-southeast (Hammerstedt and Savage 2016; Regnier et al. 2019).

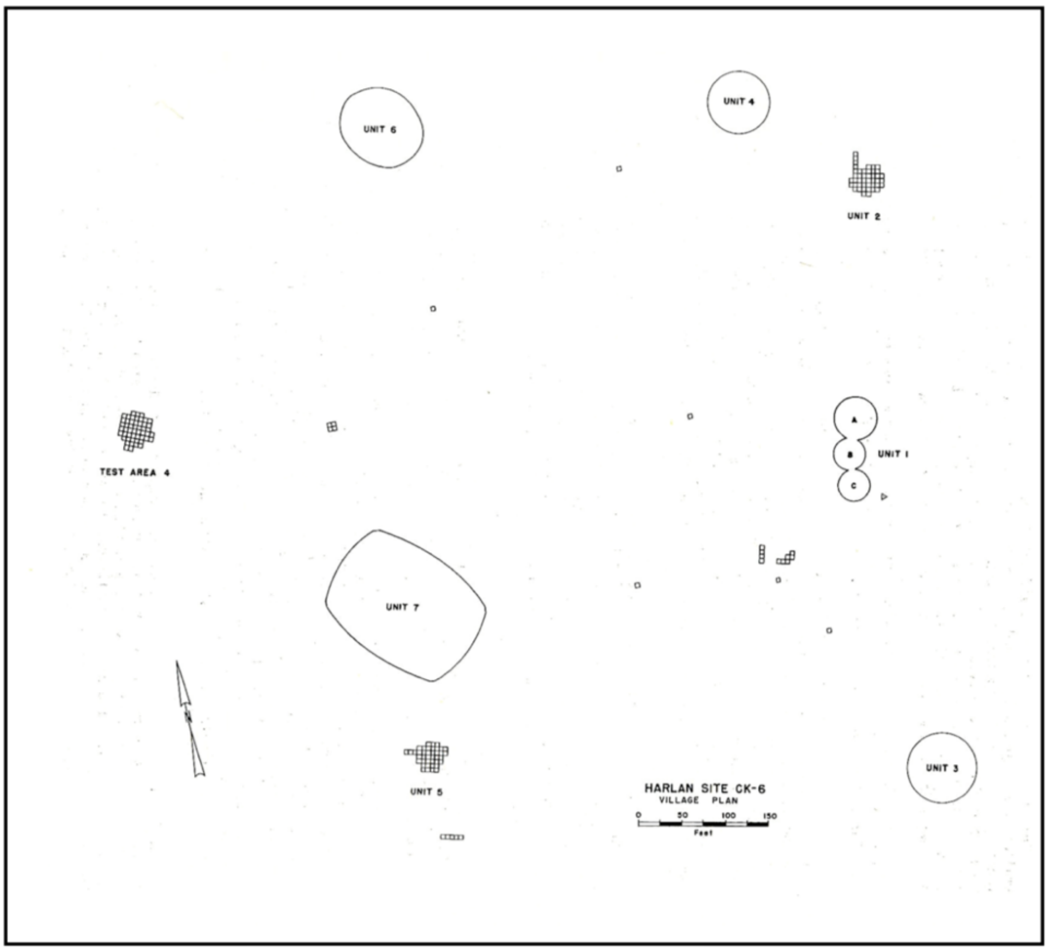

Figure 2.6 Planview Map of the Harlan Site (Bell 1972: Figure 3).

Norman (34WG2): Located about 5km from Harlan, Norman was occupied from A.D. 1000 to 1300. The site consisted of two bi-lobed mounds, one conical mound, a habitation area, and midden deposits (Cranford 2007; Regnier et al. 2019) (Figure 2.7). Norman was first excavated through WPA excavations led by J. Joe Finkelstein and Herbert Antle in the early 1930s. Later, Robert Bell with the University of Oklahoma conducted the 1948 field school at the Norman site, which was followed that same summer by work directed by Joseph Caldwell from the Smithsonian Institution River Basin Survey. Recent work at Norman focused on profiling Mound I (Vogel et al. 2005). There were 74 burials total within Mound II, seven of which were cremations. Structures tend to be oriented to the southwest and the summer full moonset at Norman (Hammerstedt and Savage 2016; Regnier et al. 2019).

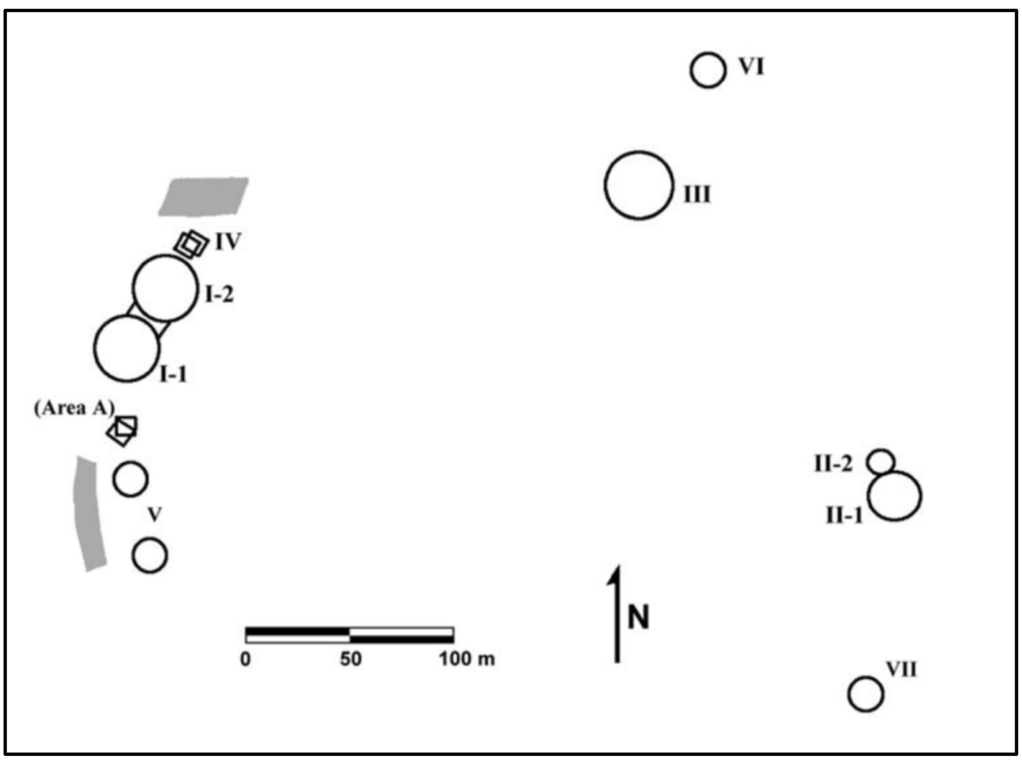

Figure 2.7 Planview Map of the Norman Site (Vogel 2005: Figure A.102).

Reed (34DL1-11, 14): Occupied around A.D. 1000-1300, Reed was located at the confluence of the Elk and Grand Rivers in Delaware County. The site was excavated by the WPA from 1937-1940, first by J. Joe Finkelstein and later David Baerreis (Regnier et al. 2019). The site consisted of a platform mound, one two-lobed mound with burials, and a habitation area (Figure 2.8). The platform mound at Reed was constructed in two phases and there were three structures with extended entryways at its base. There were 20 structures at Reed that have been assigned to the Harlan phase (Regnier et al. 2019). Structure orientations at Reed include north, south, northeast, southwest, and southeast (Hammerstedt and Savage 2016; Regnier et al. 2019).

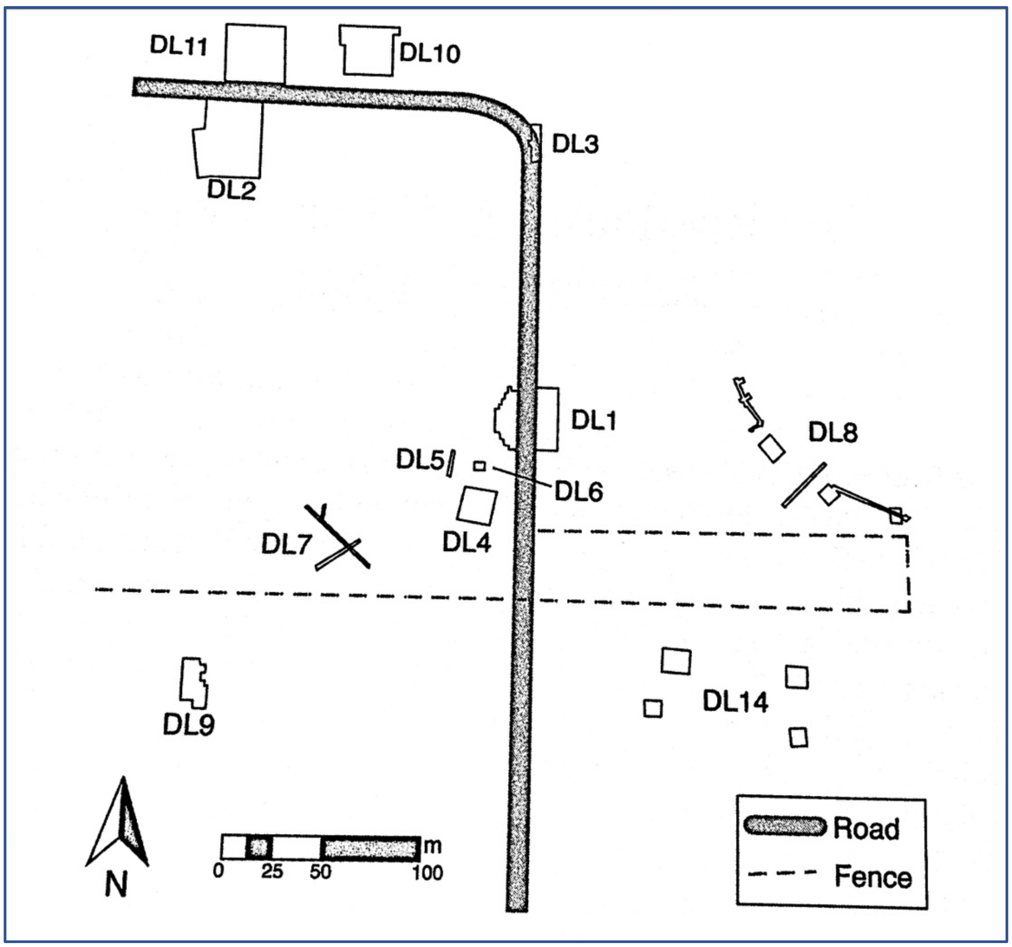

Figure 2.8 Site Map of the Reed Site (Regnier et al. 2019: Figure 8.1).

Hughes (34MS4-5): Hughes is a single mound site that was excavated by the WPA under Lynn Howard and Franklin Crawford in 1938 (Figure 2.9). Located in a bluff overlooking 3 stream confluences, Hughes has the largest viewshed when compared to other single mound sites within the area (Vogel 2005). The platform mound was constructed in two phases with a clay floor between the primary platform and secondary mound (Regnier et al. 2019:159). There were also 15 square/rectangular structures with four center posts that were located north and southeast of the mound; one of these had an extended entryway (Regnier et al. 2019). There was a burial area located to the north of the mound. Hughes was probably occupied during the Harlan and Norman phases, abandoned by A.D. 1300, and then reoccupied during the later Fort Coffee phase (Kusnierz 2016:57; Regnier et al. 2019). Hughes has not been inundated but has been largely destroyed by residential and urban activities, such as the construction of the Muskogee Country Club.

One non-mound site of interest in this area is known as School Land I (34DL64). The faunal remains at this site were analyzed by Duffield (1969). Radiocarbon dates for this site were obtained from the University of Wisconsin in the 1960s and span roughly A.D. 1050 to 1240, which places the site in the Harlan and Norman phases (Bender et al. 1968). Unfortunately, their results tend to be inaccurate by a few hundred years when the same samples are redated (Regnier et al. 2019:344). Similar to other sites in the area, School Land I was excavated by the WPA and is currently underwater due to damming of the Grand River. No WPA maps were created of this excavation, leaving Duffield (1969) to recreate the plan of excavation (Figure 2.10). This resulted in the potential locations of eight houses. These houses are typical of houses in the region, with square and rectangular shapes, 2-4 center posts, wall trench construction, and extended entryways. According to Duffield (1969), five of the structures had entryways facing he village center, one structure only had two center posts, and one structure in the west portion of the site had no entryways. These structures were either oriented to the southeast or the southwest (Duffield 1969; Hammerstedt and Savage 2016). Located northwest of School Land I is another site known as School Land II. There is not much information about this site except that there was one rectangular house located there (Duffield 1969).

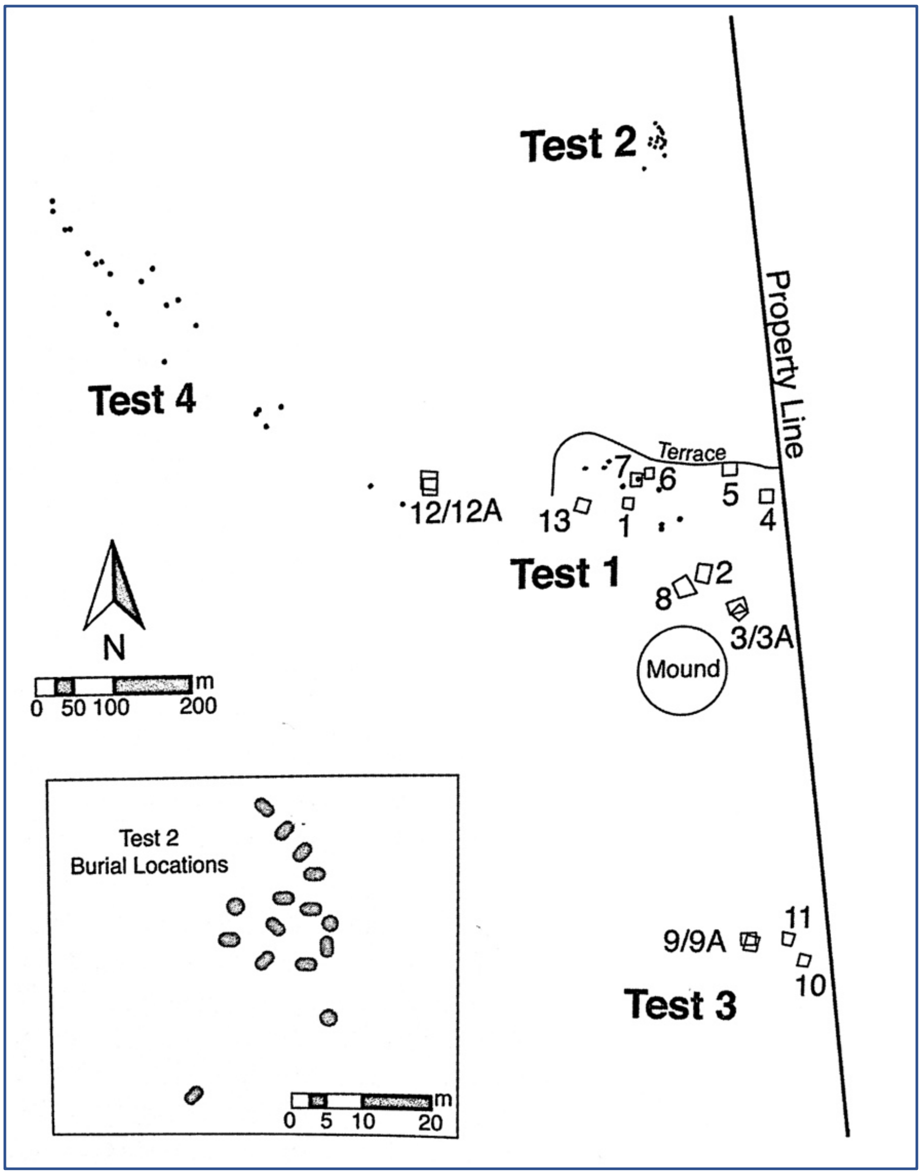

Figure 2.9 Site Map of the Hughes Site (Regnier et al. 2019: Figure 4.2).

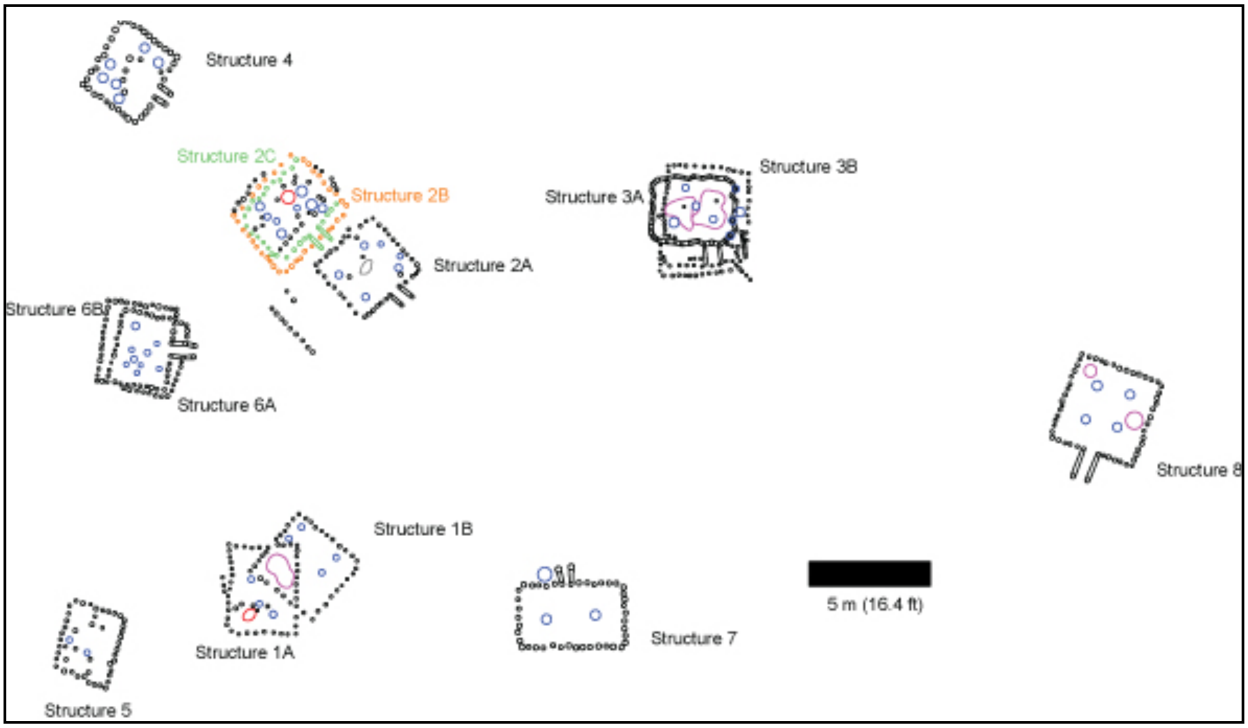

Figure 2.10 Excavation Plan Map of School Land I (Courtesy of Dr. Scott Hammerstedt).

The Brackett Site

Brackett is located on the Ozark Highlands at the fork of the Illinois River and Baron Fork Creek in Cherokee County, Oklahoma. The site was named after the landowner at the time of the WPA excavations, M. L. Brackett. The site is currently owned by the U.S. Army Corps of Engineers (USACE) and is leased out as a hayfield. This means that the only recent modern effects on the site have been related to plowing activities. Brackett consists of seven house-like structures, a burial area, and a mound (Figure 2.11). The seven structures excavated at Brackett comprise of three house types: square with four center posts, rectangular with four center posts, and rectangular with two center posts (Kusnierz 2016; Regnier et al. 2019:194).

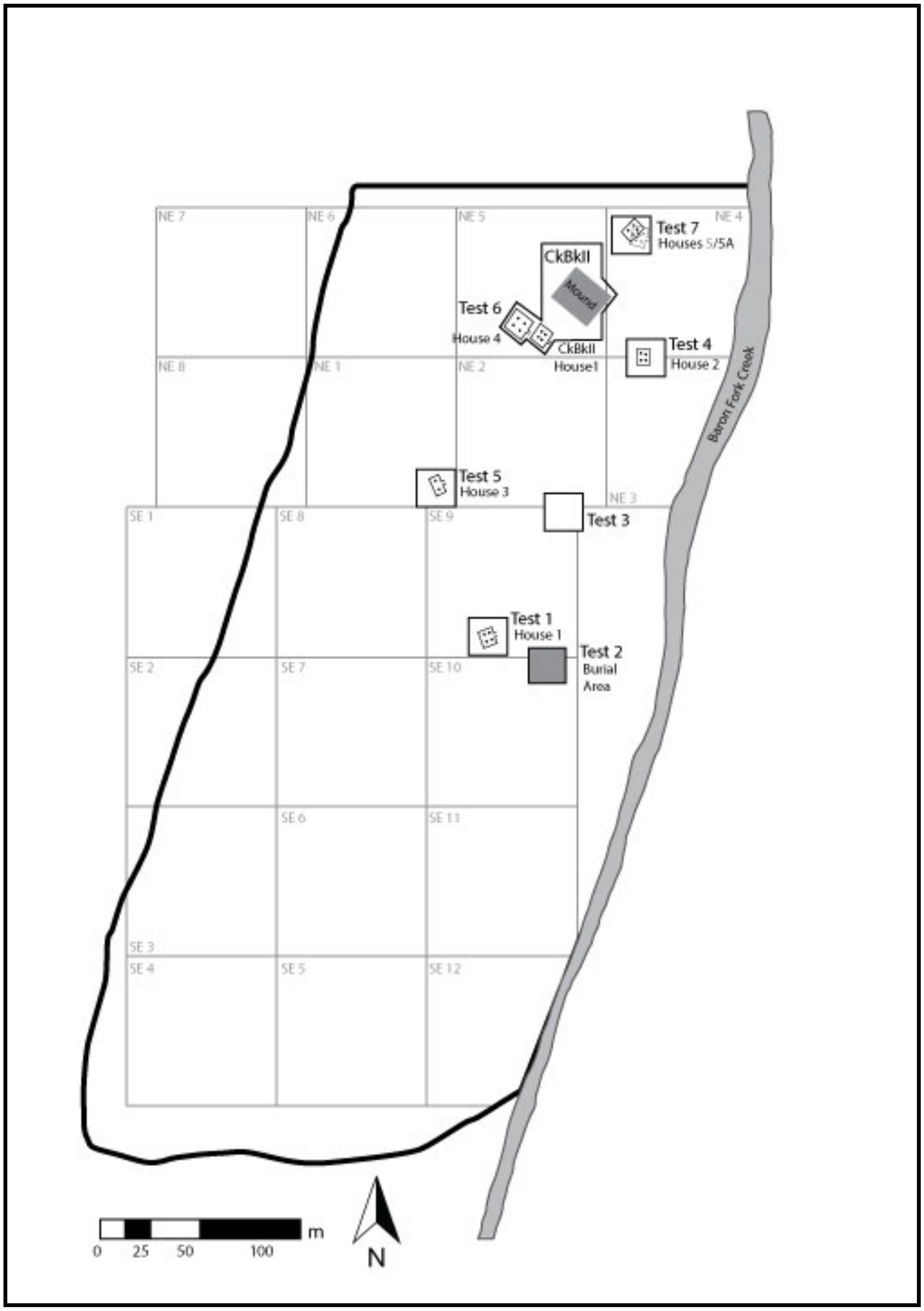

Figure 2.11 Site Map of the Brackett Site (Regnier et al. 2019:Figure 5.2).

WPA at Brackett

WPA crews under the direction of Lynn Howard conducted excavations at Brackett starting in July 1939 and continuing until March 1940. Howard and his crew followed excavation procedures set out by the University of Chicago (Regnier et al. 2019:100). At Brackett, they started with base lines running in the north-south and east-west directions, diving the site into 4 quadrangles, which were further divided into 250ft square sections. Workers then placed test pits every 3 to 6m (10-20 ft) and whenever one area suggested heavy archaeological activity, it was designated as a test area. In total, the WPA excavated seven test areas (excluding the mound). Howard used two designations to identify areas within the site: CkBk I refers to the village and burial area, while CkBk II indicates the mound and Houses 1 and 4. This procedure allowed the WPA to excavate seven structures and one burial area at Brackett. The site was estimated by the WPA to be about 457m (1500ft) north-south by 183m (600ft) east-west (Regnier et al. 2019:185).

Regnier et al. (2019:198-200) discovered a discrepancy between the number of houses reported in Howard's reports and a later analysis of the site. Bareis (1955a) appears to have misinterpreted the WPA maps and added an eighth structure that did not exist. His House 7 corresponds to Howard's CkBkII House I (see next section), and his House 8 is actually House 4. Four of the houses have orientations to the southeast, two have orientations to the northeast, and one is oriented to the cardinal directions (Regnier et al. 2019). The purposes of each house were explored by Kusnierz (2016), who concluded that there is a mix of ritual and domestic uses of these houses. In her analysis of the site's organization, Kusnierz (2016) identified an inner and outer residential area, placing all of the excavated structures within the inner area. House I was identified as a Harlan-style charnel house as defined by Kay and Sabo (2006). All but one of the houses (House 2) were later considered by Regnier et al. (2019) to be special purpose houses due to the entryway and lack of a hearth. The house oriented in the cardinal directions (CkBk H2) is the only house not believed to be a special purpose building.

The burial area was about 12.2m (40ft) by 10.8m (35ft) and located in the southeast portion of the site. This area has been hypothesized to have once been mounded but was flattened due to plowing activities (Kusnierz 2016; Regnier et al. 2019:189). The burial area consisted of 25 burials, a majority of which were in a semi-flexed position (Regnier et al. 2019:189). The assemblages associated with these burials are typical of the Harlan-phase, which was corroborated by three radiocarbon dates between A.D. 1040 to 1265 (Kusnierz 2016).

When the WPA started their work at Brackett, the existing mound was about 2.4m (8 ft) in height with a diameter of about 30.5m (100 ft). To excavate the mound, the crew continued with University of Chicago procedures. This meant that they excavated long trenches in 5ft rows starting from the south end and working north (Kusnierz 2016; Regnier et al. 2019). Profiles of the mound in the WPA field notes, indicate that it was a once a platform mound that was capped off at one point during the site's occupation. Based on the profiles, it has been argued that the mound underwent five construction phases (Bareis 1955a; Kusnierz 2016).

Previous Studies

Brackett has been the focus of two previous master's theses (Bareis 1955a, Kusnierz 2016). Both of these works provided analyses on the artifacts excavated at Brackett during the WPA-era. While Bareis' (1955a, 1955b) work was the first synthesized analysis of the Brackett artifacts, it has not aged well due to his use of outdated theoretical frameworks and the development of more refined artifact typologies. Kusnierz (2016) re-analyzed the WPA excavation notes and artifacts in an attempt to identify Brackett's role within the greater Spiro region. During her analysis, Kusnierz (2016) focused on the leadership role of Brackett's occupants, concluding that the site was occupied by a small number of ritual specialists.

