12-2013

Archaeological Geophysics, Excavation, and Ethnographic Approaches Toward a Deeper Understanding of an Eighteenth Century Wichita Site

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Archaeological Geophysics, Excavation, and Ethnographic Approaches Toward a Deeper Understanding of an Eighteenth Century Wichita Site
Archaeological Geophysics, Excavation, and Ethnographic Approaches Toward a Deeper Understanding of an Eighteenth Century Wichita Site

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Anthropology

by

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University of Oklahoma
Bachelor of Arts in Anthropology, 2011

December 2013
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This thesis is approved for recommendation to the Graduate Council.

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Abstract

This research exemplifies a multidirectional approach to an archaeological interpretation of an eighteenth century Wichita village and fortification located on the Red River bordering Oklahoma and Texas. A battle that is believed to have occurred at the Longest site (34JF1) in 1759 between Spanish colonials and a confederation of Native Americans led to several Spanish primary documents describing the people that lived there, the fortification and surrounding village, and of course the battle itself. Investigation of the Longest site (34JF1) in Oklahoma presents a remarkable opportunity to combine extensive historical research, archaeological prospecting using geophysics, and traditional excavation techniques in order to gain a more complete understanding of this important archaeological site. The fortification at the Longest site, as well as possible associated structures and cultural features, were relocated using magnetometry, ground-penetrating radar, and electrical resistivity methods. Then, previously translated historical documents provided valuable insights in the interpretation of the geophysical data. Finally, archaeological excavation permitted validation of the interpretations and identification of features described in the historical accounts. As interpreted in the geophysical data and excavations, the construction of the fortification and associated interior subterranean rooms suggests that it is indeed the fortification involved in the altercation between the Taovayas and the Spanish in 1759.
Acknowledgements

The completion of this thesis would not have been possible without the help of many people from both the University of Arkansas and the University of Oklahoma. While this list is by no means exhaustive, I would like to express my gratitude to everyone who helped me achieve this milestone. My graduate thesis director, Dr. Kenneth L. Kvamme offered me a clear understanding of directions in which I wanted to take my research, all the while allowing me the freedom to explore my ideas on my own. His level of understanding of geophysical method and theory remains a benchmark for my own future education. Dr. Jami J. Lockhart provided technological assistance when I had no other options, a patient ear and valuable advice when I needed it. Dr. George Sabo, III was an invaluable support during the historical research phase of this thesis. The Center for Advanced Spatial Technologies (CAST) at the University of Arkansas provided equipment throughout a vast majority of this project, without which, none of it would have been possible.

I cannot express the level of support I received from Dr. Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma. He made himself and his resources available to me day, night, and weekends from beginning to end, and was most often in the field with me. Meanwhile, Dr. Susan Vehik provided council and clarity when I needed it most. The Oklahoma Archaeological Survey offered equipment throughout the project, and thank you to the Oklahoma Archaeological Society volunteers for assisting during excavation. Finally, my heartfelt gratitude goes out to all of my friends and colleagues that gave up their time to 1) listen to me drone on about my research for way too long, and 2) assist me in the field while collecting data. Thank you Zack Starr, Matthew Griffin, Rachel Campbell, Truet Hinson, and Debra Taylor.

I also wish to thank Robin Longest for sharing his knowledge of the history of the farmstead, and Brenda Longest for allowing me to conduct this research on her property. I only hope that this thesis in some small way repays her for her gracious hospitality throughout the project.
# Table of Contents

**Chapter 1**

The Longest Site (34JF1) and the Taovayas ................................................. 1-7

- Research Purpose ................................................................................................. 2
- The Taovayas’ Southern Migration ......................................................................... 3
- New Problems for the Taovayas ........................................................................... 5

**Chapter 2**

Understanding Primary Sources ............................................................................. 8-17

- Reality Mediation .................................................................................................... 8
- Historical Accounts of the Taovayas Village ......................................................... 13

**Chapter 3**

Archaeological Investigation at the Longest Site ............................................... 18-40

- Previous Archaeological Research ........................................................................ 18
- Archaeological Geophysics: 2012-2013 Remote Sensing ....................................... 21
  - Airborne Remote Sensing .................................................................................... 22
  - Ground-Based Remote Sensing .......................................................................... 24
- Geophysical Methods ............................................................................................. 25
  - Magnetic Gradiometry ......................................................................................... 25
  - Electrical Resistivity ............................................................................................ 31
  - Ground-