There have been three cultural resource management projects that included Brackett in their fieldwork. In 1973, Larry Neal visited the site as part of a project examining effects of increased power pool elevation on 31 shoreline sites within the Tenkiller Ferry Lake Reservoir (Neal 1974). Later, a 1985 project sponsored by the Historic Preservation Association included a pedestrian survey and 43 shovel tests (Klinger and Cande 1985). The results of this survey support the assumptions that the site extends further west than the WPA boundaries indicate (Kusnierz 2016:72). Recently, a project funded by the USACE included a visit to Brackett in 2010 and 2014 (Bonnie 2015:87). There were six positive shovel tests from the 2010 survey (Bonnie 2015:87-88). These tests were located well west of the WPA boundary.

Geophysics in the Caddo Area

There have been multiple geophysical surveys throughout the greater Caddo Region, the results of which confirm previous interpretations of the types of structures present within the northern and southern Caddo regions. This section will summarize some of the applications of geophysical surveys in research associated with the Caddo region. Geophysical survey data provide complementary information about site organization when used alongside excavation data and previous maps (Lockhart 2007, 2010; Walker and McKinnon 2012). This new source of data allows for a new lens through which to interpret archaeological sites.

Major sites within the Caddo region that have been surveyed by archaeogeophysics include (but are not limited to) George D. Davis, Hill Farm, Battle Mound, Grobin Davis, Clement, Tom Jones, Boxed Spring Site, Collins, Crenshaw, and Spiro (Hammerstedt et al. 2010; Hammerstedt et al. 2017, 2019; Lockhart 2007, 2010; McKinnon 2008, 2013; Regnier et al. 2014; Samuelsen 2010; Sullivan and McKinnon 2013; Walker and McKinnon 2012). These studies exemplify how geophysics in the Caddo area can reveal important information about previously unknown structures present alongside features related to occupation intensities.

In the Caddo area of Oklahoma, surveys of Spiro, Clement, and Grobin Davis have been conducted over the past decade. Hammerstedt et al. (2017) conducted a large-scale survey of the Spiro site. This project revealed multiple anomalies of interest for archaeology within the region, one of which could be indicative of a potential rectangular structure in the upper terrace (Hammerstedt et al. 2017:18). Work in the lower terrace revealed anomalies that likely represent temporary structures associated with pilgrimage activities; four of these have been excavated to date (Hammerstedt et al. 2017:17; Hammerstedt et al. 2019).

The Clement site is a multi-mound Caddo site (~A.D. 1200-1500) located along the Glover River in southeastern Oklahoma that was subject to a geophysical survey in 2008 (Hammerstedt et al. 2010). This survey resulted in the documentation of multiple sub-surface structures, as well as remnants of the 1941 WPA trench excavations of Mound A. The presence of previously unknown house-like structures at the site suggest that this was not a vacant ceremonial center within the Caddo region (Hammerstedt et al. 2010:290).

A few kilometers southwest of Clement is the Grobin Davis site (~A.D. 1200-1400), which is located at the confluence of White Oak Creek and the Little River. This site consists of seven mounds arranged in a horseshoe pattern. The site was surveyed in 2011-2012 and the results suggest that non-mounded house-like structures lie north of the mounds (Regnier et al. 2014). The presence of sites such as Grobin Davis and Clement around the border of the north and south Caddo regions could be indicative of Caddo control of major water ways (Brooks 2012).

There have also been surveys conducted in the Caddo area of western Arkansas. Lockhart (2007, 2010) conducted a geophysical survey of the Tom Jones site in southwest Arkansas to find patterns in the site's organization. Tom Jones is a Caddo ceremonial mound site that consists of one temple mound and five house mounds that date to around A.D. 1400 (Lockhart 2010: 236). This survey revealed the presence of square houses with extended entryways and berms. Another southwestern Arkansas site that has been surveyed is the Crenshaw site. This early Caddo site has 6 mounds and a geophysical survey identified 100 possible structures (Samuelsen 2010).

Survey at the Battle Mound civic ceremonial site in southwestern Arkansas revealed multiple features, including both rectangular and circular structures, pits, hearths, a potential cemetery, borrow pit, and a linear causeway (McKinnon 2008, 2009; Walker and McKinnon 2012). In northwest Arkansas, Sullivan and McKinnon (2013) conducted a geophysical survey of the Collins site, which was contemporary with the Harlan Phase in Oklahoma. This site consists of five mounds separated into north and south groups by a plaza. This survey revealed rectangular and circular structures associated with both the mounded areas and the plaza.

North Texas Caddo sites have also been the focus of geophysical surveys as a means to better understand architecture and site organization. Surveys at Hill Farm revealed circular structures with extended entryways and other features associated with farmsteads (Walker and McKinnon 2012). Other important information revealed at this site through geophysical survey include the orientation of entryways, which were open to other occupied spaces within the community. This is important because it could help provide insight into how these structures might have been used by the site's occupants and the restrictive nature of the events within the community. The George C. Davis site is a Caddo site in east Texas with three mounds that was also subject to various survey activities (Walker and McKinnon 2012). Features that were revealed include circular structures, plazas, and ramps associated with one of the mounds (Walker and McKinnon 2012:183-186). Perttula (2011) summarizes archaeological and archaeogeophysical investigations that have occurred at the Boxed Spring Site in Texas. This site is an Early Caddo (A.D. 900-1200) mound site consisting of four mounds surrounding a plaza, midden deposits, and a borrow pit (Perttula 2011). Apart from fire cracked rock, this geophysical investigation did not reveal any previously unknown archaeological features (Perttula 2011:23).

The recent applications of geophysical surveys within the Caddo Region summarized in this section show that it provides new and useful information about different sites within the region. The ability of geophysical surveys to collect site-wide data means that archaeologists can start asking broader questions relating to landscape uses and organizational patterns (Kvamme 2003; Thompson et al. 2011). This then encourages archaeologists to use theoretical perspectives that might not have been previously applied to these types of questions.

Chapter Three: Theoretical Perspectives

In this chapter, I will be summarizing theoretical perspectives used to explore site organization and community within the Spiro region of eastern Oklahoma. First, a brief review of landscape archaeology is presented. The archaeology of communities will also be to provide perspectives on how these mound sites within the Arkansas River Valley interacted with each other and how that might affect site organization. Ideas relating to Mississippian period sites will be discussed in an attempt to understand our current understandings of site layouts and organization. This is followed by a short section about ritual and pilgrimage as an example of new research occurring within the greater Mississippian and Spiro regions. This chapter ends with a discussion of how geophysical survey data contributes to multiple applications of theoretical perspectives to understand a site and its importance in archaeology.

Landscape Archaeology

Landscape archaeology looks at how people constructed and used their local environments. Through this understanding, phenomenology (the study of the structures of human experience) came to be associated with landscape and included interest in the ideas of landscape as subjective, the ease of how landscapes are experienced by people, and the developments of political agendas (Johnson 2012). The idea of a socially oriented landscape came from rising importance of cultural resource management (CRM) and public archaeology, rising interests in style, and indigenous critiques of archaeology (David and Thomas 2016:32). However, it is necessary to note that there is not a unified landscape theory (Anschuetz et al. 2001), but rather landscape is understood in these contexts to be a unit of study that is a reflection of meaning behind human interaction with space.

Landscapes should be understood in terms of the formation and negotiation of identity (Johnson 2012), so it would make sense for changes in social stratification to be reflected in how people use and understand landscapes. The important aspects of landscapes that should be considered are inscription, inhabitation, and ritualization (Randall 2015). Inscription is simply the modification of landscape and how that reflects a social memory of a place, Inhabitation is the creation of meaning, and ritualization is the formalization of something in order to create a social effect (Randall 2015). While not every landscape is ritualized, this description allows for archaeologists to look at landscapes of the past in a broader context.

As claimed by David and Thomas (2016), current understandings of landscape archaeology include the emergence of landscape as something other than environment, understanding that being is entangled in social processes, and the rise in understanding people and culture as the core of worldly engagements. Anschuetz et al (2001) describe similar principles for landscape, which are that landscapes are not the same as natural environments, landscapes are products of culture, landscapes are made up of community activities, and landscapes are dynamic. Landscapes can be understood as both object, such as an artifact that emphasized how people shaped the physical appearance of landscape, and subject, which would consist of the experiences associated with reconstructed landscapes (Darvill 2003).

According to Anderson and Sassaman (2012), landscape archaeology has been receiving more attention in the southeast as a way to explain Mississippian complexity. Landscape archaeology goes beyond environment and can be used to understand why people placed their monuments and communities where they did by exploring the overarching social process that influence uses of landscape. The landscape framework relies on the fact that landscapes influence people's decisions about site placement and usage, but it has expanded to include more than just the environment. Certain landscapes are known to be sacred and the visibility of such landscapes influences where people place their sites. This has been known to occur with some populations living in the American Southwest (Bernardini et al. 2013). Comparative analyses of landscapes, such as those undertaken by Birch et al. (2016), who looked at how different landscapes support different population densities, can be used to explain population difference in multiple areas. They also explain how landscape can be used to contextualize construction of mounds. This is important for understanding population settlement and how changes in landscape and its importance can be reflected in population redistribution and site reorganization.

While not directly relevant to some arguments presented in this thesis, landscape archaeology is important for providing an overarching perspective on why site-wide and intra-regional investigations are important in archaeological research. By looking at site-wide data as opposed to specific areas of a site, we can start to ask larger questions relating to site organization, land usage, and various changes to the site over time. Geophysical surveys provide the site-side data that allows these types of inferences to be made (Kvamme 2003).

The Archaeology of Communities

The archaeology of community is another framework that can be used to explain both societal and spatial organizations. This approach focuses on the idea of past communities as individual units of study. Typically, communities are understood to be associated with intra-settlement organization. Yaeger and Canuto (2000) described the major theoretical perspectives on community, including structural-functionalist, historical- developmental, ideational, and interactional. Structural- functionalist is the most popular view of community during the 21st century and it looks at the functions of communities within differing social structures. Historical-developmental views are concerned with how communities came about within a society.

Ideational views look at how people perceive themselves and their places within a community. The last perspective is interactional, which concentrates on the creation of communities through the relationship of both individuals and larger social groups. Kolb and Snead (1997) outlined the important aspects of community organization and its role in creating a sense of self. These include the role of community as a mode of social interaction, centrality of subsistence production, and the self-identification and social recognition by members of communities.

The word community itself has various definitions associated with it. Rogers (1995:92) defined community as a "local group of households that interact frequently and share decision making processes", while also referring to supra-communities as "spatial relationship[s] between communities at settlement pattern scale used to infer economic, social, and domestic interactions". The patterns of spatial distribution of residences can also be reflections of interaction and communities (Peterson and Drennan 2005). The intersection of politics and everyday practice happens with community, which can be understood as a "specialized field of cultural identity formation" (Pauketat 2007:107). Community formation is a key aspect of Mississippian towns, with different forms of communalization, such as monumental construction, affecting town organization (Pauketat 2007:130-131). These places of communalization can lead to decentralization of large towns or recentralization of smaller ones (Pauketat 2007:131).

One of the easiest ways to study communities is through architecture. Lewis et al. (1998) explained that architecture should be understood as a physical manifestation of human culture, which agrees with Yaeger and Canuto's (2000) explanation of community as materialization of people's thoughts. With this in mind, archaeologists should not separate function from complexity because structures (and communities as a whole) are going to change over time as people's beliefs change. For example, it has been argued that changes in communities living in pueblos in the American southwest could be reflections of attempts at increased defense (Rautman 2000). This evidence of increased community complexity might have been a result of more people coming together as a survival strategy against other groups and even changing climates. In the southeast, the growth of populations is believed to be reflected in settlement complexity, which then led to greater productivity (Crook 1984). In other words, as people found better ways to organize themselves, either for defensive purposes or because of population increase, the conditions in which they lived changed. Boudreaux (2013) argued that Town Creek, a Mississippian ritual center in North Carolina, started as a domestic town but evolved into a vacant ceremonial center. This was seen through the different types of structures found and which time periods they were determined to be associated with during excavations. Wilson (2008) discussed Moundville as an example in which households changed over time due to new structure types (2 central posts increasing to 4) and increasing household sizes. This is the opposite of what occurs in the Spiro region; later houses are rectangular with two center posts. Demel and Hall (1998) used Cahokia as an additional example of mounds purposefully changing over time through evidence for urban renewal and changing uses of land in the American Bottom during the Mississippian.

Early interpretations of Mississippian settlements claim that the changing scales of settlements is a direct response to changing environments as seen through different intra-site clustering (Clay 1976). Crook (1984) described the importance of looking at the microstructure of communities, which is defined as the cultural and social structures within individual settlements. Wilson (2010) discussed the importance of social memory within communities and how changes in community not only reflect changes in function but also changes in identity. It has also been noted that community changes through time become less marked by community design plan and more by the function of the design form (Kidder 1998). For example, any households that had openings that faced the rest of the community might have had a specific purpose either as a reflection of the importance of communal participation or because the people living within those structures were important to a community. Walker and McKinnon (2009) explained how a geophysical survey at a Caddo site in Texas revealed architectural features that represent complex arrangement of areas of continued use in addition to areas that were left vacant during the site's occupation. This could be a reflection of Crook's (1984) concept of microstructure because it shows how multiple generations of people used the same areas over time. Anderson and Sassaman (2012) described how constant maintenance of the same areas is tied to community stability. Any changes in these uses of area could be a representation of larger structural changes or changes in ideology. Kusnierz (2016) proposed that Brackett follows the typical Mississippian architectural design for the households, which suggests that any changes would reflect the common site organizational patterns found throughout the region.

In his examination of Spiroan sites, Rogers (1995) distinguished communities as local groups interacting households. While discussing rituals occurring between and within these communities, he argues that "the integrative function of major ritual occasions that bring together the entire population from a particular area becomes even more fundamental when they are not frequent" (Rogers 1995:93). The rituals occurring could be private or public and would still be considered integrative and fundamental to the community. Dowd (2012) provided an example of this in her interpretation of two southeastern Oklahoma Caddo sites, Woods and Biggham Creek. She hypothesized the former to have functioned as a place for large social gatherings, while the latter was a place for restricted ritual activities. Despite their vastly different functions, the sites were both still important to the community at large.

Recently, there has been an increase in research aimed at understanding the relationships between sites in eastern Oklahoma and throughout the greater Caddo Area (e.g. Cranford 2007; Dowd 2012; Lambert 2017; Regnier et al. 2019). Communities existed throughout the region, as evident by Lambert's (2017) argument for a community of practice between the north and south Caddo regions (see Chapter 2). In the Arkansas River basin, mounds are located about 15 km apart, while in the Ouachita River basin the average distance between mounds is only about 4 km (Dowd 2012:42). The shared mortuary tradition of the Arkansas River valley should be a clue that there might be a communal element to the occupation of the region.

Mississippian Studies

While sites within the Arkansas River are not directly Mississippian, there have been studies in the area that utilize theoretical perspectives associated with the Mississippian chiefdom model (Brown et al. 1972; Cranford 2007). Since this model has recently been argued against (Brown 2012), it is necessary to re-think how ideas about the Mississippian can be applied to the Spiro Region. As exemplified by Hammerstedt et al. (2017), site organization is a viable way to think about site purpose and occupation.

Plazas and Platform Mounds

One common characteristic between Mississippian sites is the presence of mounds and plazas, sometimes referred to as a mound-plaza complex (see Stout and Lewis 1998). While the specific layout of Mississippian sites varies, the presence of a plaza-like feature surrounded by other architectural features, be it houses or mounds, suggests some sort of communal activity occurring (Cobb and Butler 2017). However, the rituals and other activities occurring likely varied from site to site. Because plazas were within close proximity to other features, such as mound, it would useful to look at the purpose of mounds within the Mississippian Period.

Platform mounds play an important role within Mississippian and Caddo societies. They represent the presence of some authoritative figure, or at the very least people who might not be considered ordinary (Lindauer and Blitz 1997). The construction of mounds themselves can also be seen as a representation of material symbolism, from purposeful soil changes during construction stages to alignments of mound features (Kay et al. 1989; Sabo 1986). In the southeast, the open access to platform mounds at early Mississippian sites provides an opportunity for social integration among occupants (Lindauer and Blitz 1997).

The construction of mounds can be seen as a way to bring people together. It would be expected that the people who participated in such events hoped to receive something from the experience, which was probably to gain access to the site during ritual or ceremonial events. The construction of monuments is a way for people to come together and solidify their identity in times of political uncertainty (Artursson et al. 2016). Anderson (2012) explores the idea of monumental construction within the Mississippian as a way of creating and reaffirming identity. In his exploration of Mississippian religion, Knight (1986) relates sacra (symbolic objects) to the institutions that make them, specifically arguing mounds to be sacra related to community renewal and purification.

While Brackett is not directly associated with the Mississippian, these concepts about Mississippian mounds and plazas are important as references to the physical manifestations of rituals and sacred spaces. Brackett had a platform mound and is believed to have been a place for ritual specialists (see Chapter 2). It would be appropriate to think about how the presence of a platform could be understood in the larger context of Mississippian influences since platform mounds were an important architectural feature.

Site Organization

There have been multiple publications dedicated to the study of Mississippian towns and settlement organizations (e.g. Rogers and Smith 1995; Lewis and Stout 1998; O'Brien 2002). The design of Mississippian towns and settlements can be seen as a representation of changes in identity or relationships (Lewis and Stout 1998:229). The activities around different areas of the site could also provide information about a site's relationship to other sites within the area (i.e. Lorenz 1996). While models associated with Mississippian site organization are not directly applicable to sites within the Spiro Region, they show that people during the Mississippian Period were following rules relating to site organizations with visible patterns (Lorenz 1996).

Various models of Mississippian site organization exist that could be helpful to understanding the broader implications of how sites were organized during the Mississippian Period. Using Portnoy's (1981) framework, Oetelaar (1993) creates a model for Late Mississippian period sites, consisting of a communal front region, family front region, family back region, and communal back region. This model is based on the premise that settlement patterns are influenced by socioeconomic organization, activities, and environmental constraints (Oetelaar 1993:663). Price (1978) introduces a site model that consists of 4 categories of occupational areas: limited activities, hamlets, villages, and an apex. In this model, the limited activities area is the smallest, while the apex is considered the epicenter of most activities. In Missouri, there have been studies that utilize this model to understand Mississippian period occupations (O'Brien and Krakker 2002; O'Brien and Perttula 2002).

Mississippian-based models have also been directly applied to the Spiro Region. Brown et al. (1978) looked at settlement patterns in eastern Oklahoma and classified the mound sites as first-, second-, and third-echelon ceremonial centers. This classification is based on mound type, quantity, and structures present at the site. However, this model assumes that sites within the Spiro region were part of a chiefdom, which is not as prevalent of an idea today (Regnier et al. 2019). Cranford (2007) uses a chiefdom-based fission-fusion model to interpret the relationship between Harlan and Norman because it does not rely on settlement patterns. Since this time, new information has been collected about settlements in the Arkansas (Kusnierz 2016; Regnier et al. 2019). This provided the ability to look at the relationship of these two sites with a new theoretical perspective that could be used to further support Cranford's (2007) conclusion that Harlan and Norman were competing ceremonial centers within the same community.

Ritual Symbolism and the Caddo Landscape

As Brackett is interpreted as a center for ritual specialists, it would be appropriate to delve deeper into the concepts related to ritual in the Arkansas River Valley. Ideas relating to structure orientation, color symbolism, and pilgrimage might help in the exploration of layouts of single mound sites within the Spiro region. Through their summary of WPA work at mound sites in the Spiro Region, Regnier and colleagues (2019) argued for a shared mortuary tradition within the Arkansas River valley. The presence of charnel houses in the Arkansas River Valley supports the idea of a local mortuary ceremonialism and potentially common ideologies relating to rituals (Kay and Sabo 2006).

The WPA noted the orientations of the seven structures excavated at Brackett, which aligned to the northeast and southeast directions (Hammerstedt and Savage 2016; Regnier et al. 2019). Orientations play an important role in Caddo cosmology, especially in regard to the south-

southwest house alignments associated with death (Kay and Sabo 2006). Other orientations present at sites in the region include the southeast, east, south, and north (Hammerstedt and Savage 2016; Regnier et al. 2019). In their analysis of ethnographic accounts from Caddoan-speaking groups, Hammerstedt and Savage (2016) interpret that southeast-facing structures might be associated with the summer full moonrise in the Caddo region. There have been studies within the American Bottom that also suggest the importance of lunar cycles during the Mississippi Period (Pauketat et al. 2017; Romain 2015).

The presence of conjoined mounds at ceremonial centers in the Arkansas River valley (specifically Spiro, Harlan, Norman, and Reed) could also be indicative of communal ritual, especially since color symbolism is present (Hammerstedt and Savage, unpublished manuscript). The use of color in the greater Mississippian and Caddo regions has also been explored (Hammerstedt and Savage, unpublished manuscript; Pauketat 2019). During the early Mississippian period in the Midwest, people participated in some belief associated with the moon, with color yellow present in some degree (Pauketat et al. 2017; Pauketat 2019). The southeast has been associated with red, males, sun, dawn, and life, while the northeast can be linked with black, night, and the new moon (Hammerstedt and Savage 2016). The Harlan Phase experienced an emphasis of black and white for mortuary rituals, along with southeast-facing structures aligning with the summer full moonrise (Hammerstedt and Savage 2016; Hammerstedt and Savage, unpublished manuscript).

In northeastern Texas, the Terán map has been used as a template of site organization at southern Caddo sites. The Terán map is the result of the 1691-1692 explorations of Domingo Terán de los Rios throughout east Texas. It depicts the layout of an Upper Nasoni village along the Red River. Sabo (2012) argues that it should be viewed as a cosmogram depicting Caddo beliefs about their relationship to the spiritual world. While not a perfect representation of site organization throughout the Caddo region, the Terán map provides a useful reference when thinking about Caddo landscapes and community organization. As explained by Sabo (1998; 2012), the historic Caddo communities consisted of both political and spiritual leaders (high priests). The latter, known as *xinesi*, were in charge of maintaining the reciprocal relationship between humans and spirit beings. The designated spaces for these activities included the temple mound, which functioned as a gateway to enter the community.

The Terán Map layout represents a hierarchical community with the temple mound in the western edge acting as a place of maintaining relationships between both human and non-human agents. Caddo belief system associates west with death and mortuary rituals, while the east is typically associated with life-affirming events (Sabo 2012). Thinking of the Caddo landscape as a ritual object itself, as done by McKinnon (2013), provides archaeologists with the opportunity to tie the landscape to overarching ideological principles. Geophysical surveys provide that opportunity to examine broad regional and intra-site organization.

Approaches to Geophysical Survey Data

The use of geophysical surveys in archaeology allow for data collection within a site during a shorter amount of time than traditional archaeological methods (see Chapter 4). This allows for analyses of site organization that are not dependent on limited shovel testing or excavation of certain areas. The use of geophysical survey in archaeological research can answer questions relating to landscape, site organization, and uses of space within a site (Kvamme 2003). As Walker and McKinnon (2012) exemplified, geophysical surveys also provide opportunities to go beyond relying solely on the Terán Map of 1961-1962 (Figure 3.1).

Schambach (1982) used this map to create a model of Caddo communities around the Red River, suggesting that the mound area is located in the outskirts of the community because it is a place of contacting spirits. Later, Sabo (1998) suggested that these mound locations are used by multiple communities, which accounts for their remote locations. While this map provides an ethnographic example of Caddo settlements, we need to be wary of assuming settlements stayed the same over time. Also, the Terán Map depicts a southern Caddo Region village, which have different layouts than sites in the northern Caddo Region (see Chapter 2).

Anderson (2012) suggested that in order to fully understand monumentality and monument building during the Mississippian, researchers have to conduct remote sensing to get comprehensive maps of total site areas. Kvamme (2003) explained how the use of archaeological geophysics reveals larger areas within a site in smaller amounts of time and how this allows archaeologists to take a landscape approach to archaeological questions. Peterson and Drennan (2005) mentioned how the identification of communities of varying scales tends to be ignored in archaeology and we can change this by conducting site-wide surveys to get a better sense of how and where people are organizing their households and how that might reflect the overarching community. The application of archaeological geophysics to Brackett could lead to a better understanding of the relationship between settlement and ceremonialism, as suggested through the work done by Lockhart (2010) and Regnier et al. (2014), both of which focused on how useful geophysical survey is for understanding broader spatial organization.

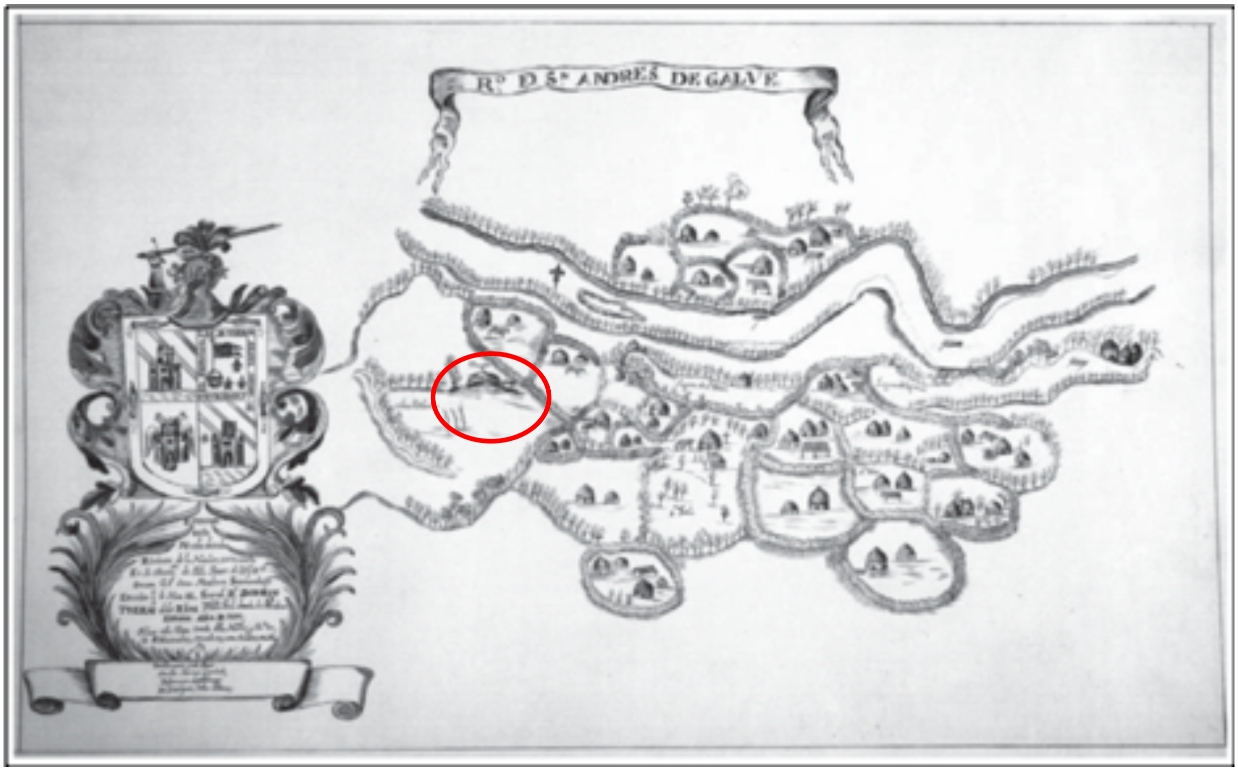

Figure 3.1 The Terán Map of 1961-1962. The mound site is located to the far-left area of the community and circled in red (Adapted from Sabo 2012: Figure 15-1).

Walker and McKinnon (2012) use geophysical survey at multiple Caddo sites in Texas to show how, at an intra-regional scale, arrangements of internal features provide useful insights for analyzing different architectural styles and their social functions. Residential areas are located further from the central plazas as opposed to the public structures that might be more centrally located within a site. A complete survey of the George C. Davis reveals how architectural remains can define complex arrangements of areas with continued structure use and rebuilding over multiple years. The survey at Hill Farm displays that structures with extended entryways open towards other parts of the community, with some compound dividers associated with certain features. The work at the Battle Mound site reveals centralized hearths and circular structures with extended entryways. On a similar note, Horsley et al. (2014) discuss the use of surveys at the Garden Creek site in North Carolina and the Washausen site in Illinois and how the results show how geophysics can be used to explore settlement patterns in relation to mounds located at the site.

As previously discussed in Chapter 2, Brackett has been the focus of two master's theses: Bareis (1955a) and Kusnierz (2016), with the former analyzing the results of the WPA excavations and the later re-analyzing the WPA collections with a focus on understanding leadership at the site. Barreis' analyses utilized outdated theoretical perspectives and artifact typologies, so they will not be discussed further. In her research, Kusnierz (2016:15) explored theoretical perspectives related to the social significance of mound building and site arrangement to understanding Mississippian leadership. By exploring theories covering middle-range societies, platform mounds, mortuary practices, and Caddo archaeology to guide her site analysis, Kusnierz (2016) concluded that Brackett was a home to ritual specialists within the Arkansas River drainage during the Harlan and Norman Phases.

Brackett was not the sole site within this region and certainly not the only mound site. Nearby sites in Oklahoma include the multi-mound ceremonial complexes Harlan, Norman, and Reed, as well as single mound sites Eufaula, Hughes, and Lee Creek/Parris Mound. Evidence of Spiro-related artifacts found at these sites suggests that they were included in exchange within the region, probably interacting with each other (Regnier et al. 2019). In an attempt to better understand the organization of single-mound ritual centers and their relationships with each other within the Arkansas River valley, new theoretical perspectives will be applied to Brackett. Specifically, an exploration of the archaeology of community and landscape will be applied to interpret the site and its relationships with these other mound sites.

As recently revealed by geophysical investigations and targeted excavations, Spiro might have been host to a massive pilgrimage event at one point during its occupation (Hammerstedt et al. 2019). If pilgrimages did occur throughout the Arkansas River Drainage, then it is relevant to include some ideas about the movement of peoples between the mound sites in close proximity to Brackett. As discussed by Skousen (2018), the act of pilgrimage creates relationships not only between people but between people and their landscapes. Movement provides energy and gives meaning to the experiences along the way. Pilgrimage to shrines can also be a way to reaffirm human-non-human relationships (Alt and Pauketat 2017:67). According to Lulewicz (2019: 6711), who focused on social networks during the Mississippian period in the Southeast, creating and bridging ties relies on formalized institutions that can be a means to integrate populations. The Mississippian religious institutions can link systems of people (Knight 1986), further suggesting the idea that people were interacting within different areas.

Geophysics and the Caddo Ritual Landscape

As discussed by Kay et al. (1989), spatial separation was an important aspect of Caddo ritual. This would suggest that ritual landscapes should include features that would provide that separation between ritual and secular spaces. Berms are one example of this type of separation within the landscape (Kay et al. 1989). The presence of berms in the region is not uncommon, as they have been found at sites in both the northern and southern Caddo regions. Vogel (2005) found evidence of a berm around one of the mounds at the Norman site in northeastern Oklahoma. A geophysical survey of the Grobin Davis site in southeastern Oklahoma recorded anomalies that possibly represent berms around mounds (Regnier et al. 2014).

The application of geophysical surveys in the Caddo region has allowed for archaeologists to look at broader topics relating to site organization and uses of space at sites.

The sites discussed in the previous section of this paper show that the Terán map is not an exact depiction of Caddo site organization throughout the Caddo region, especially sites in the northern Caddo region. As exemplified by many of the surveys summarized in this section, off-mound structures are found in close proximity to the mound at mound sites. This differs from the lone temple mound depicted in the Terán map. Despite this discrepancy, it can still be useful to thinking about the relevance of an east-west symbolism when looking at site organization of Caddo sites. In his exploration of the Caddo landscape as a ritual landscape, McKinnon (2013) was able to make inferences about regional and intra-site organization based on the Caddo belief of east and west as life and death symbolism.

The location of features throughout these various Caddo sites can also be indicative of space usage. The placement of pits and hearths in close proximity to house-like structures could be indicative of long-term occupations. It could also be an example of dedicated space usage where domestic activities are restricted to residential activities. However, when thinking about these types of anomalies in geophysical data (represented typically as positive anomalies) it is necessary to acknowledge that other features could also be represented in a similar way. This is why geophysical surveys should be complimented by ground truthing whenever possible.

Chapter Four: Methods

This chapter details the data collection and processing methods used during this project. The results of these methods will be described in detail in Chapter 5. For this project, a multi-sensor geophysical survey was conducted to determine the presence of unknown features at the Brackett site. Archaeological geophysics can be defined as "the examination of the earth's physical properties using non-invasive ground survey techniques to reveal buried archaeological features, sites, and landscapes" (Gaffney and Gater 2003:12). Geophysical surveys are important in archaeology because they are non-destructive, cost-effective, and provide more data in a short amount of time compared to a traditional excavation (Kvamme 2003; Johnson and Haley 2006).

The geophysical techniques used for this project include magnetometry, electrical resistance, and ground-penetrating radar (GPR). Magnetometry measures the strength of the magnetic variation in soils. For example, topsoil is more magnetic than subsoil, so any intended human manipulation (such as hearths and pits) will be seen in the magnetic data. Non-human factors will also affect soil magnetism, such as the presence of certain bacteria or natural changes to the landform. Hearths and other burnt materials are easily detected with magnetometry due to the chemical changes that occur during the burning process. This is considered a passive technique because it measures earth's properties without introducing its own energy into the ground. Electrical resistance measures the resistance of soil to an electrical current, which is dependent upon soil moisture. GPR sends a radar pulse into the ground and records the two-way travel time and amplitude of the pulse reflecting off anomalies in the soil (this includes both features and soil changes). Resistance and GPR are considered active techniques because they introduce their own form of energy into the ground in order to obtain their respective data. These different techniques were used in the project because they are complimentary, and they all measure contrasts between features and the surrounding soil matrices. The use of multiple methods is important because one method might reveal a feature that was not visible in the data of another (Clay 2001; Kvamme 2007).

Data for this project was collected over a span of three weeks during July and August 2019, and one day in February 2020. Due to unexpected flooding in the region, this project was postponed from its intended May start date. In trying to plan a survey around Oklahoma's unpredictable weather, I had to keep the mentality that "it is what it is" (Dr. Scott Hammerstedt, personal communication 2019). Summer field work began on July 8, 2019, which coincidently falls within the same starting week as the WPA excavations at Brackett exactly 80 years prior. The data for each technique were collected using 20x20 meter grids that were laid out using a Leica total station. Each grid was named with the coordinates of the southwest corner. Back sights were located at the corner of the fence and two rebar permanent datums were placed along the tree line. In total, 115 gradiometer grids, 10 electrical resistance, and four GPR grids were collected for this project. Due to the grass height at the end of the summer, which was five feet tall in some areas, the grids available to be surveyed by electrical resistance and GPR were very limited. There were some grids of interest that were supposed to be surveyed but were not due to the grass and limited time in the field.

Magnetometry

Magnetometry is a passive geophysical method that measures the strength of magnetic variations in soil. The earth's poles create magnetic fields, the strength of which depends on location. These localized magnetic fields can be culturally or naturally manipulated over time, the results of which can be measured with a technique known as magnetometry. Measuring changes in local the magnetic field depends on the presence of magnetized iron oxides in the soil. Archaeological feature that can be detected through magnetometry include, but are not limited to, pits, ditches, structures, hearths, burials, and postholes.

There are two types of magnetism of concern for magnetometry: induced and remanant magnetism. Induced magnetism is when the earth's magnetic field causes magnetic particles in a material to align with it and the strength of this alignment is described by that material's magnetic susceptibility, which depends on the presence of iron-containing minerals, such as magnetite and maghemite (Kvamme 2006). Magnetic susceptibility can be enhanced through continued human activity, such as occupations or fires, as well as natural processes. For example, the presence of organic material in topsoil makes it more magnetic than subsoil. Another type of magnetism is known as remanant magnetism, which is fixed in a material. An important type of remanant magnetism is known as thermoremanence. This is the process through which weakly magnetic materials are heated to a certain point (known as the Curie Point) and acquire new, permanent magnetization in the current direction of the magnetic field when it cools (Gaffney and Gater 2003; Schmidt 2009). This can include any artifact or feature that have been exposed to hot enough firing or burning, such as ceramics or hearths.

The chemical properties of archaeological features create a magnetic field around them that combines with the earth's magnetic field in that location. This total magnetic field contrasts with that of the background and the instrument used to collect the data will measure these contrasts and map them as anomalies. Magnetic data is measured in units known as nanoTeslas (nT) and anomalies of interest to archaeologists are typically within +/-5nT of the background (Kvamme 2006:209). The factors that could affect magnetometry readings include depth, size, presence of noise, contrast between the feature and the background, and instrument sensitivity.

Multiple types of magnetometers are used in archaeological geophysics, including caesium, proton, vapor, and fluxgate. These different magnetometers are classified based on what aspects of the magnetic field they measure (either its strength or direction). For this project a fluxgate gradiometer was utilized (Figure 4.1). A fluxgate gradiometer consists of two vertical sensors with metal cores and primary and secondary coils, the top sensor measuring the earth's magnetic field and the lower one measuring the effects of buried features to that same field (Gaffney and Gater 2003: 40). The readings are a result of subtracting the former from the latter. Fluxgate gradiometers measure the vertical component of the magnetic field, making them directionally sensitive but less affected by lateral changes compared to the other magnetometers (Kvamme 2006). According to Schmidt (2009:12), gradiometers are thought of as "intrinsic high pass filters". A high pass filter only allows narrow anomalies to pass through, removing background data that varies over a large scale (Aspinall et al. 2008:128).

Data Collection and Processing

For this project, a Bartington Grad-601 gradiometer was used to survey 20x20m grids, collecting 8 readings per meter with 12.5 readings between readings. Transects were walked at every odd meter, resulting in 20 lines of data per grid collected in a zig-zag pattern with 50 cm transects. The data was collected starting in the southwest corner of the grid going in the north-south direction. The southern-most grids were surveyed first and we subsequently moved north. A total of 115 grids of magnetic data were collected for this project. Most were 20x20m, but six were partial grids due to fence or tree line interference.

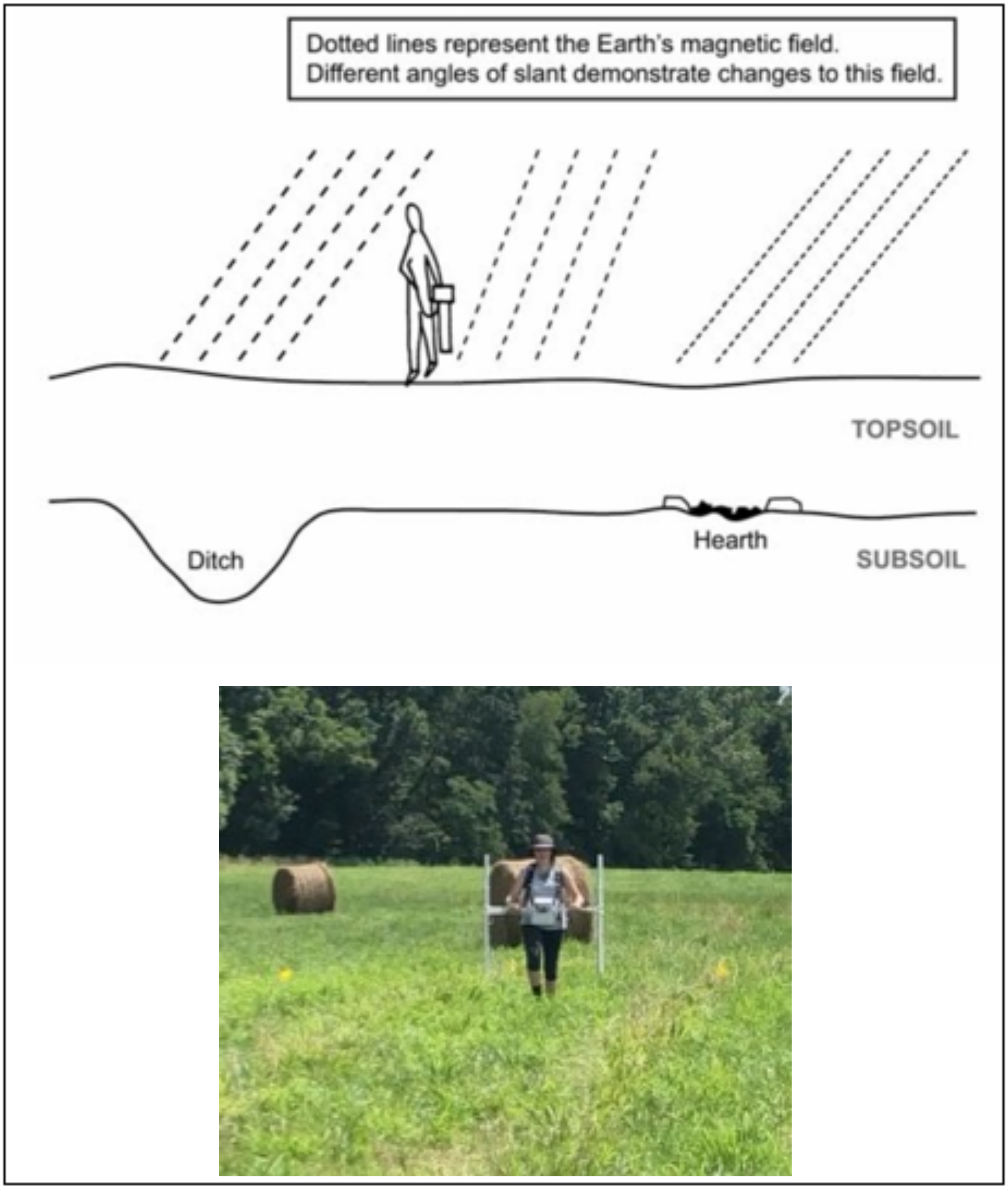

Figure 4.1 (Top) Diagram of changes in magnetic field caused by human activity (Oswin 2009: Figure 2.6); (Bottom) Photo of data collection at Brackett with Bartington Grad 601 gradiometer.

After each day of data collection, the data was downloaded and analyzed with DW Consulting's TerraSurveyor 3. The grids were stitched together according to the coordinates assigned to the southwest corner of each grid. The raw composites were then filtered using the following filters: DeStripe, Low Pass, Interpolation, and Clip. DeStripe equalizes differences in data caused by walking errors during collection. The default DeStripe and Low Pass settings were used for this project. Low Pass reduces the contribution of high-frequency noise (Kvamme 2006: 242). Interpolation can be used to increase or decrease data resolution. In the Interpolation window, I matched the X and Y axes and selected 'increase' in the Factor panel. Clip replaces all values in a layer outside a specified limit with those values. First, the data was clipped to three standard deviations, which resulted in readings of 7/-7 nT. The data was then clipped to another three standard deviations, which resulted in 4.65/-4.56 nT readings. The individual grids were also examined separately using the same filters.

Electrical Resistance

Electrical resistance is an active geophysical technique that measures a material's resistance to an electrical current. Specifically, resistance meters introduce an electrical current into a soil matrix and measures the current's flow within that matrix (Somers 2006, Schmidt 2009, 2013). The movement of the current is provided by charged particles within the soil known as ions. The presence of these ions influences the ease of movement for the electrical current; the more mobile the ions, the lower the soil's resistivity. Resistivity is a property that describes that soil's resistance to the movement of the electrical current (Somers 2006:111). Electrical resistance follows what is known as Ohms Law, which states that the electrical current flowing through material is proportional to the potential difference (voltage) that is used. The resistance

(R) can be found by measuring the current (I) flowing through a material and monitoring the change in voltage (V) across that material: R=V/I, where R is expressed in Ohms (**Ω**).

In archaeology, electrical resistance is used to reveal buried archaeological features by showing the contrast between the resistivity of the feature and the surrounding soil matrix. Archaeological features that have the potential to be detected by electrical resistance include brick and stone foundations, walls, ditches, pits, and postholes just to name a few (Gaffney and Gater 2003:26; Somers 2006, Schmidt 2013). High (positive) resistivity features are those with little moisture, while features with more moisture will have a low (negative) resistivity. For example, a ditch will have a negative contrast with the surrounding soil because it is filled with loosely packed soil, resulting in a higher moisture content (Schmidt 2013). One factor to take into consideration when using electrical resistance is the weather, which can affect the moisture content on both soil matrices and archaeological features. Another factor is the local geology, specifically the pore and grain sizes of the soil itself. Sand does not hold water well, which makes it unideal for electrical resistance.

Electrodes are used to measure resistance. Typically, four electrodes are needed and can be configured in multiple arrays, including the Wenner, Schlumberger, Double Dipole, and Twin-Probe arrays (Gaffney and Gater 2003:28). The most common array is the Twin-Probe array, which is the configuration of the GeoScan Research RM15 used in this project. This array consists of a current-potential pair of electrodes on a mobile frame (which also houses the resistance meter) and a pair that is fixed in a position away from the survey area that is connected with a cable (Figure 4.2). When the mobile probes are inserted into the ground, this array creates a closed circuit with the fixed probes. According to Gaffney (2008:320) the Twin-Probe array is commonly used because of its speed and simplification of anomaly response compared to the other arrays.

Figure 4.2 (Top) Diagram of Twin Array setup (Somers 2006: Figure 6.4); (Bottom) Photo of data collection at Brackett with GeoScan RM15.

Data Collection and Processing

A GeoScan Research RM-15 electrical resistance meter with an MPX15 multiplexer in PA20 Twin-Probe array was used to collect data for this project. A total of 10 20x20 meter grids and one partial 20x20 meter grid were collected during the span of five days during the 2019 summer season. The grids were collected in a zig-zag mode starting at the southwest corner and moving in the north-south direction. The transects were 50 centimeters apart and the lines were placed every odd meter, totaling 20 lines per grid. The instrument measured two readings per meter. For each grid the fixed probes were placed at least 15m from the grid itself, as suggested for Twin-Probe arrays in Gaffney and Gater (2003:32).

Once collected, the data was uploaded to GeoScan Research's GeoPlot 4 software. Composites were created for single grids (totaling three) or multiple grids (totaling four). Once the composites were created, all of the resistance grids were processed with the same steps. The steps were DeSpike, Interpolate, Low Pass, and Clip. De-Spike removes random readings from the data. In the DeSpike window, the default settings were applied to the data. The standard deviation threshold was 3.0 and the mean was used for the Spike Replacement. High Pass subtracts the average background resistivity and replaces it with zero, allowing positive data to represent high resistivity anomalies and negative data to represent low resistivity anomalies (Somers 2006:118-119). The default X,Y radius was used (10) and the weight selected was Gaussian in the High Pass window. Interpolate was used to obtain the same sample density in all directions (Somers 2006:118). The default settings were used, and the step was repeated twice for the X and Y directions. When necessary, Search and Replace was used to replace high points with dummy data to take out data spikes.

Ground-Penetrating Radar

GPR uses radar pulses to find buried features and then measures the time it takes for that signal to return (Figure 4.3). When used in GPR, radar waves are produced by a transmitting antenna with a wire or plate that oscillates when an electrical current is applied (Gaffney and Gater 2003; Conyers 2013). Higher oscillation frequencies mean short wavelengths and vice versa. These wavelengths determine how deep the radar wave can penetrate into the ground and the type of objects that can be detected within that depth. Longer wavelengths will go further into the ground but record less reflection of smaller objects, while shorter wavelengths cannot go too deep into the ground, but they can receive reflections from small objects. Radar data is collected in units of Hertz, or cycles per second. The two most common antenna sizes used in archaeology are 200 MHz (megahertz) and 400 MHz, but 10-1000 MHz is the typical range used by archaeologists (Gaffney and Gater 2003; Conyers 2006; Conyers 2013). The 200 MHz antennas are more powerful because they create a long wavelength, allowing the pulses to travel about 10m below the surface, while the 400 MHz antennas only go about 3-4m below the surface because they have a shorter wavelength. In general, the lower the hertz, the longer the wavelength, so the deeper the radar pulse can travel.

The ground material can affect how useful GPR surveys can be in an area. For example, the radio signal will move quickly through sand and the data will virtually be useless. However, more clayey materials will slow down the signal. In general, radar waves travel about 30cm/nanoseconds in air, 15cm/nanosecond in sand, and about 5cm/nanosecond in clay material (Conyers 2006). This is why it is important for archaeologist conducting GPR surveys to know the local geology of their areas of study. In order to collect the best data possible, the machinery needs to be calibrated depending on the depth and the soil type of the research area. The electromagnetic nature of radar means that the archaeologists should also take into account the material's electrical conductivity, magnetic permeability, water content, and the salinity of the water (Davis and Annan 1989; Conyers and Goodman 1997; Gaffney and Gater 2003; Conyers 2013). Other things that need to be taken into account as well include the size of potential features and outside interference on the radar frequency.

Because GPR can detect material changes, it is most useful in archaeology to find architectural features, such as walls and floors. Specifically, GPR produces images of specific horizons, which can consist of soil changes, floors, and mound construction (Davis and Annan 1989; Conyers 2010). GPR's ability to find boundaries between materials makes it a good method for finding features such as foundations and walls made from brick or stone. It is also used in geologic studies of bedrock depth, water table depths, soil stratigraphy, and glaciers (Davis and Annan 1989; Annan and Davis 1992; Annan 2002).

Data Collection and Processing

GPR was chosen to survey the location of the mound due to its ability to reveal different horizons within subsurface materials. For this project, a GSSI UtilityScan with a 350 MHz antenna was utilized to survey the site in four 20x20m grids. Data was collected at 100 readings per meter with 50cm intervals between profiles. The depth was set to 2 meters and the dielectric was set to 13. The grid data was collected in a zig-zag pattern in the north-south direction staring in the southwest grid corner.

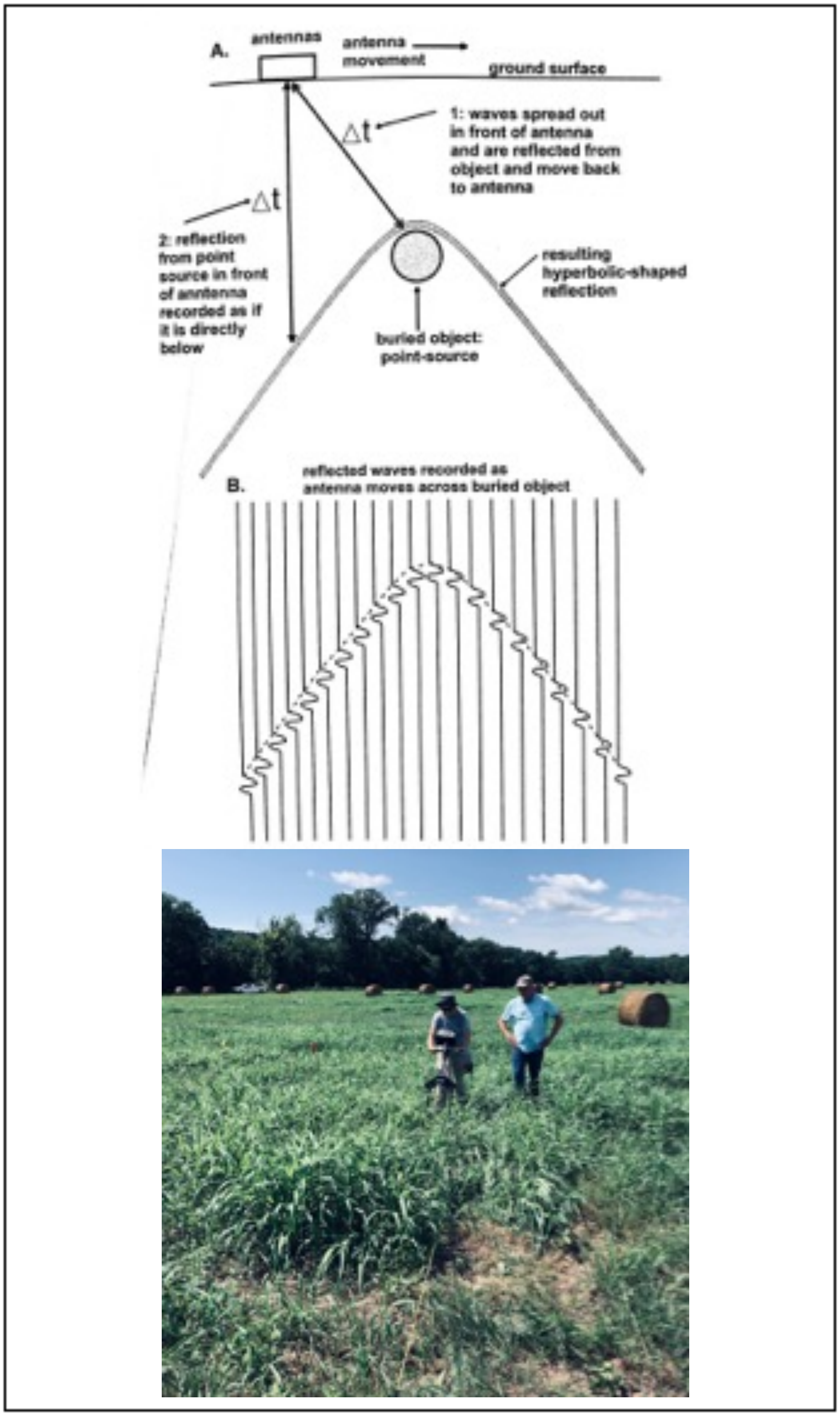

Figure 4.3 (Top) Diagram of GPR radar pulse and recording (Conyers 2013: Figure 3.17); (Bottom) Photo of data collection at Brackett with GSSI Utility Scan by myself (left) and Tim Mulvihill (right).

The data was processed using GSSI's software program RADAN 7 following the software guide provided by Leach (2019). This guide suggests the use of processing steps that include a Time-Zero, Range Gains, Impulse Response filters, and Migration when processing raw GPR data. Time-Zero refers to position correcting the data. This processing step sets up a position for the ground surface based on the first peak of the initial wave generated by the transmitting antenna (Leach 2019: 2). Range Gain is used to equalize amplitudes and minimize shadowing, allowing data to be displayed clearly (Leach 2019: 2). The Impulse Response filter used for this project is the Finite Impulse Response (FIR), which uses a bounding box to limit the effects of distant scans in the form of low and high passes (Leach 2019: 3). The high passes are going to be a low value because it is the minimum frequency wanted and the low pass is going to be a higher value because it is the maximum frequency. In other words, we want values higher than the high pass value and lower than the low pass value. A final step suggested by Leach (2019:4) is known as Migration, which gets rid of the tails of hyperbolas that result from the movement of the GPR pulses over point features. As pointed out by Gaffney and Gater (2003), migration can be used in data processing to reveal smaller features that might have been obstructed by the hyperbolic tails.

A Super 3D grid was created with the four collected mound area grids. The four grids and the super grid were all processed with the same steps. The processing steps used in this case study were simple and consisted of Time-Zero, FIR filter, and Range Gain. The Time-Zero was the first processing step to correct the ground surface position. Then the FIR filter was used, and the inputs consisted of the following information:

-Design: Triangle
- Scans: 200
-Low Pass: 800
-High Pass: 200

The number of scans was suggested by Leach (2019:3). The Range Gain was then used on the data. The gain type was exponential, and the number of points used were seven. Migration was not used in the processing of these data because there were no visible hyperbolas with tails that obstructed the data. In order to better display the data without further manipulating it, the Display Gain was set to 6.

Data Interpretation Approaches

Unless ground-truthing is conducted alongside surveys, it is difficult to make absolute identifications of the resulting anomalies. Kvamme (2008) provides two basic approaches to interpreting geophysical data: inductive and deductive. For the purpose of this project, I will be utilizing both approaches. An inductive approach to data interpretation involves identifying systematic patterns of anomalies, as well as any anomalies that resemble geometric shapes. In this case, any square or rectangular anomalies would be of interest as representations of potential houses. Deductive approaches associate anomalies with the known properties of the soil and is associated with ground-truthing activities. For this project, deductive approaches are limited because ground-truthing is out of the scope of this project. One example of using a deductive approach without ground-truthing is the deduction that higher-valued magnetic signatures might be indicative of burning events based on the concept of thermoremanence (McKinnon 2008:51).

Chapter Five: Results and Interpretations

This chapter summarizes the results of the multi-sensor geophysical survey that was conducted at Brackett. The techniques used to conduct this survey included magnetometry, electrical resistance, and ground-penetrating radar (GPR). Due to time constraints, only the area immediately surrounding what is assumed to be the mound remnants was surveyed for this project, totaling 4.48 hectares. This is the same area that was first excavated by the WPA. This location was purposely chosen to explore if the WPA missed any houses in the mound's vicinity. As discussed in the previous chapter, magnetometry was used to survey the whole area of interest, while GPR was focused on the mound remnants and electrical resistance was used to survey grids with magnetic anomalies of interest. The results of this survey suggest the presence of at least one previously unknown cultural feature, as well as anomalies that are potentially associated with the WPA excavations from 1939-1940. The lack of house-like anomalies around the mounded area is not necessarily discouraging, as the WPA systematically tested that area (Kusnierz 2016; Regnier et al. 2019).

This survey resulted in 115 grids of gradiometer data, 10 grids of electrical resistance data, and four grids of GPR data. The areas surveyed by resistance and GPR were determined based on anomalies found in the magnetometry data. Unfortunately, the electrical resistance was not conducted on every grid of interest because the Johnson grass at the site had grown up to five feet in some areas, limiting our ability to collect data. This meant that we had to choose areas of interest where the grass was not tall enough to hinder our ability to successfully use the instrument. The grass also hindered our ability to successfully survey the mound area with the GPR during the summer, so on February 13, 2020 the site was revisited to collect the four grids of data around the mound.

Geophysical Survey Results

The data for this project were processed in three programs: gradiometer data was processed in TerraSurveyor 3, resistance data was processed in GeoPlot 4, and GPR data was processed in RADAN 7. For a more detailed summary of the processing steps used for the data collection, refer to Chapter 4. Because the gradiometer data covered the entire area, the rest of this chapter will only refer to the other types of data when appropriate. The last processing step for the gradiometer data was to clip the data. The data was first clipped to +7/-7 nT and subsequently clipped further to +4.64/-4.55 nT (Figure 5.1).

While this is the first geophysical survey conducted at one of the Spiroan single mound sites, there have been numerous surveys conducted in the Caddo Region that provide some insight into how the data should be presented (see Chapter 3). For example, results from a landscape-scale survey of the Spiro site show anomalies associated with a possible burned structure (on upper terrace) and temporary structures (located on lower terrace) to be visible at <1 nT (Hammerstedt et al. 2017, 2019). Across the border in Arkansas, Sullivan and McKinnon (2013) processed gradiometer data to +7/-7 nT and found potential anomalies associated with Harlan phase structures at the Collins site. Using nT values of +2/-2, Haley (2014) was able to identify multiple burned structures from the Mississippian Period, in addition to distinguishing structures that even had extended entryways at the Hollywood Mounds site in Mississippi. At the Clement site, Hammerstedt et al. (2010) identified a structure with a signature strength of 4-5 nT.

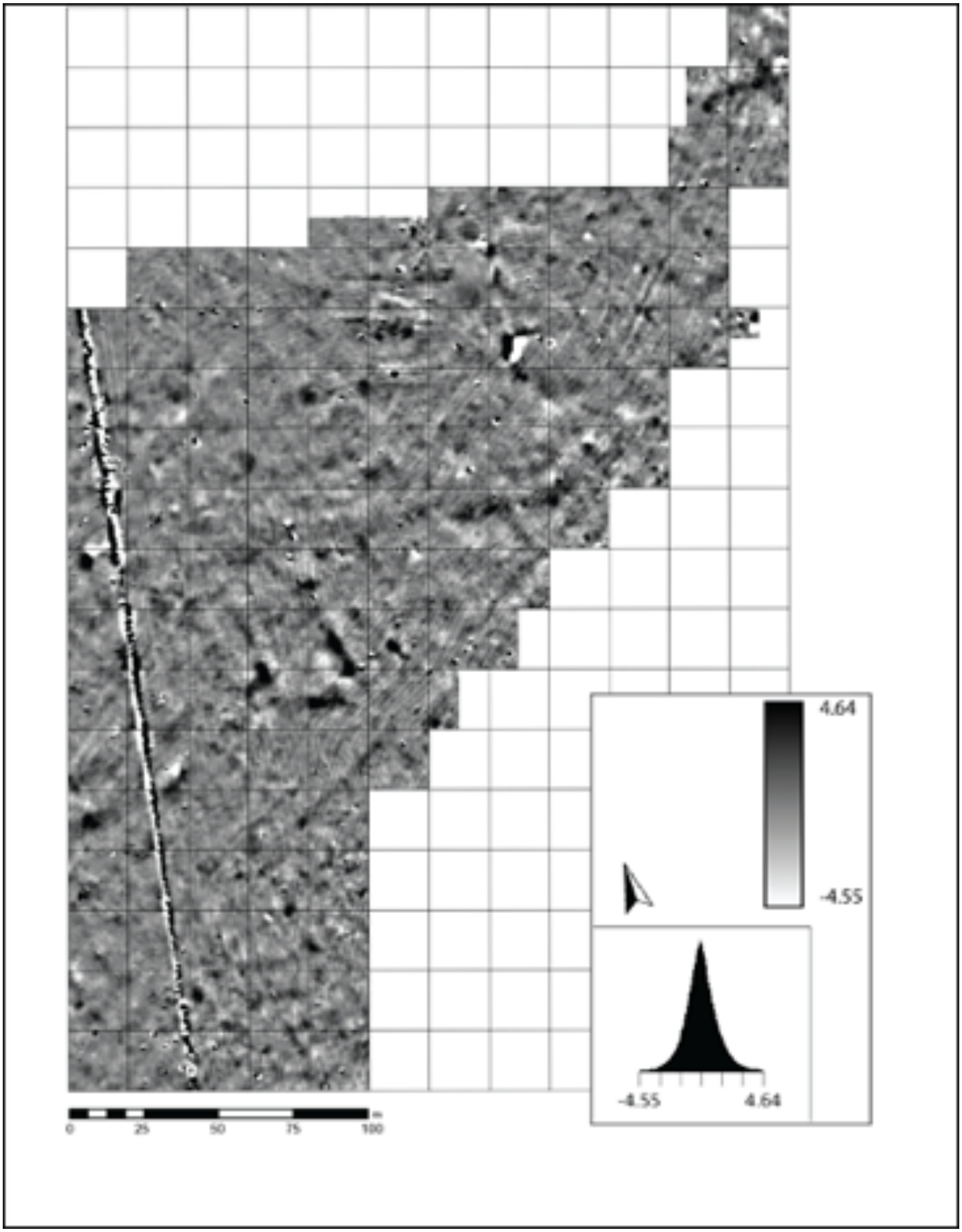

Figure 5.1 Gradiometer survey results of the Brackett Site.

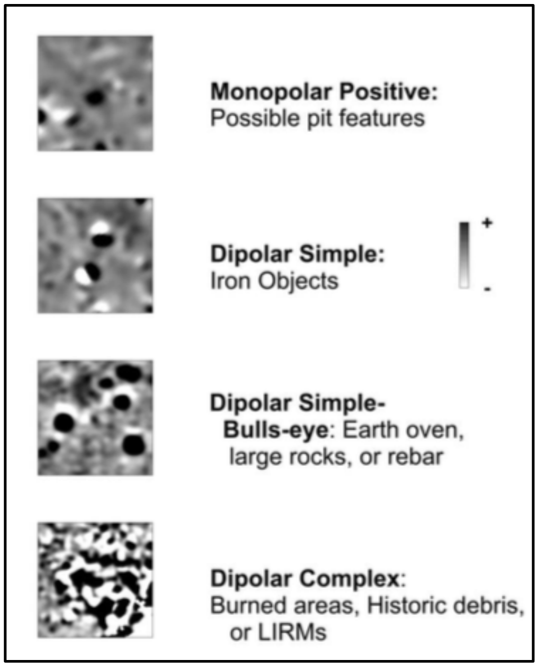

Figure 5.2 Examples of magnetic anomalies (Burks 2013: Figure 10)

Based on the site-wide survey of Brackett, there are numerous anomalies present that will be discussed in this chapter, ranging from potential pits to remnants of WPA excavations. The anomalies will be characterized based on definitions provided by Burks (2013:13-16) (Figure 5.2). Monopolar positive refers to localized magnetic positive peaks and dipolar simple refers to adjacent positive and negative peaks. Dipolar complex anomalies are clusters of dipolar simple readings. Multiple monopolar positive anomalies refer to groups of monopolar positive anomalies in a visible pattern. Throughout the site, there are a number of monopolar positive anomalies that are consistent with pit-like features. There are also a couple small dipolar anomalies consistent with either hearths/ burnt feature, which are represented by bulls-eye shaped dipolar anomalies (Burks 2013:14). The lack of these types of features associated with long-term occupation suggests that Brackett was either not occupied full time, or there was only a small group that lived at the site. While there are no complex dipolar anomalies consistent with intense pre-contact burning activities, there are a significant number of dipolar anomalies that are most likely historic metal scattered throughout the survey area, including a complex dipole that is consistent with the remnants of a historic fence. While not visible on the ground, aerial photos of the site clearly show the fence's extent (Figure 5.3). There is also a large (>10m) dipolar anomaly located in the northern portion of the site, which is likely associated with historic metal. When discussing these results, it is important to note that my interpretations of these anomalies are not concrete identifications.

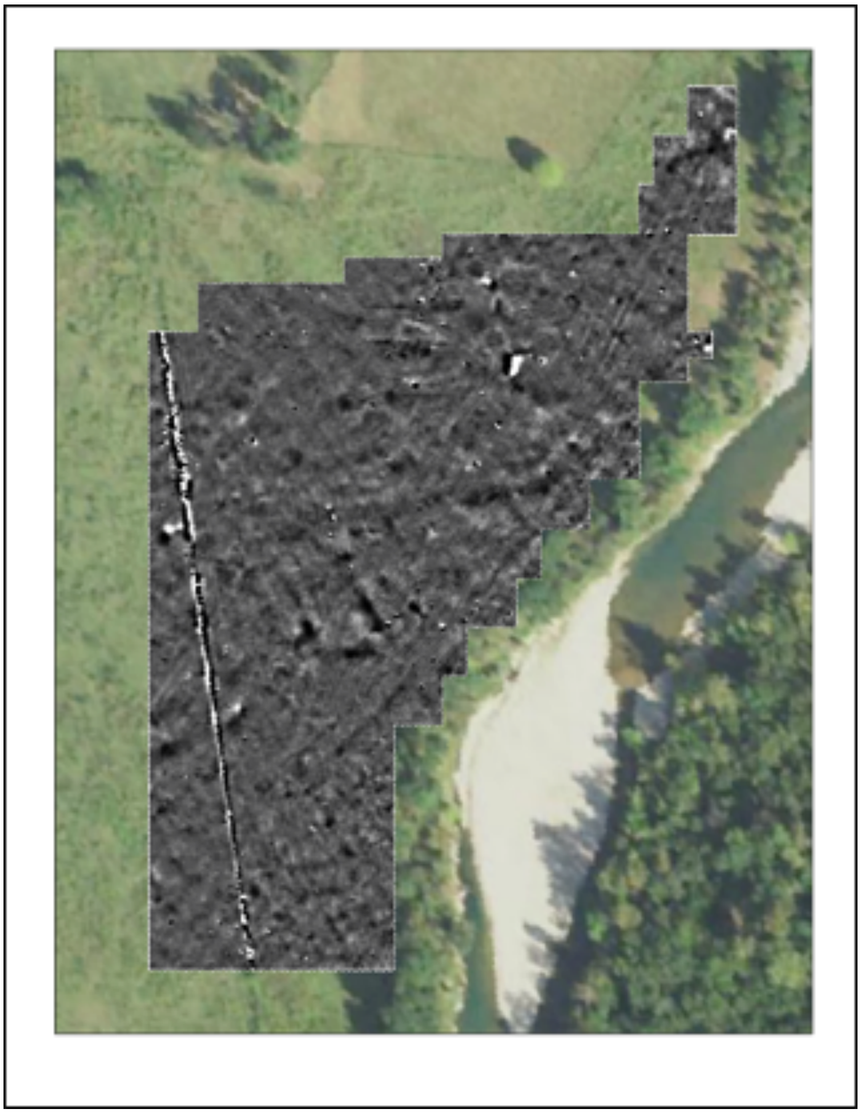

Figure 5.3 Gradiometer data placed over aerial photograph of the site. Note the fence remnants running north-south in the western half of the survey area.

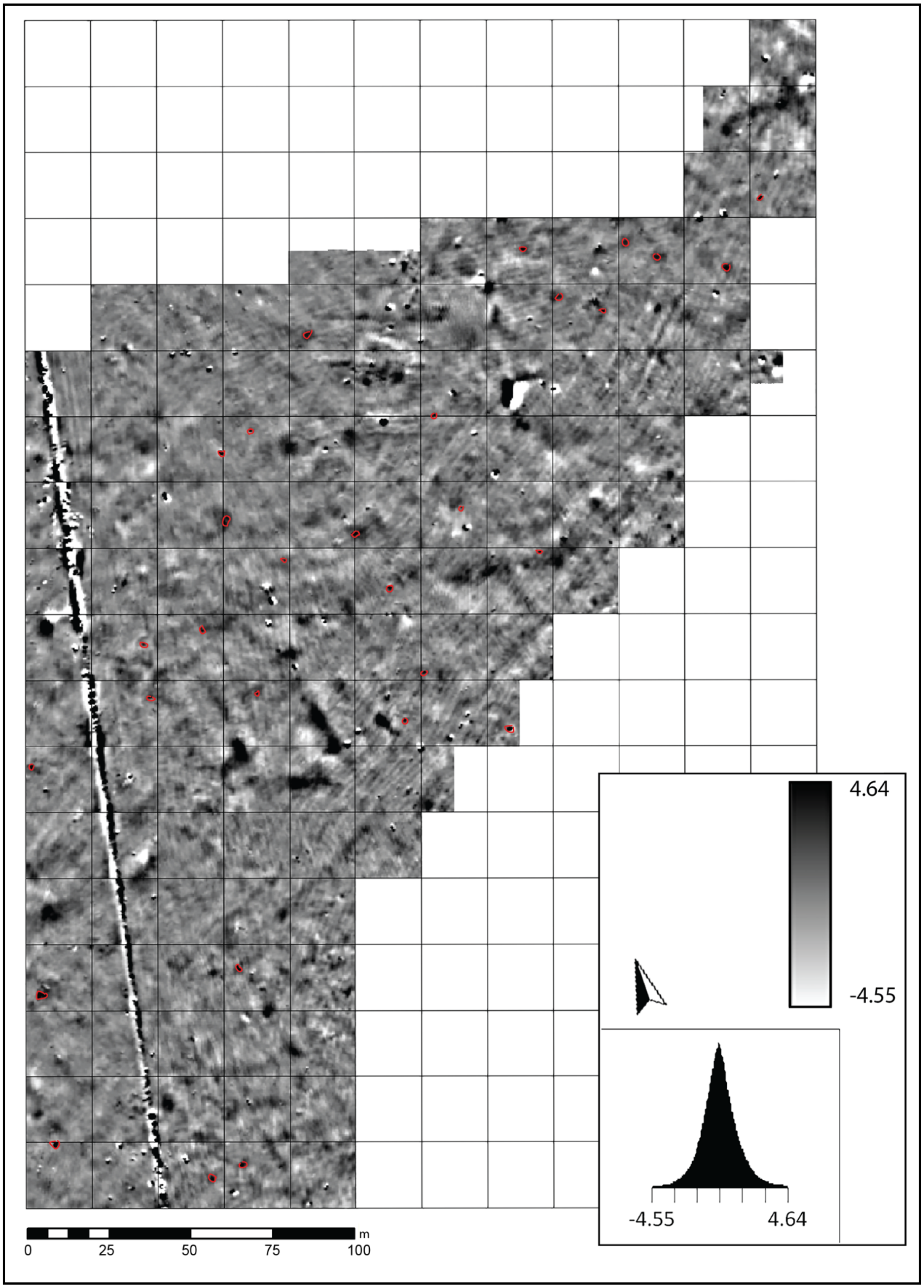

Figure 5.4 Locations of monopolar positive and bullseye dipole signatures that could be indicators of possible external pit and hearths.

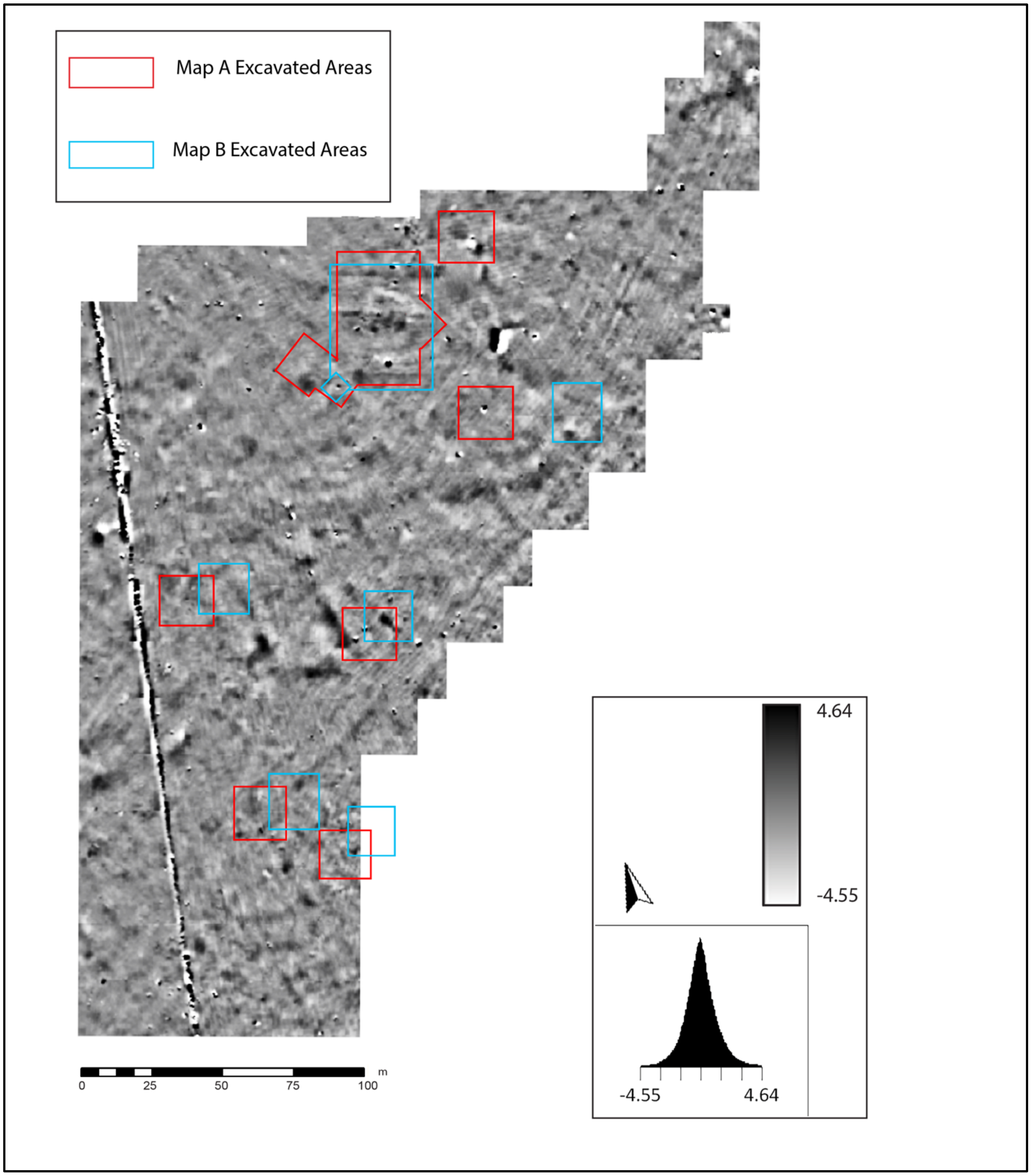

Figure 5.5 Estimated locations of Map A) Updated WPA site plan map (See Figure 2.11) and Map B) Adapted from original WPA site plan map overlaid on the gradiometer data (maps courtesy of the Sam Noble Museum of Natural History) (Appendix A).

U-Shaped Anomaly

This anomaly is located in the central portion of the survey area. This anomaly is slightly more than 20m across and consists of 3 smaller anomalies in a u-shape with both positive and negative magnetic signatures (Figure 5.6). This anomaly was recorded by both the gradiometer and the resistance meter (Figure 5.7). The resistance data for this anomaly show it is indicated by a negative resistance signature, which corresponds to the positive magnetic areas in the gradiometer data. The negative resistance signature means that those anomalies have low resistance to an electrical current (in other words, the current easily travels through this area). This low resistance could be the result of a dug-out area, such as a pit, that has been filled with loose soil and easily retains water (Schmidt 2013).

One possibility is that this anomaly represents the burial area excavated by the WPA (Figure 5.8; also see Figure 2.11). The burial area at the site was located in the southern half of the WPA excavated area and was u-shaped with daub in the center (Kusnierz 2016; Regnier et al. 2019). While the shape is similar, the burial area is significantly smaller than this anomaly. The burial area was roughly 10.38 m (35ft) across, which is about half of the size of this abnormality in the data. This means that the anomaly is most likely not associated with the burial area. Another possibility is that it represents a previously unknown plowed-down mound that is separate from the platform in the north and the hypothesized burial mound. This is due to the anomaly's relatively large size to others within the survey area. However, the discontinuous nature of both the positive gradiometer signatures and the negative resistance signatures make this hypothesis less appealing. The third possibility is that it represents a borrow area, either by the occupants at Brackett to build the mounded area or by the WPA when they were backfilling the site. The nature of both the resistance and the gradiometer data suggest that this is the most likely what the anomaly represents. Comparison with WPA site maps suggests that there were two test areas on either side of this anomaly, which further supports the idea that it is associated with WPA activities that the site.

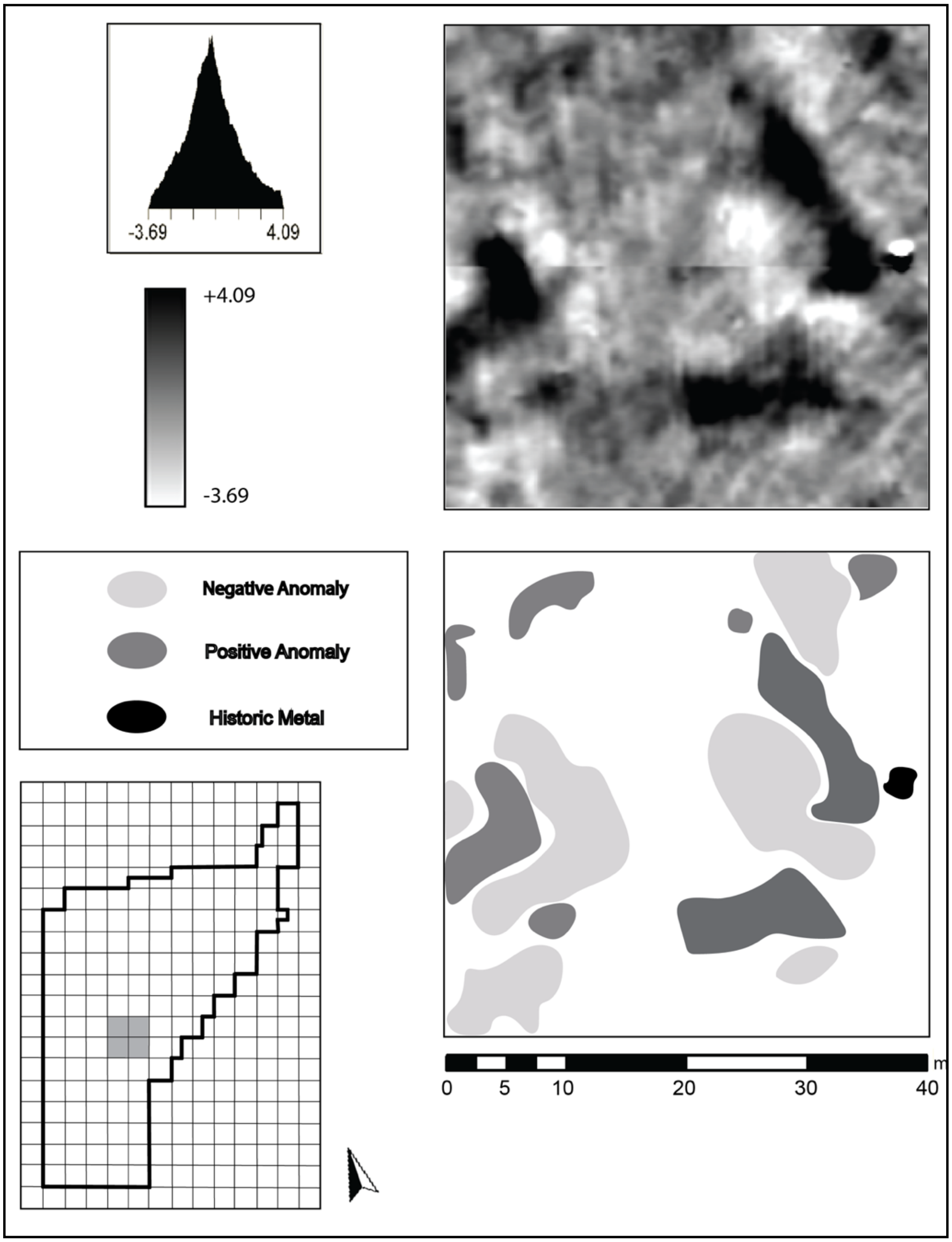

Figure 5.6 The U-shaped anomaly. This anomaly is present in four grids of data and consists of both positive and negative magnetic signatures.

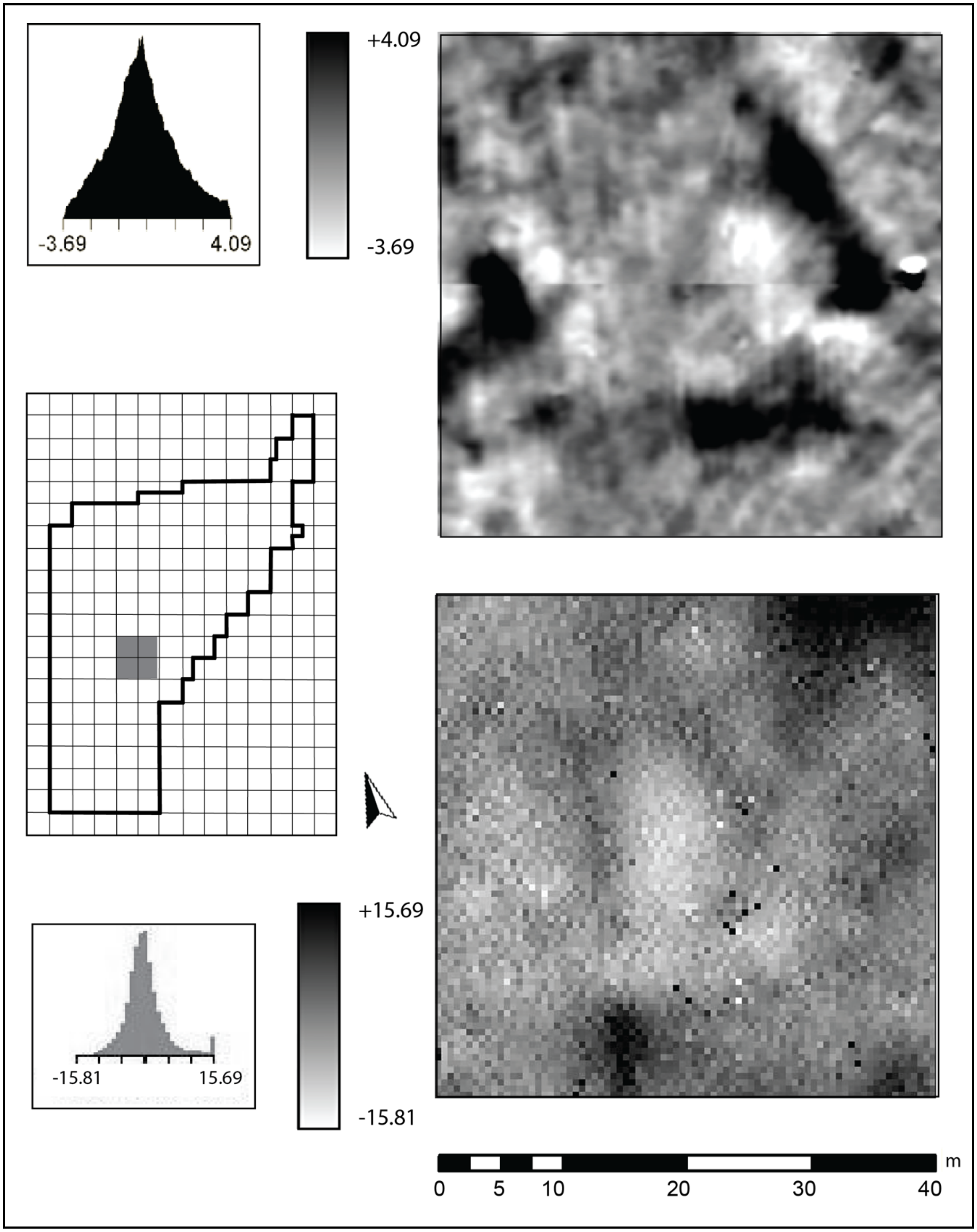

Figure 5.7 The U-shaped anomaly with gradiometer data (top) and resistance data (below).

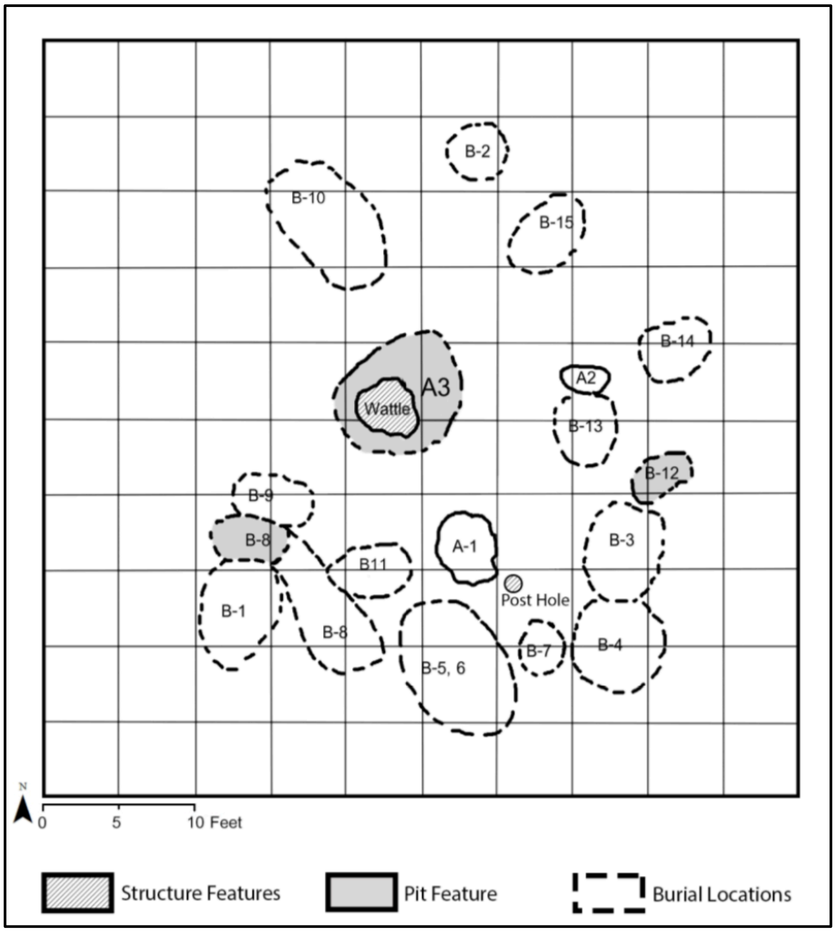

Figure 5.8 Burial area at Brackett (Kusnierz 2016: Figure 3.12)

Mound-Area Anomalies

The excavated mound at the site was located in the north portion of the site. There is still a remnant of the mound present at the site (Figure 5.9). The mounded area was surveyed with both the gradiometer and the GPR. The magnetometry data reveals dipolar linear anomalies near the mound area that run in the west-east directions (Figure 5.10). The linear and regular nature of these anomalies and their location suggest that they could be the remnants of the WPA trench excavations of the mound (Figure 5.11). As demonstrated by Hammerstedt et al. (2010) and McKinnon et al. (2017), it is possible to identify trench excavations in gradiometer data. These anomalies are located to the west and north of the current mound remnants and three are visible in the data. If they indeed represent WPA trenching, then it would suggest that the mounded area that remains at the site is just backfill from the excavations and not intact mound deposits. This is because the WPA excavated the mound using 5ft trenches running east to west (see Chapter 2). They started at the southern end of the mound and worked their way north, which suggest that any trench remnants should be located south of any intact mound remains. The footprint of the mound is clearly visible in the southeast portion of the gradiometer data. The contour map of the site confirms that this anomaly is located in the same spot as the mounded area.

This area was surveyed with GPR in an attempt to clear up confusion about these linear anomalies. GPR is a useful technique for identifying changes in soil horizons or surface materials, which can be indicative of floors or mound construction stages (Davis and Annan 1989; Conyers 2010). GPR can also reveal manipulations to those surfaces, such as previous excavation units (Leach 2019). The results of the GPR data reveal anomalies that could correspond to those associated with the gradiometer data, but there is no clear indication of intact mound construction stages. A time slice of the four grids surveyed shows that the GPR records few anomalies present at about one meter below the surface, in addition to traces of modern plow lines (Figure 5.12). One thing to note is that there is a curved anomaly in the southeast corner of the southeast grid (most clearly visible 80-100 cmbs) that correspond with the mound footprint in the gradiometer data. There is also a subtle anomaly in the southern half of the northwest grid that looks to correspond to a monopolar anomaly in the same location in the gradiometer data (Figure 5.13).

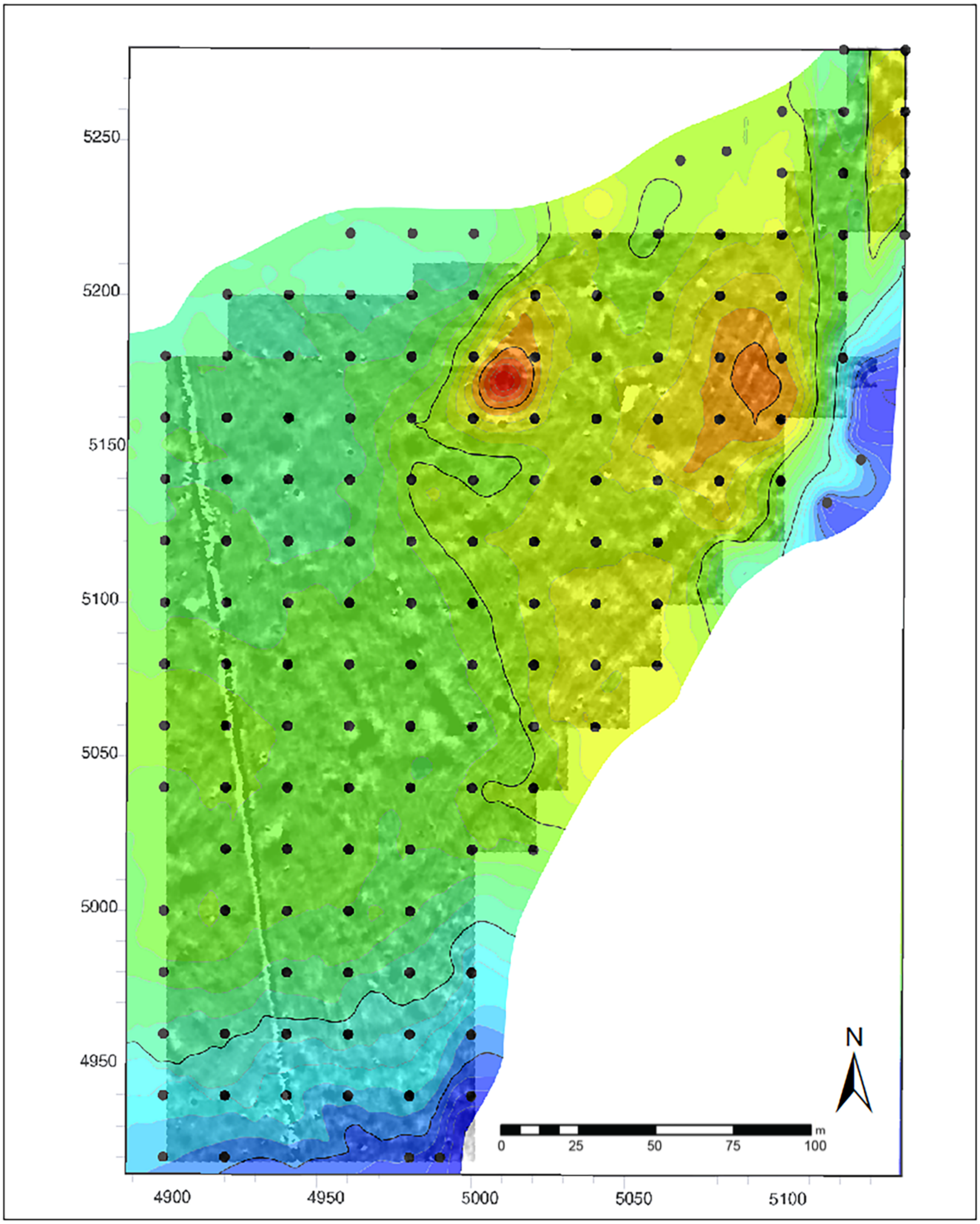

Figure 5.9 Contour map of Brackett with 10cm intervals overlaid on the gradiometer data. Red indicates higher elevated areas. Mound remnant is indicated by the western-most red area. Contour map provided by Dr. Amanda Regnier.

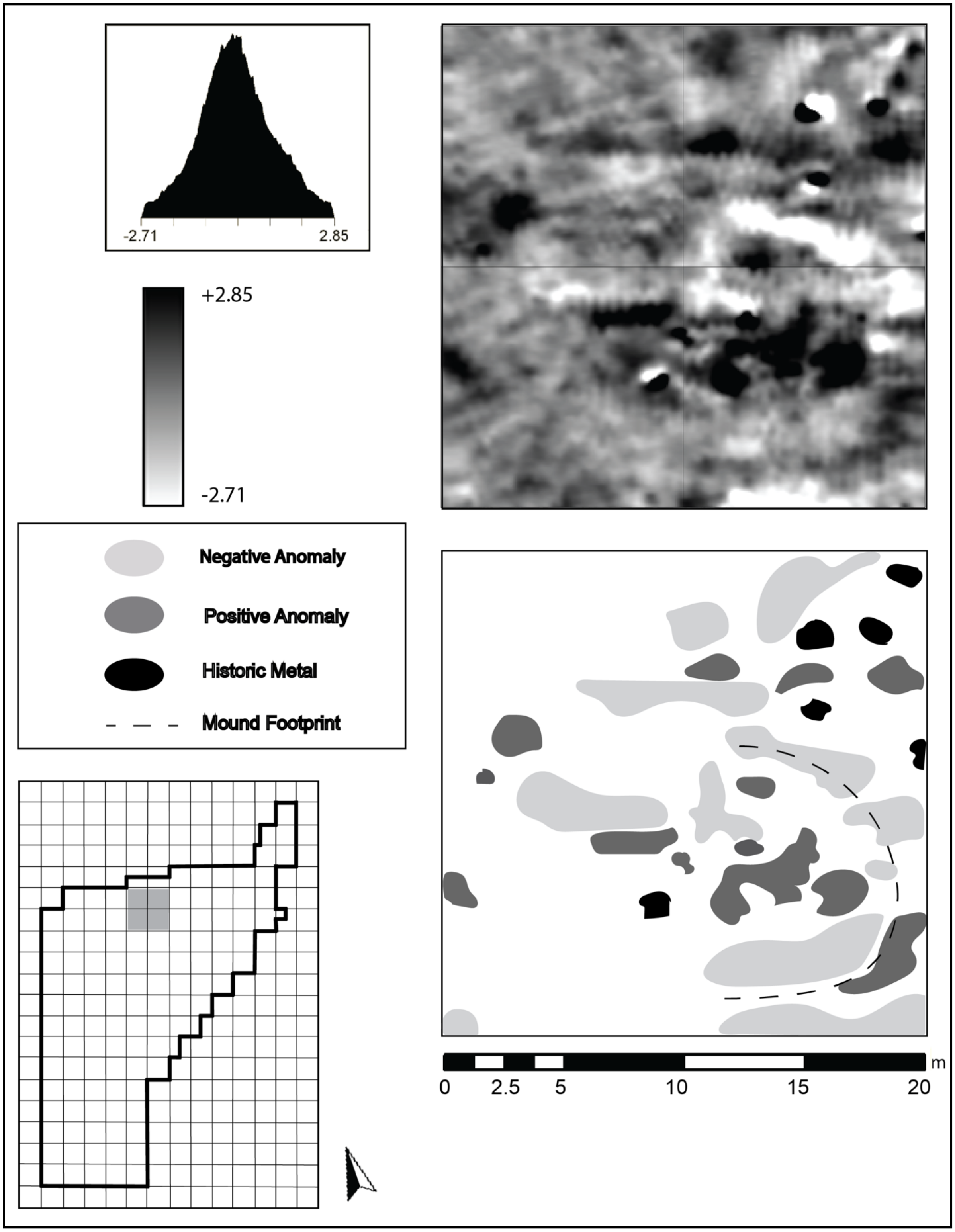

Figure 5.10 Gradiometer data of the mounded area. The mound remnant is located in the southeast grid.

The GPR profiles revealed a clear soil change that occurs between 0.50-1 m below the surface (Figure 5.14). This anomaly is a constant presence in every GPR profile for the four grids surveyed in this area. This could be a representation of the boundary of the pre-mound soil matrix (Figure 5.15). As visible in the plan view of the grid with the mounded area, at about 50 cmbs the GPR data shows an anomaly in the northwest portion of the grid. The anomaly is also visible in the profile (Figure 5.16). It seems that this anomaly is in the same location a group of monopolar positive anomalies located in the same area of the gradiometer data. The location of the anomaly in the GPR profile (towards the bottom of the soil matrix change) suggests that it is associated with either the excavations or the pre-mound surface. This anomaly could be indicative of a pit feature based on the depth and magnetic signature. The lack of GPR anomalies associated with mound construction further supports the idea that the mounded area currently present at the site is the result of WPA backfill.

Figure 5.11 WPA trench excavation of the mound, working from the southern end northward. Courtesy of the Sam Noble Museum of Natural History, WPA Files.

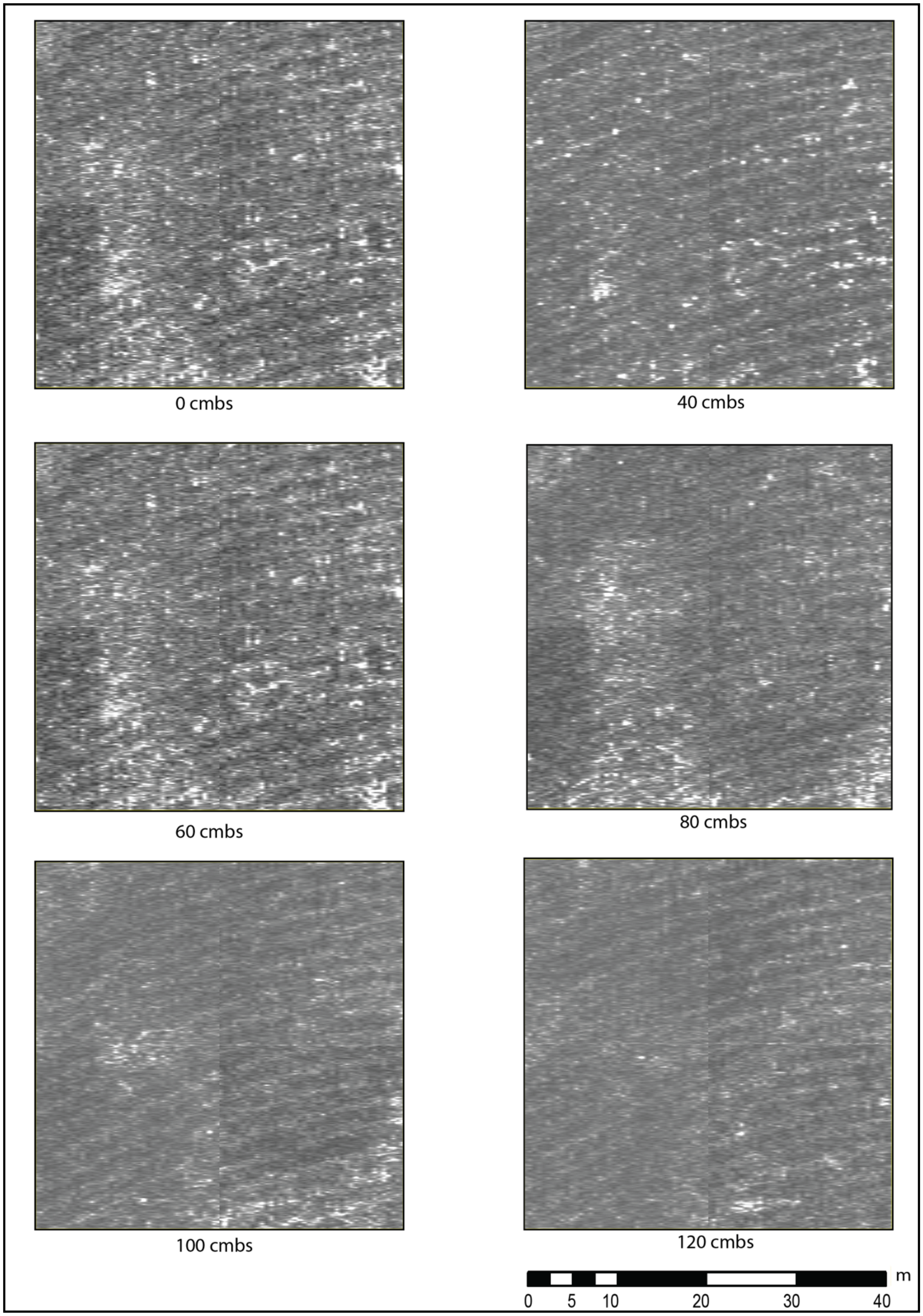

Figure 5.12 Time slices of the mounded area grids.

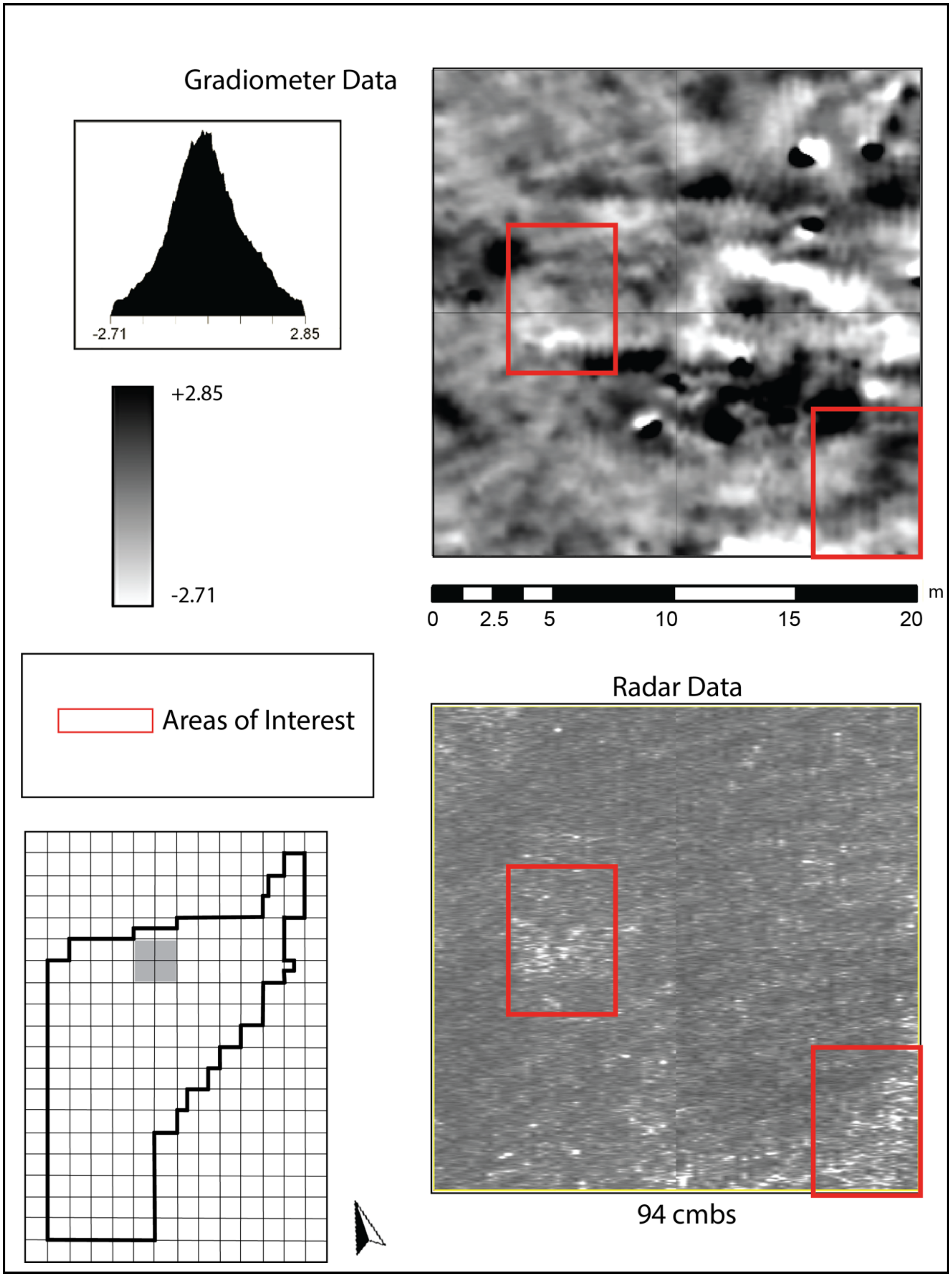

Figure 5.13 Gradiometer data and the GPR data of the mounded area.

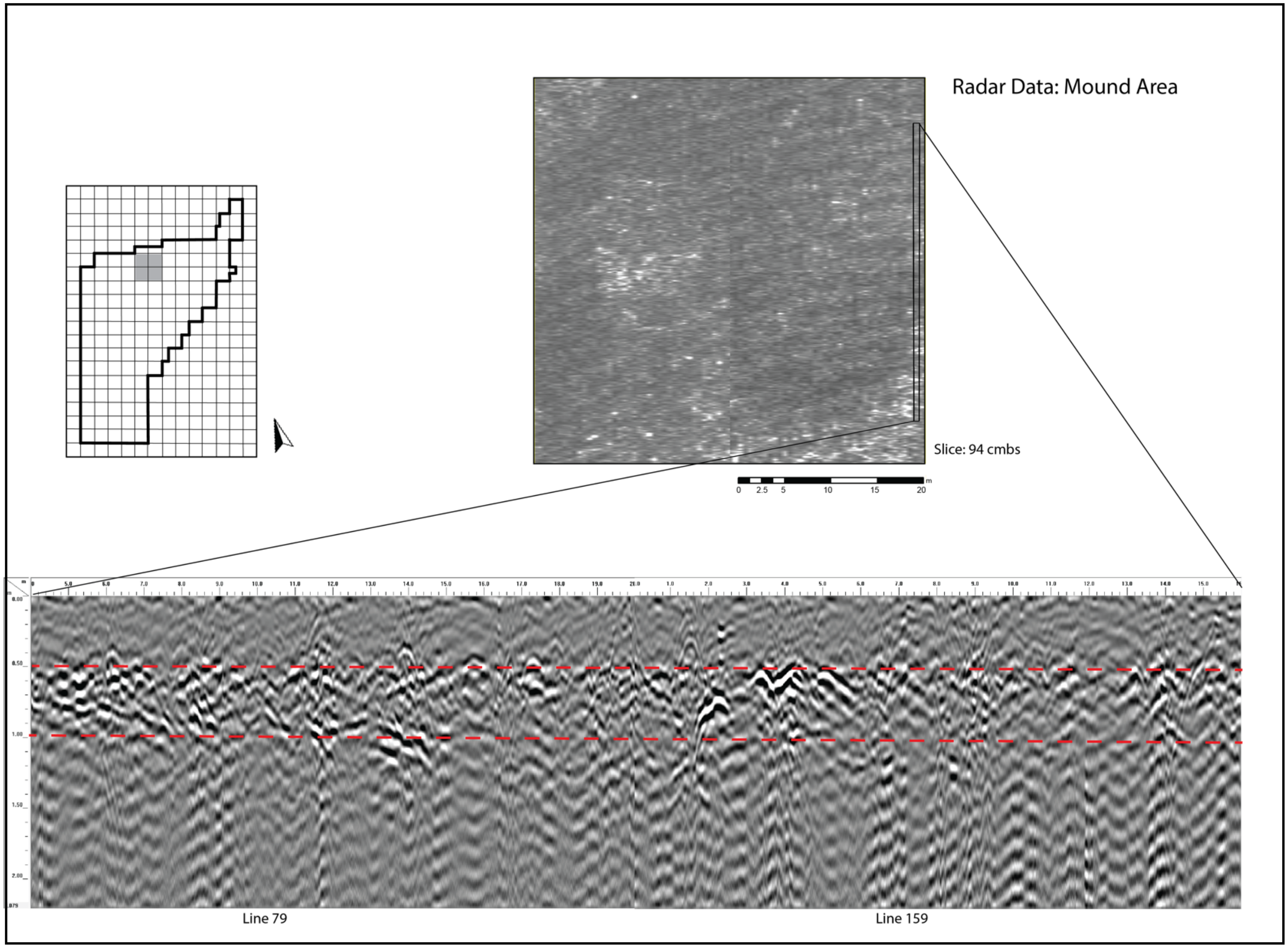

Figure 5.14 Example of GPR plan view (top) and profile (bottom). This profile shows the soil disturbance that occurs between 50-100 cmbs.

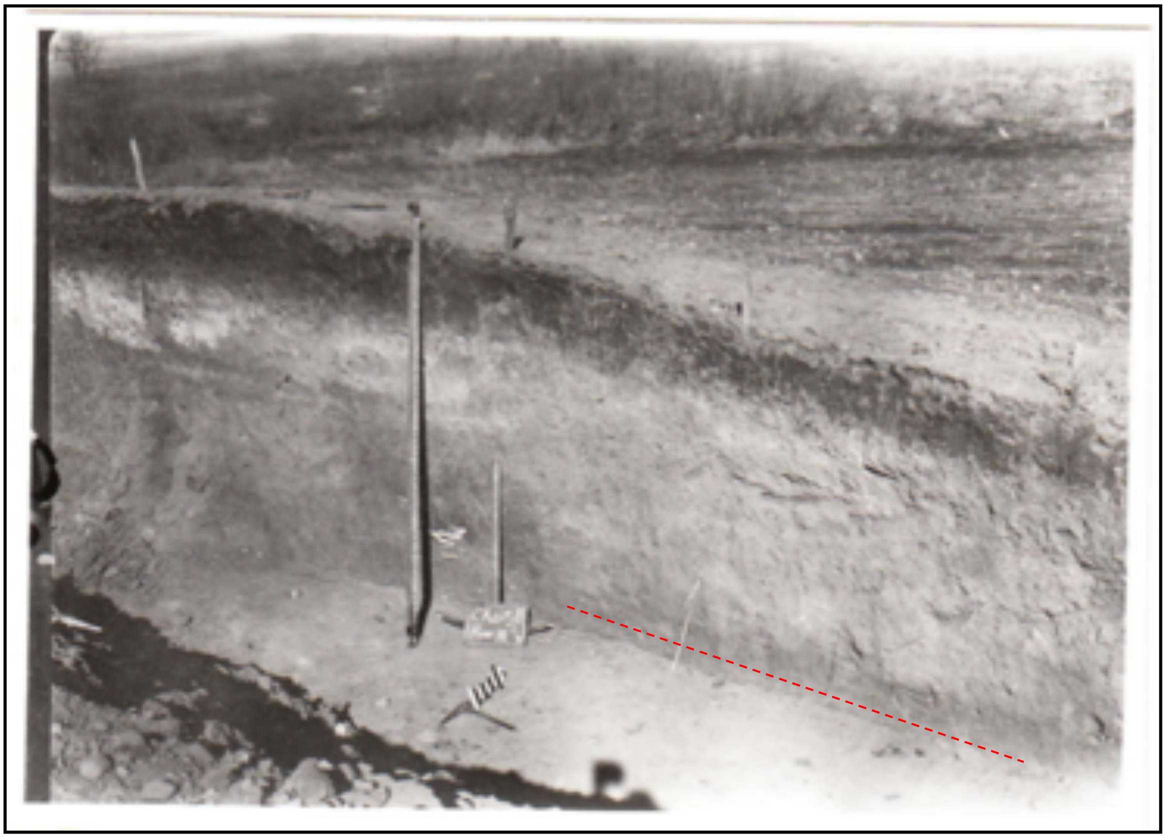

Figure 5.15 WPA photo of mound excavation. The disturbance in the GPR data is likely associated with the boundary below the darker soil towards the bottom of the excavation profile shown in this photo (indicated by dashed line). Courtesy of the Sam Noble Museum of Natural History, WPA Files.

Miscellaneous Anomalies

There were a few anomalies throughout the site that, at first glance, might have represented cultural features associated with the Brackett site. This includes a rectangular shaped dipolar anomaly, a large monopolar circular anomaly, and linear anomalies in various areas. However, upon closer inspection of the magnetometry and electrical resistance survey results, it seems that there is little to support these anomalies as potential archaeological features. The following anomalies were targeted with electrical resistance and compared to the corresponding gradiometer data.

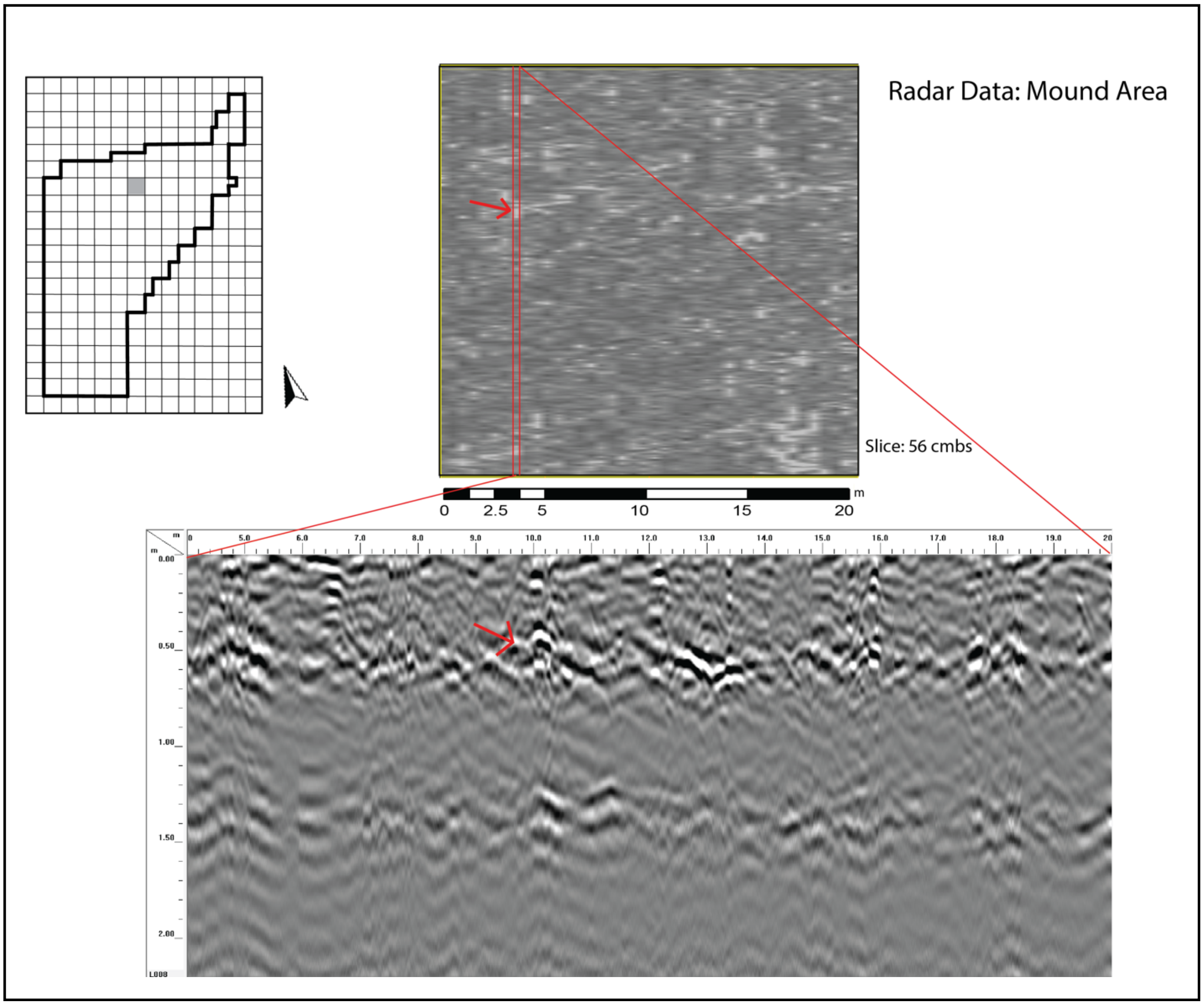

Figure 5.16 GPR anomaly that is also present in the gradiometer data. This anomaly occurs around 80 cmbs.and is associated with a positive magnetic anomaly in the gradiometer data of the same area (see Figure 5.10).

<u>Anomaly 1</u>: This anomaly is located just east of the U-shaped anomaly (Figure 5.17). This rectangular anomaly is about 4 meters across and consists of a positive signature surrounded by a subtle negative signature. There is also a tail-like area of positive signatures that faces the southeast direction. One possibility is that this is the representation of a previously unknown house at Brackett based on the shape and size. This area was surveyed with electrical resistance, and there is a negative resistance signature present in the data that suggests that the soil

associated with the anomaly is loosely settled. The proximity of this anomaly to the u-shaped anomaly and the similarity of signatures suggests that this anomaly might also be associated with borrowing activities. After overlaying the WPA maps on the survey data, it seems that this area corresponds to the WPA's Test Unit 3, which did not reveal any house-like structures (Figure 5.25).

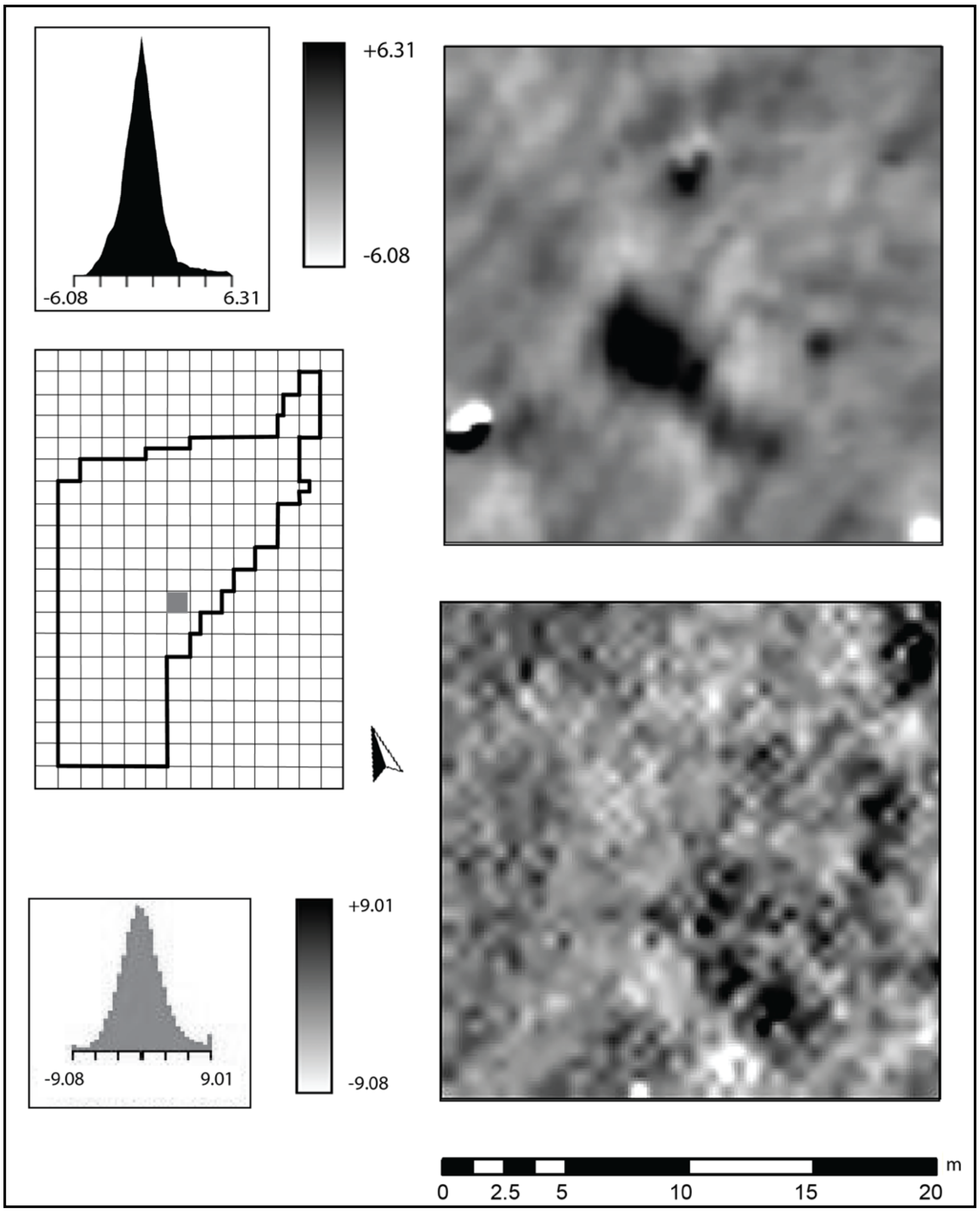

Figure 5.17 Gradiometer results (above) and electrical resistance results (below) of Anomaly 1.

Anomaly 2: Another anomaly of interest was located in the southwest portion of the survey area, just west of the fence seen in the gradiometer data. This is a 4-5m monopolar positive anomaly (Figure 5.18). This area was also surveyed with electrical resistance. Just like Anomaly 1, the resistance data did not reveal a corresponding anomaly of interest. The only thing to note about this is that the anomaly area in the resistance data consists of both positive and negative signatures. The recording between the two instruments may not correspond but given the nT readings in the gradiometer data further testing is needed to confirm whether or not this anomaly represents a Spiroan feature.

Anomaly 3: This linear anomaly is located across three survey grids and measures a little more than 35 meters across (Figure 5.19). This consists of monopolar positive and negative anomalies, as well as subtle dipolar anomalies. After overlaying WPA maps on the survey data, it appears that there was a test unit that contained one of the houses just north of this anomaly (see the next section for more details). If the location of the house is near this area, then it is possible that these monopolar anomalies are associated with pits utilized by the house's occupants. The resistance data reveals a subtle square shape with a positive signature that measures almost 20m across.

Anomaly 4: This area of interest consists of relatively quiet gradiometer data (Figure 5.20). However, there is an anomaly that seems to resemble a corner-shape of a positive signature in the southern-most grid of this data. There is a strong circular bullseye dipolar signature in the northern-most grid that might be indicative of an external earth oven or hearth. I wanted to survey the immediate grids east of these grids, but the grass was too tall at the time to successfully run the resistance meter. The electrical resistance data collected for this area does not reveal the presence of any undetected features compared to the magnetometry data, nor does it support the presence of any feature with corners in that area.

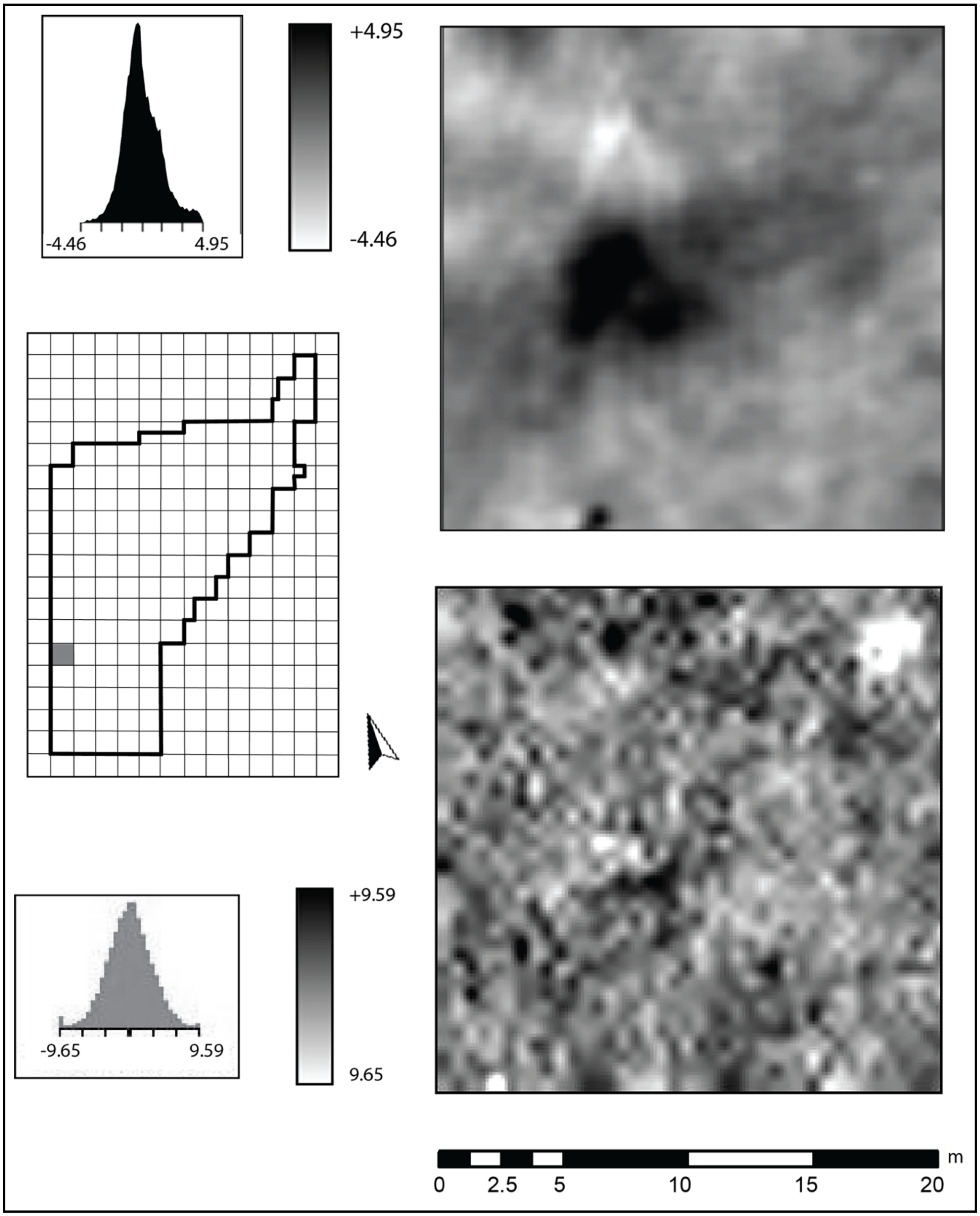

Figure 5.18 Gradiometer results (above) and electrical resistance results (below) of Anomaly 2.

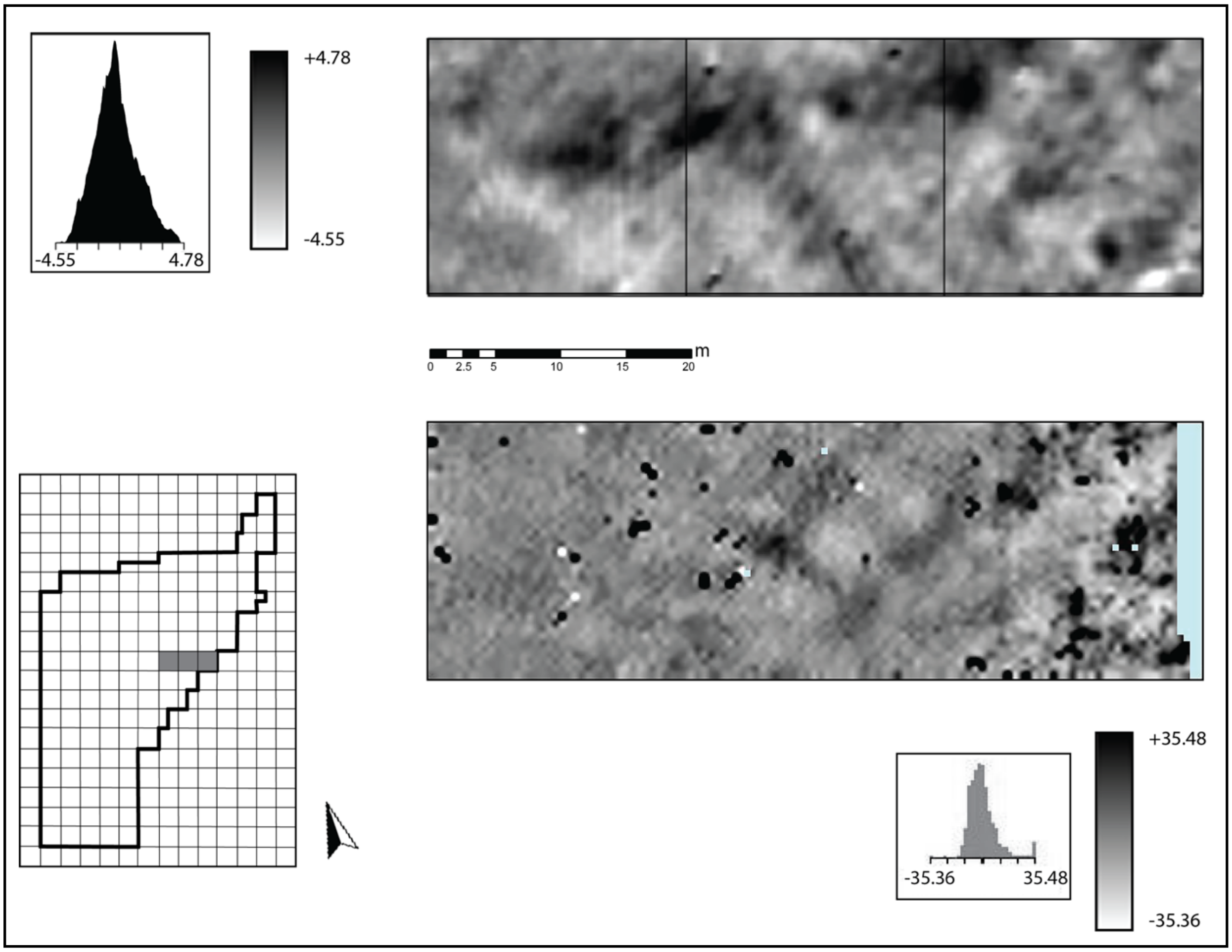

Figure 5.19 Gradiometer results (above) and electrical resistance results (below) of Anomaly 3.

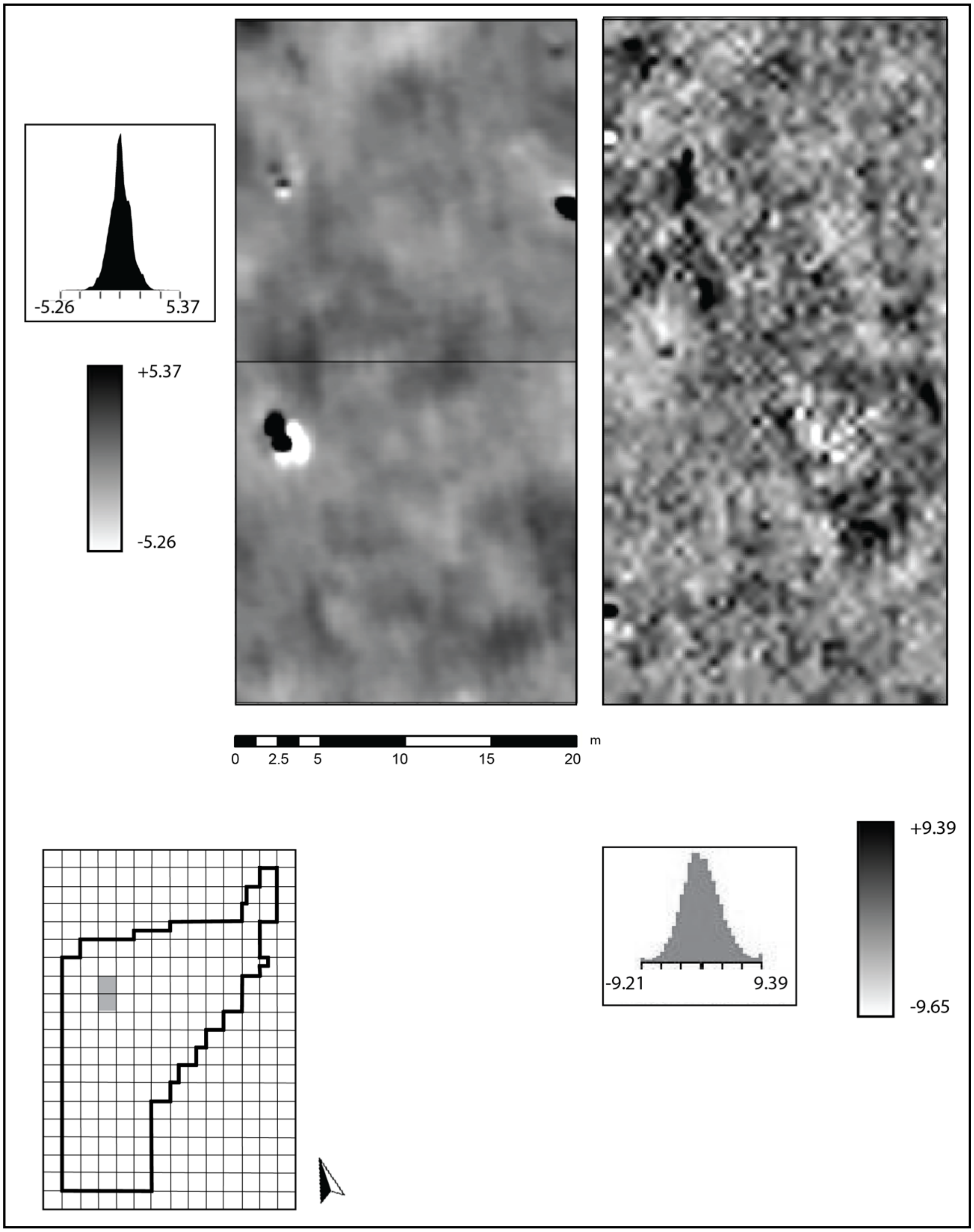

Figure 5.20 Gradiometer results (left) and electrical resistance results (right) of Anomaly 4.

Anomaly 5: This is the northern-most anomaly located within the survey area. It measures about 25m across and consists of monopolar positive signatures, as well as some dipoles that most likely represent metal. The electrical resistance data for the same grids does not reveal any anomalies consistent with those of potential cultural significance. However, there are two negative anomalies of interest that are visible in the resistance data, which are located at the north-central portion of the area. It was determined that these anomalies correspond to two hay bales that were sitting in the area for presumably a few weeks (Figures 5.21 and 5.22).

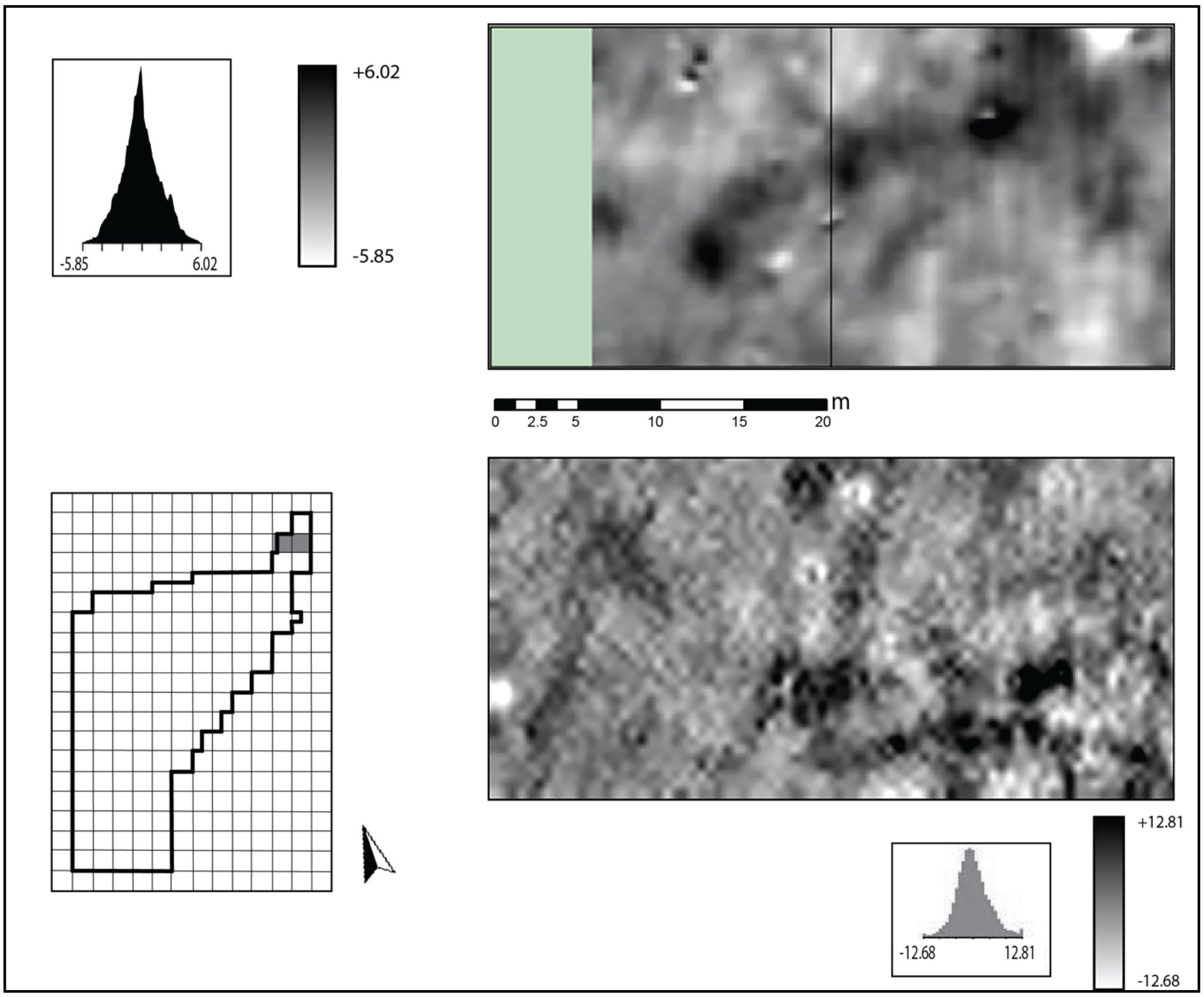

Figure 5.21 Gradiometer results (above) and electrical resistance results (below) of Anomaly 5.

Figure 5.22 Photo of area where hay bales were located before we moved them to survey the area. Photo facing north. The negative anomalies associated with these marks are visible in the electrical resistance data depicted in Figure 5.21.

Anomaly 6: This is a faint, square-shaped anomaly found in the northern half of the survey area that is about 10m across (Figure 5.23). The signature of this anomaly is very faint, with a positive signature surrounded by a stronger negative signature. There is also a central positive signature within the square. This shape is similar to the signatures found at the Hollywood Mounds site in Mississippi (Haley 2014) and the Tom Jones site in Arkansas (Lockhart 2010) (Figure 5.24). The only way to be sure if this anomaly indicates a house is to ground-truth the area. Another is that it represents the signature of one of the houses excavated by the WPA. Its location to the northeast of the mounded area, the square shape, and the southeast orientation of the potential entryway is similar to House 5A. However, that house was superimposed with another house (House 5) that had a northeast entryway. Unfortunately, the grass was too tall in this area to survey with electrical resistance or GPR.

WPA at Brackett

According to Regnier et al. (2019:324), the WPA crews knew how to successfully find houses at the mound sites they excavated. At Brackett, the lack of anomalies consistent with pre-contact houses in the survey data further supports the claim that the WPA could find most, if not, all of the houses in their targeted areas of interest. In an attempt to associate any areas within the survey area with the WPA's test excavations, maps were overlaid on the data to try to get a general sense of where these activities took place (Figure 5.5 and 5.25). There were no clear reference points on the WPA maps for me to confidently georeference them to my survey results. I tried to associate the potential excavated mound area to the same area on the WPA excavation map, but there is no way to know exactly where the first excavation alley was placed (see Appendix A for overlay of maps onto the survey data).

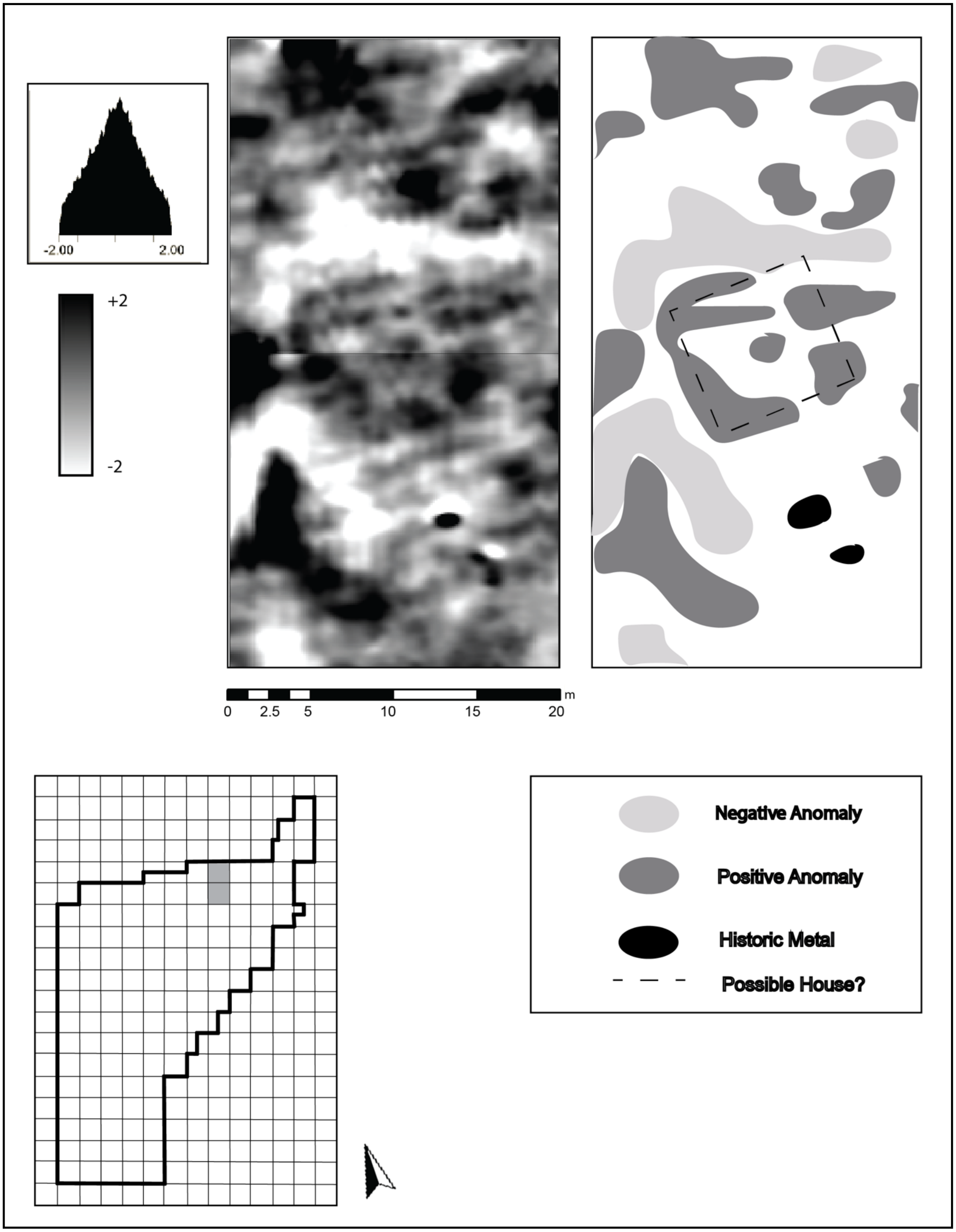

Figure 5.23 Gradiometer data revealing a potential house structure with a faint magnetic signature.

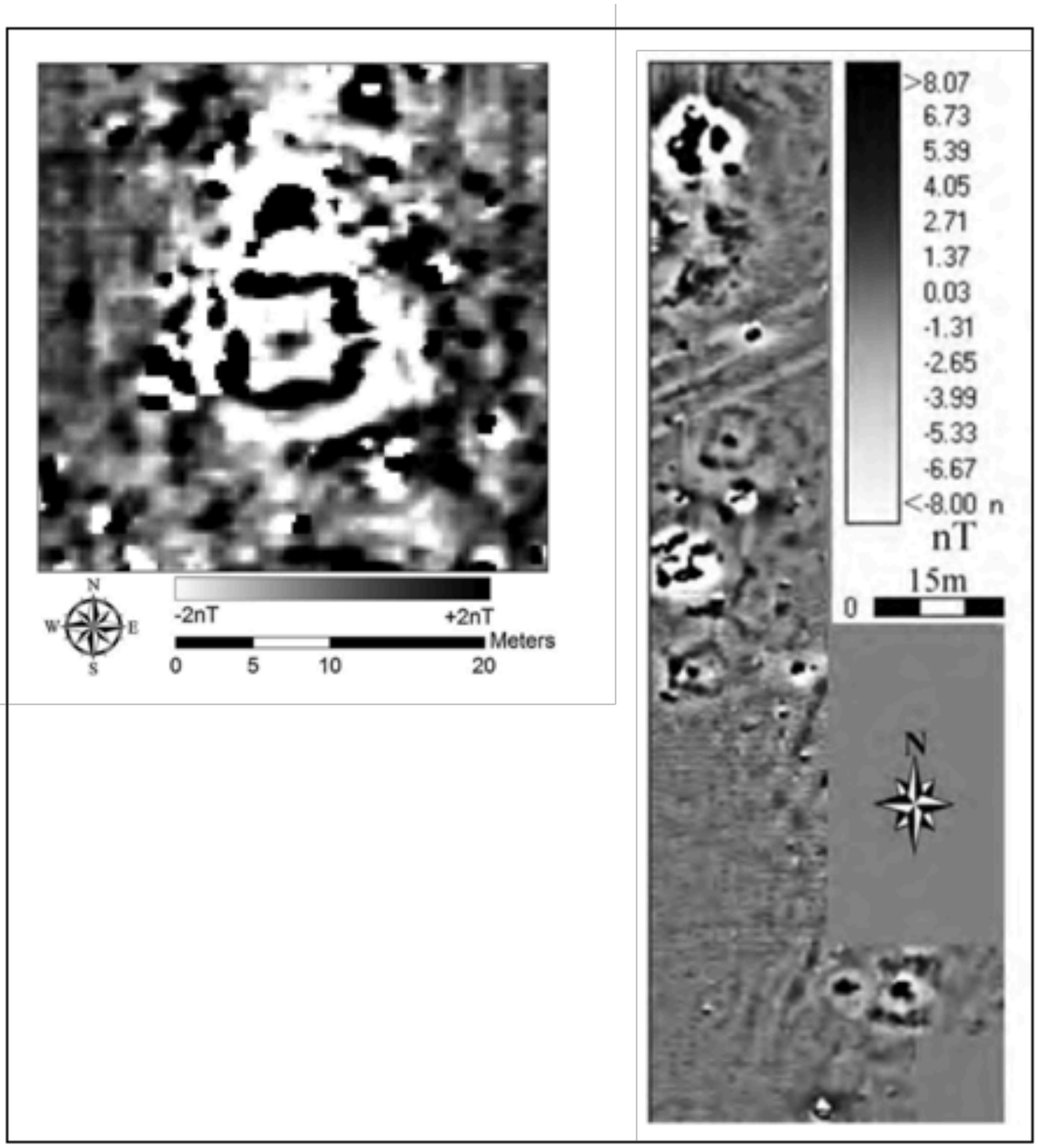

Figure 5.24 Gradiometer data of house anomaly at (left) the Hollywood Mounds site in Mississippi (Figure 7 from Haley 2014: Figure 7) and (right) the Tom Jones site in Arkansas (Lockhart 2010: Figure 8).

The areas of interest include dipolar anomalies that could be representative of metal, while mixed signatures might be associated with the mixed soil that results from backfill. According to comparisons with the WPA site plan map, the burial area is located in the southern portion of the survey area. This potential location of the burial area is characterized by the presence of small dipolar and monopolar anomalies scattered throughout the area in a faintly visible circular pattern. The mix of positive and negative signatures in the burial mound area are most likely the result of the WPA backfilling the area. Just west of the burial area is the potential location of Test Unit 1, which contained a square, 4-post house with an extended entryway to the northeast. There does seem to be a low-magnetism signature that is square shaped in this area, which could be the indicative of the test unit boundary. Otherwise, there is nothing indicative of any cultural features present in this area.

Based on the general locations of the maps, it seems that Anomaly 1 is associated with the WPA's Test Area 3. This was the only test area that did not reveal a house feature. While the exact location of the unit cannot be pinpointed, the high magnetic anomaly in the area suggest that there was some type of disturbance in the area. There are also strong dipolar anomalies in the area, which could be metal objects left from the WPA work. The U-Shaped Anomaly is located between Test Unit 3 and Test Unit 5, which suggests that is area of high magnetism might be associated with excavation and backfill activities. The location of Test Unit 5 is just north of the U-Shaped Anomaly. Test Unit 5 contained a rectangular house with two center posts and an extended entryway oriented to the northeast. The data associated with this area suggests the soil is disturbed, with relatively low positive and negative signatures scattered throughout the area.

Test Unit 4 is the eastern-most test area excavated by the WPA. This test unit contained the four-post square house without an extended entryway that was oriented in the cardinal directions. The survey area of that general location is devoid of any anomalies of interest, with the exception of one dipole consistent with metal and a more subtle dipole that could be indicative of either metal or a hearth. Test Unit 7 is located northeast of the mounded area and contained two superimposed house structures, both of which were square with four center posts and extended entryways oriented to the southeast. There are two strong dipolar anomalies in this area, which are consistent with historic metal. To the east of this area, there is a subtle square-shaped anomaly that could be indicative of either a previously unknown house or is the remnants of one of the houses excavated from this area. Ground-truthing will need to occur to determine this anomaly's identity. Test Unit 6, which was located southwest of the mound consisted of two houses, which were both square in shape and had four center posts and extended entryways oriented to the southeast. Much like the other house areas, there is not much to see in this data. There is a positive anomaly in the southwest portion of the area as well as two clear dipoles in the east portion. These are most likely associated with the excavation process.

As previously discussed, survey of the mounded area at the site revealed linear anomalies that might be representations of excavation trenches along with a semi-circular anomaly that aligns with the current mound remnants present at the site. The linear anomalies could also be the result of natural processes, but the regular linear patterning suggest that they might be man-made. After analyzing some of the WPA photographs of the mound excavation process, it appears that survey stakes were left in the ground and the crew dug around them, leaving rows of intact deposits (Figure 5.26). This might be able to account for the linear shape of these potential excavation-related anomalies. If these linear anomalies are associated with the excavation of the mound, then most likely the WPA excavated the whole mound and the current mounded area is WPA backfill. If this is the case, then Trench 23 was likely the last trench the WPA excavated before they filled it back in.

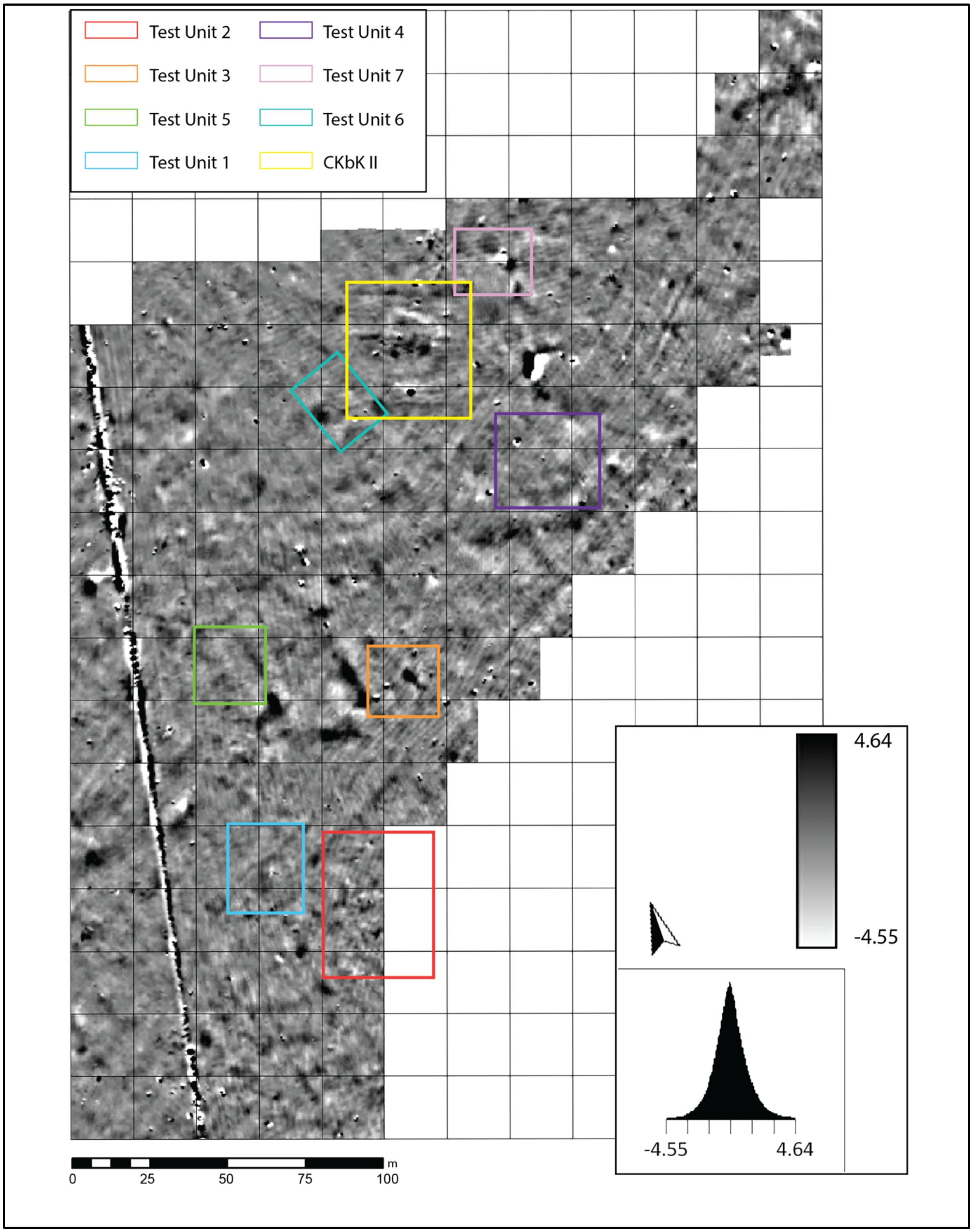

Figure 5.25 Estimated WPA excavated areas based on map overlays. Areas are overestimated to take into account discrepancies between the scale of the two maps.

Figure 5.26 WPA photo of the mound excavation showing the in-place stakes. Note the southern slope of the mound to the far left. Courtesy of the Same Noble Museum of Natural History, WPA Files.

Even though the locations of the WPA excavations are not completely accurate, it was the best that could be done with the little reference material provided. Identifying potential locations for the houses could give some indication of the location of activity areas throughout the site. Exterior hearths and pit features are a common occurrence at pre-Contact archaeological sites and are associated with long-term occupations. The presence of anomalies consistent with these features throughout the site, both near house locations and further away, supports that the site was continually lived at during its 200-year occupation (Kusnierz 2016). This information can be used to continue the discussion of Brackett's relationship with other mound sites within the Spiro Region.

Brackett in Context

The results presented in this chapter do not reveal any anomalies that we can confidently identify as consistent with known cultural features associated with the Arkansas River Valley. While there is only one anomaly (Anomaly 6) that has potential to be associated with a house structure in this data, that does not mean that there are not more houses present at the site. There were also a minimal number of small anomalies throughout the survey area that are consistent with pits (monopolar anomalies) or external hearths (dipolar anomalies) (Burks 2013). These types of anomalies would have been expected, especially for a site with even a small number of permanent occupants. However, it is necessary to note that these anomalies could also be associated with historic activities at the site, especially the stronger dipolar anomalies. Rogers' (1995:86) exploration of site organization during the Harlan phase revealed that there were only a few houses in his sample of 41 sites that were associated with external hearths or storage pits. However, his data set did not include Brackett, Hughes, and Reed. There has been evidence from other mound sites in the region where activity areas occurred around the houses; for example, at the Hughes site there is a burial area located just north of one of the houses (Regnier et al 2019:156) and at least two houses at Reed have pits located outside of house walls (Dr. Scott Hammerstedt, personal communication 2020).

Compared to other mound sites in the Spiro Region, it seems that Brackett has a similar number of structures with seven known house-like structures at the site. The two multi-mound ceremonial centers that are located roughly 30 km from Brackett are the Norman and Harlan sites. Both sites had seven houses. Regnier et al. (2019: 321) defined special purpose buildings to be either within the mound or non-mound buildings with extended entryways, no internal features, and not used after AD 1450. Since the WPA did not excavate a building within the mound, any special purpose buildings at Brackett are identified by the latter criteria. There were four residential structures identified at Harlan and three that were considered by Regnier et al. (2019) to be special purpose. The structure that was not identified as special purpose was oriented to the west, while the others were either to the northeast or southeast. Two structures were located within the mound, with a special purpose one orientated to the southwest and a non-special purpose structure oriented in a semi-cardinal direction (Regnier et al. 2019). The sub-mound structure at Harlan was a special purpose house oriented to the southeast. The west-facing non-special purpose structure at Harlan is similar to the non-special purpose structure at Brackett, which was oriented to the cardinal directions. At Norman, there were three structures not directly associated with any of the three mounds, one within Mound I, two within Mound III, and one sub-mound structure associated with Mound III (Regnier et al. 2019). Those within Mound III were oriented to cardinal/ semi-cardinal directions. The sub-mound structure was oriented to the southwest. At Harlan, there was one sub-mound structure, two within the mound, and four considered residential (Regnier et al. 2019: 318). At Brackett, five of the structures are near the mound while the other two are in what has been considered a residential area (Kusnierz 2016). This number of structures is significantly smaller than the multi-mound site of Reed, which had at least 26 known houses, 22 of them considered residential (Regnier et al. 2019).

The structure at Brackett that was interpreted as a Harlan-style charnel house is located west of the burial area and oriented to the northeast. This is unusual, as Kay and Sabo (2006) described that Harlan-style charnel houses were generally oriented to the southwest. For example, at Harlan, where one of the houses within Mound IV is oriented to the southwest. The location of the potential charnel house at Brackett is on the southern half of the site, while the charnel house at Harlan is located on the site's the northern half. The possible charnel house at

Brackett is oriented to the east towards Baron Fork Creek, like all of the other structures at Brackett. The east-southeast orientation, which is also present among structures at Harlan, Hughes, and Lillie Creek, could be an association with spring and autumn moonrises. (Hammerstedt and Savage 2016).

Hughes is one of the single mound sites that was contemporaneous with Brackett, located around 40 km to the west. The WPA excavated 10 houses near the mound, while another six were located further away in what has been termed a residential area (Regnier et al. 2019:312). Of the houses located near the mound, they were all considered to have no special purposes and were oriented in either cardinal or semi-cardinal directions (Regnier et al. 2019:312). At Hughes, the near-mound houses were located north of the mound, while the residential houses are south and northwest of the mound. The near-mound houses also had burials near the houses themselves (Regnier et al. 2019:156). At Norman, the houses near Mound III were located south of the mound area. At Harlan, the substructure mounds are located north and southeast of the platform mound. The organization at both Harlan and Norman consists of mounds surrounding a plaza-like area. The burial mounds are located in the east portion of both of these sites. The burial area at Hughes is north of the mound area, while the burial area at Brackett located south-southeast of the platform mound.

Kusnierz (2016) hypothesized that the burial area at Brackett was a plowed down mound. This was hypothesis was also recently applied to the burial area at the Hughes site by Regnier et al. (2019). If this were the case, then that some of the supposed single mound sites may actually have been multi-mounded sites, consisting of a platform mound, a burial mound, and houses. However, the data collected for this project did not identify any anomalies that could be associated with a plowed mound at Brackett. If there were no mounds associated with the burials at Hughes and Brackett, then the occupants might have dealt with their dead in a manner separate from how they are treated at other mound sites in the region.

One site of interest to compare to Brackett and these other mound sites is the non-mound School Land I/II Site. This site consists of eight structures that were square or rectangular in shape with 2 or 4 central posts (Duffield 1969). Five of these had entryways facing the village center. Unfortunately, such like other sites in the region, School Land has been inundated and we are no longer able to conduct any field work at the site. There are three structures without extended entryways located in the southwest corner of the site. Four of these were oriented to the southeast, two are generally to the south-southwest, and one is oriented to the north. While it is tempting to say that orientation plays an important role here, it is necessary to note that the outer structures are oriented towards the north-facing structure located in the center of the plaza.

After a brief exploration of mound sites near Brackett, it would seem that there is not a universal layout of sites. However, there are similarities that can be further discussed. In the region, there are four types of mounds that have been defined: platforms, burial mounds, buried structures, and multi-lobed (Bell 1972; Brown 1996; Brown et al 1978). Early (1982) then defined two types of mound sites in the region, which are 1) low clusters with buried structure mounds and 2) mound centers with platforms. Brackett falls into the latter site type, as does Hughes. Harlan can be included in the former site type that consists of buried structure mounds. Norman and Reed include aspects of both of these categories, with both platform and multi-lobed burial mounds present. Wyckoff and Baugh (1980) categorized site types based on historic Caddo Hasinai villages: single farmsteads, hamlets with 2-3 houses, and villages of greater than four houses.

Site organization has been argued to be a representation of identity (Rogers 1995; Pauketat 2007). It is plausible that populations within the same community would have similar communal identity represented by their respective occupied areas. The presence of similar architectural features, colors, and motifs suggests that there was at least some shared identity within the Arkansas River drainage (Regnier et al. 2019). With this in mind, it would make sense that mound sites are located on the periphery of village communities, as depicted on the Terán Map, because they represented a shared ritual practice. In other words, the mound site itself is accessible to multiple communities (Sabo 1998).

How does this add to our current understanding of Brackett as a village of ritual specialists? As already discussed, the number of houses present at Brackett is similar to other nearby mound sites. The site is organized with the houses and mound in a semi-circular formation facing east towards Baron Fork Creek. The two southern-most houses (House 1 and House 3) have extended entryways facing the northeast, while the northern-most houses with extended entryways face the southeast (with the exception of 5A). This formation is similar to that of School Land I where all of the houses face a plaza-like area. Norman also is also organized in a slightly semi-circular formation. The lack of cultural features within Brackett's semi-circular formation makes it tempting to say that there is also a plaza-like area present at the site, similar to many of the other mound sites. It also suggests that any ritual activities that brought people within the community to the site did not frequently occur, as there are no anomalies that suggest large groups of people stayed at the site for an extended period of time. With this in mind, it should not be assumed that rituals within the Arkansas River Valley were intended to bring large crowds together in the first place. As Vogel (2005:95) showed in his analysis of site viewsheds within the Ozarks, Brackett has very low viewshed ranks. This means that it was not meant to be seen by many people. Taking this information along with the geophysical data collected for this survey, it suggests that rituals occurring at Brackett were either performed without large audiences or groups of people visited the site to partake in ritual activity but did not stay for an extended period of time. Either way, the site was probably used exclusively for ritual activities by the local community.

Chapter Six: Conclusions and Future Work

This project consisted of a multi-sensor geophysical survey conducted at the Brackett site (34CK43) in eastern Oklahoma. The site is a Spiroan single mound site that was excavated by the WPA during 1939-1940. In addition to revealing that the mound was originally a platform, these excavations resulted in the discovery of seven house structures and a burial area present at the site. While this site is not the only one of its kind in eastern Oklahoma, it is one of the few that is not inundated or destroyed by residential activities. The questions proposed for this research were: 1) Can a geophysical survey successfully be conducted at the Brackett site? 2) Does a geophysical survey of the site reveal the presence of previously unknown features? If so, what might they be? 3) Does the use of a geophysical survey affect our understanding of the role that Brackett has within the Spiro Region? The following sections examine and attempt to answer these questions. Lastly, a description of future work will be provided.

Conclusions

Project Summary

This project was the first geophysical survey conducted at Brackett. The technology used included magnetometry, electrical resistance, and ground-penetrating radar. Magnetometry was used to survey the whole site, while the other two were used on targeted areas based on the magnetic data. The survey covered 4.48 hectares of the site closest to the mounded area. Since the site was excavated by the WPA, many of the resulting anomalies are interpreted to be associated with WPA activity. Anomalies of interest include a u-shaped anomaly, linear anomalies associated with the mound area, a semi-circular anomaly within the mound area that might represent the mound footprint, an unknown anomaly that could represent a Spiroan feature, and a square anomaly that looks similar to house anomalies found at other Mississippian period sites. There are also a small number of anomalies that could be associated with pre-contact occupation, including pits and external hearths. This data was then used in a discussion about the WPA activities at Brackett and how these results can be incorporated into the narrative of Brackett and its role within the Spiro Region.

Can a geophysical survey successfully be conducted at the Brackett site?

The Brackett Site is located at the confluence of the Illinois River and Baron Fork Creek, with a local geology that consists of loamy alluvial deposits associated with stream terraces. The site itself has little topographic variation, which made surveying the site simple. The only obstacles were hay bales, which were moveable, a fence, and the tree line. The survey focused on the area that was excavated by the WPA, which coincided with the area around the mound remnant. The only shortcoming of this survey was that the project was pushed back a month later than intended due to severe flooding in the region. This resulted in tall grass that hindered our ability to use the electrical resistance meter in every area of interest. In total, 115 gradiometer grids, 10 electrical resistance grids, and four GPR grids were collected for this project. Once the data was processed, anomalies of interest were clearly present (see next section). This data came out relatively clean and it seems that there were no significant discrepancies, such as too much historic metal that affect the rest of the data. Despite the postponement of the project, a geophysical survey was successfully conducted at the Brackett Site. This is encouraging for future work that might occur at the site.

Does a geophysical survey of the site reveal the presence of previously unknown features?

There were multiple anomalies of interest identified in this survey. One is a U-shaped anomaly that was argued to be associated with WPA backfill activities. Another group of anomalies were located around the excavated mound area. These linear anomalies also seem to be associated with WPA excavation activities. There is a semi-circular anomaly in this area that could be indicative of the footprint of the remnant mound, as the eastern edge of the mound perfectly matches the anomaly's shape. GPR data indicates that there is a boundary present about 50-100 cmbs in the mound area that could be associated with a change in the soil matrix. GPR data also confirms the presence of the mound footprint. After overlaying maps of the WPA's excavated Test Units, it came to light that an anomaly that is the correct size of the house (Anomaly 1) is located in the same area as the WPA Test Unit 3, which did not contain any cultural materials. This association suggests that the anomaly is also of WPA origin. There are also historic metal debris scattered throughout the site, such as the remnants of a fence in the western portion of the survey area.

Due to the nature of geophysical surveys, the anomalies consistent with the pre-Contact occupation of the site are not identified with confidence. Based on its size and magnetic signature, Anomaly 2 has the potential to be a Spiroan feature. However, it should be ground-truthed because the electrical resistance data did not identify any corresponding anomalies. There were a handful of anomalies consistent with pit features and external hearths throughout the site too. However, these also need to be ground-truthed because the signatures are also similar to those associated with historic debris. One anomaly, Anomaly 6, shows potential to be indicative of a house structure. This low-magnetic anomaly is square in shape and is similar to house anomalies identified at other Mississippian period mound sites. There even seems to be an extended entryway oriented to the southeast. However, the WPA excavated areas suggest that Test Unit 7 was located in the general vicinity to this anomaly. There is a possibility that this anomaly is representative of the remains of House 5, which was also square in shape with a southeast-facing entryway.

To answer the question posed: maybe. The lack of cultural features is not surprising considering how systematic the WPA crews were in their excavations (Regnier et al. 2019). Without ground-truthing it is difficult to claim that any of the anomalies found in the survey data are of cultural origin. If anything, this survey clearly shows that there have been some human activities occurring at the site. There are some anomalies that could be possible exterior pits and hearths throughout the site, but not enough to support the notion of a large population continually living at the site.

Does the use of a geophysical survey affect our understanding of the role that Brackett has within the Spiro Region?

Brackett was initially thought to be a permanently occupied village site within the Spiro Region (Bareis 1955a, b; Brown et al. 1978). Kusnierz (2016) recently argued that Brackett was occupied by a small group of ritual specialists. However, she was unable to confirm whether the site was a permanently occupied village. This survey did not confirm the presence of additional house structures at the site, and there are only a handful of anomalies that I am able to confidently identify as consistent with long-term occupational features. Until more of the site is surveyed, this interpretation holds. By using geophysical data to confirm the architectural features present at the site, we are able to make more inferences about Brackett's role within the Spiro Region. Following Kusnierz' (2016) exploration of the relationship between site organization and leadership, I went a little broader and looked at the relationship between site organization and community.

Regnier et al. (2019) provides updated information about the mound sites in the Arkansas River Valley in eastern Oklahoma. I was able to use this new information to compare Brackett to these other sites, specifically Hughes, Norman, Harlan, and Reed. I also included the nearby

School Land I non-mound site in this brief comparison. While there is not a clearly defined site organization, there are similarities between these sites. Based on the WPA excavations and the results of this geophysical survey, Brackett has a similar number of houses as other mound sites, such as Norman and Harlan. With the exception of one anomaly, the geophysical data from this project suggests that there are not any other house structures in the survey area. If the structure-like anomaly is proved to be a buried structure in the future, it would make the total structures at Brackett eight. This is still not too different from other sites in the region.

The orientations of the structures at Brackett were generally to the east. Specifically, the structures at the southern end of the site were oriented to the northeast, while the sites on the northern portion of the site closest to the mound were facing the southeast. The presence of southeast-oriented structures at Brackett is not surprising, as other Harlan Phase sites have similar orientations, such as the nearby mound sites of Harlan and Reed. Hughes had one special purpose structure and it was oriented to the southeast. As suggested by Hammerstedt and Savage (2016), the structures facing northeast could be associated with the winter full moonrise, while the southeast-oriented structures might be tied to the summer full moonrise. These moonrise orientations could be indicative of rituals revolving around the lunar cycle occurring at Brackett.

Yeager and Canuto (2000) describe different views of community, two of which are ideational and interactional. The former focuses on how people perceive themselves and their places within a community, while the latter looks at the creation of communities through the relationship of both individuals and larger social groups. If communities are understood as materialization of people's thoughts, then a community of ritual specialists could be reflections of ritual practices. The similarities between Brackett and other sites could be indicative of a community of ritual specialists, or at least reflect a shared ritual system as suggested by Regnier et al. (2019). These mound sites are argued to be symbols of this shared religious practices on the landscape (Regnier et al. 2019:327).

The geophysical data does not indicate any significant features present in the eastern half of the site closest to Baron Fork Creek. The houses, mound, and burial area seem to surround this area in a roughly semi-circular shape. This is similar to the organization of School Land I and Norman. While we cannot be certain that this area is a plaza, it seems to have been a communal area for the site's occupants. As previously mentioned, there are only a small number of possible cultural features associated with long-term occupation. By looking at site-wide geophysical data, there are new insights relating to Brackett and its purpose within the Spiro Region. The small number of dispersed pits and hearths were missed by the WPA because they only targeted structures and the mound in their excavations. The lack of features directly associated with these structures is similar to Roger's (1995) explanation that only a small number of houses in the Spiro region did not have external features associated with them (see Chapter 5).

Any ritual activities that brought people within the community to the site did not frequently occur, as there are no anomalies that suggest large groups of people stayed at the site for an extended period of time. The presence of long-term usage of a site can be seen the repetition of architectural features in the same area, a concept Crook (1984) described as microstructures. If a site is consistently occupied by generations of people, its longevity would be visible in the architecture. The lack of evidence of rebuilt structures at Brackett from the WPA excavations and the lack of external domestic features at Brackett support the idea that not many people consistently occupied Brackett at one time.

Since Brackett has a low viewshed (Vogel 2005) and the geophysical data does not support that larger gatherings occurred at the site, Brackett was most likely a space for restricted ritual activity. If these ritual activities are associated with summer and winter moonrises, then they might only occur a couple times during the year. The combination of infrequent communal rituals, lack of evidence of long-term occupation, and a small viewshed suggest that activity at Brackett were performed with small audiences, if any. This is further supported by Kusnierz's (2016) conclusion that Brackett was occupied by a small population of ritual specialists. Regnier et al. (2019:324) argued that this model can be applied to other mound sites in the Arkansas River drainage wherein residents of Spiroan mound sites were small groups of ritual specialists and their immediate kin, while the sites themselves were centralized activity areas for gathering ritual activities. While not many people might have been living at Brackett full-time, that does not mean that larger groups people were not involved in some of the rituals occurring at the site.

As argued by Kay et al. (1989), the presence of berms around mounds at Caddo sites might be indicative of maintenance of sacred space. The presence of features with this purpose could be an example of intentional separation of ritual space from secular space within the Caddo region. The lack of features that can be used to separate spaces, such as berms or fences around the mound area, at Brackett supports the idea that the whole site might have been used for mostly ritual purposes. Or at least, the activities occurring on and around the mound were not intentionally hidden from view from the site's occupants.

Future Research

One important aspect of conducting geophysical surveys at an archaeological site is ground truthing, which was outside of the scope of this project. Continued work at the Brackett site should include ground truthing some of the anomalies found as part of this project. Specifically, the subtle house-like anomaly (Anomaly 6), the monopolar anomaly west of the

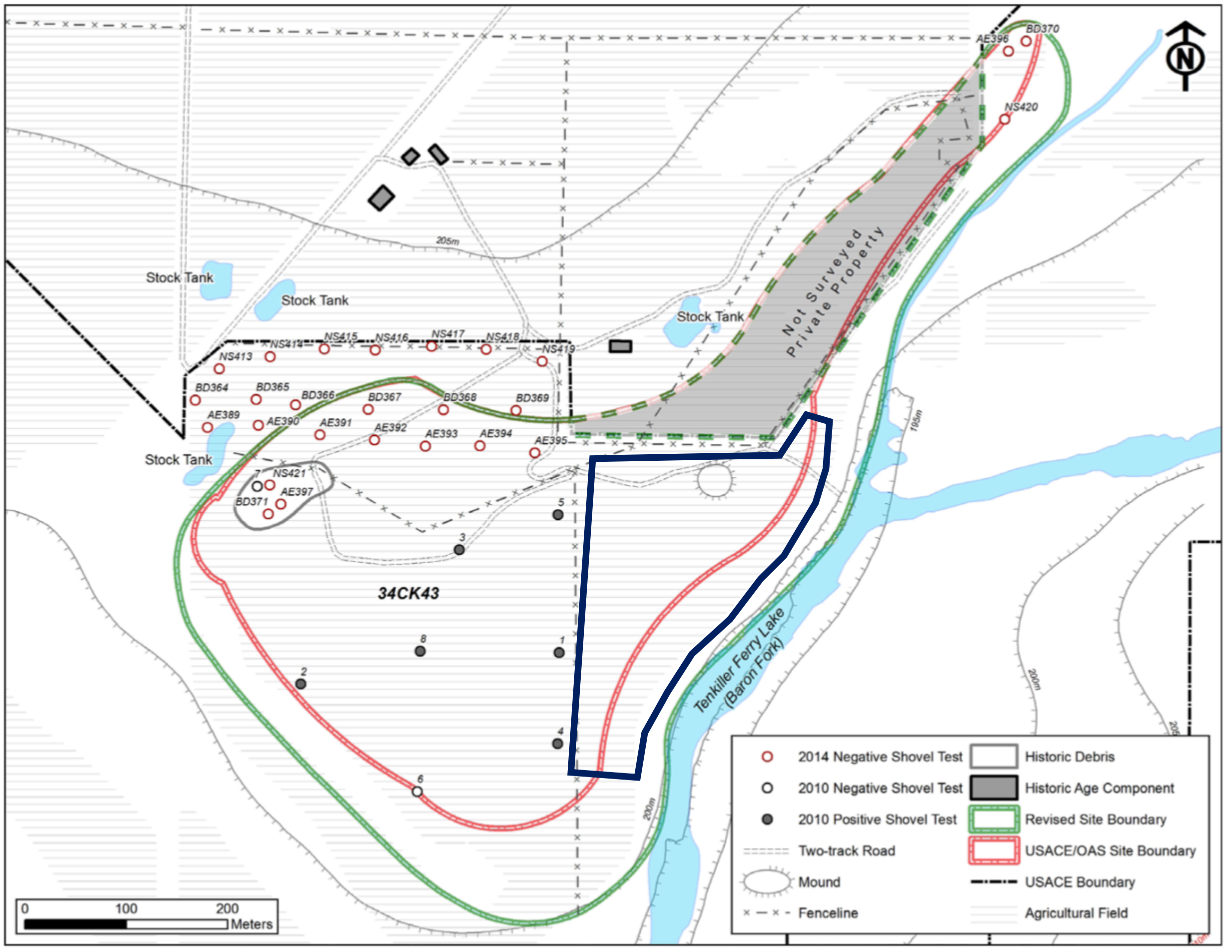

Figure 6.1 Shovel test results showing positive tests west of the fence line (Bonnie 2015:Figure 4-49). Dark blue line (added by me) indicates general location of the surveyed area for this project.

fence line (Anomaly 2) and the u-shaped anomaly discussed in Chapter 5. Since this project focused on the area excavated by the WPA, conducting another geophysical survey to the west and the north of the now previously surveyed area would be useful for getting a better understanding of Brackett's organization. The presence of a potentially previously unknown house suggests that the site consisted of more than the seven WPA-excavated structures. Positive shovel testing in the western portion of the site from previous investigations at this site further support the idea that the site extends further away from the mounded area. The preliminary comparison of Brackett's organization with contemporary mound sites nearby suggest that there is some relationship between the occupants of the sites. I suggest research to further explore site organization and creating a model for site layouts. The site organization of non-mounded sites should also be explored to see what types of relationship existed between the ritual specialists at these mound sites and others within the Spiro Region.

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Appendix A

The following images are the original maps overlaid on the geophysical data used to create Figures 5.5 and 5.25. The maps were scaled to size and their placement over the data was estimated based on the locations of the WPA excavation remnants of the mounded area. Since the WPA did not provide clear references, these locations are not the exact locations of the WPA excavation units. Figure A.1 is the Brackett site map from Regnier et al. (2019:Figure 5.2) overlaid on the gradiometer data collected for this project. Figure A.2 is the original WPA site plan map overlaid on the gradiometer data (map courtesy of the Sam Noble Museum of Natural History).

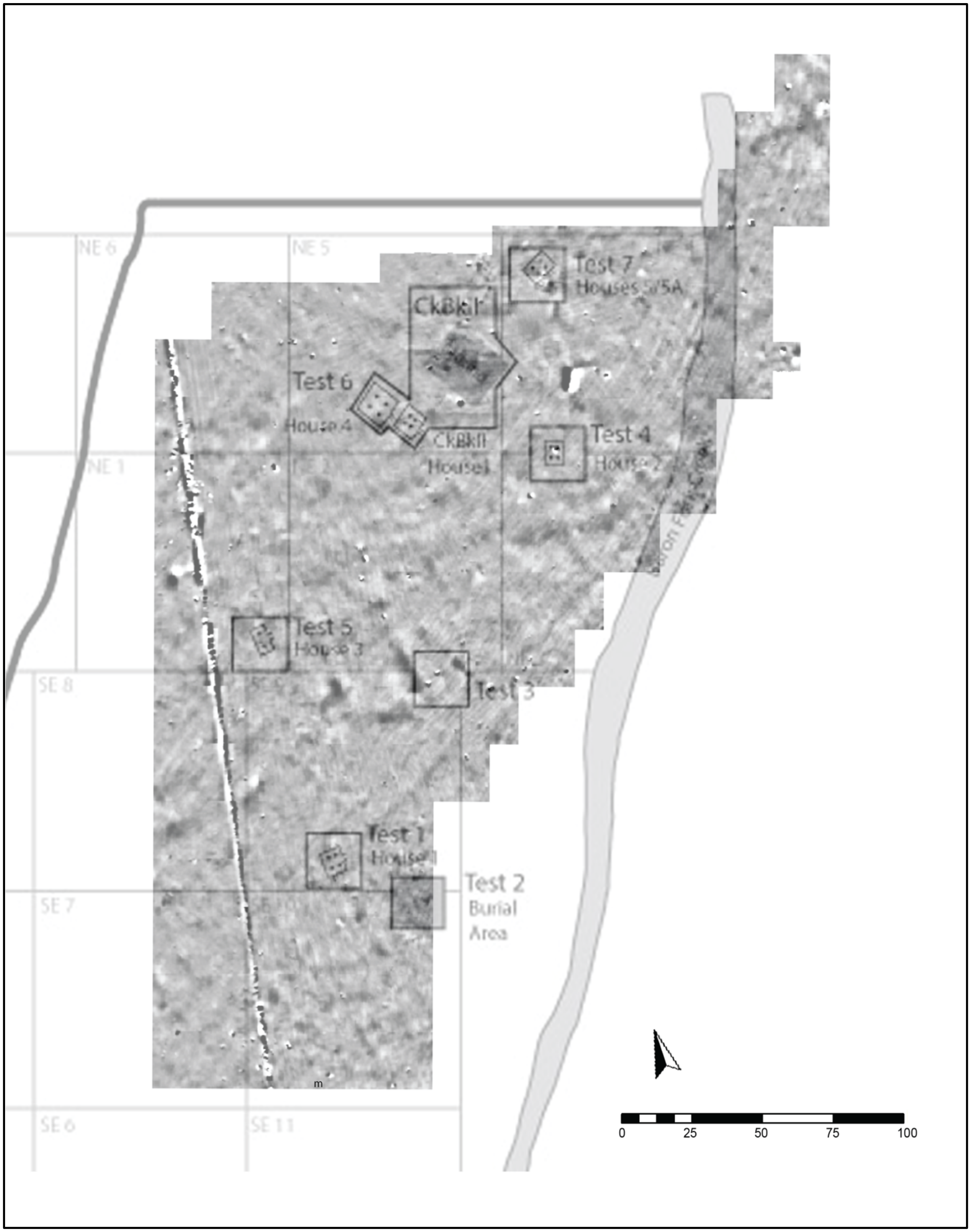

Figure A.1 Map overlay used to create Map A from Figure 5.5

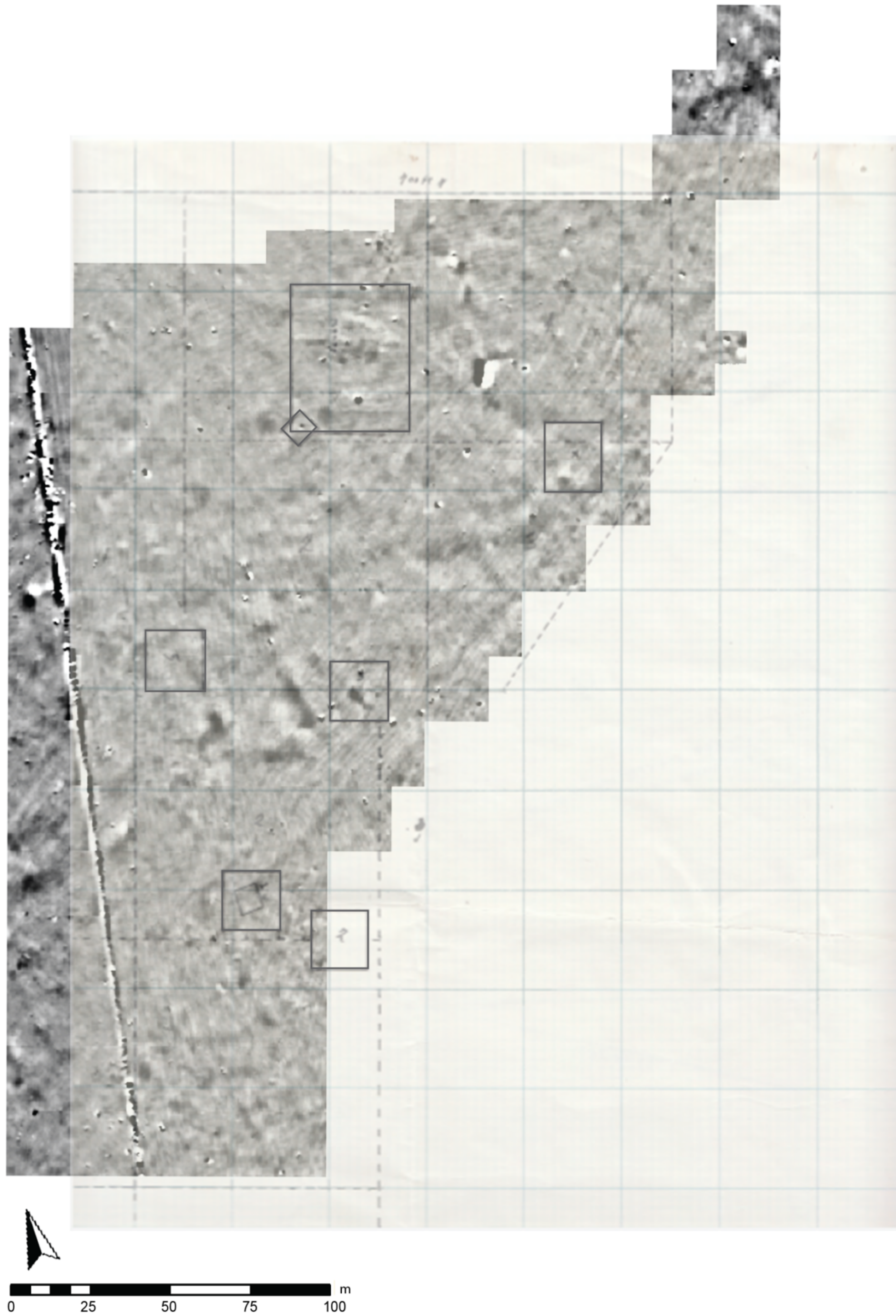

Figure A.2 Map overlay used to create Map B from Figure 5.5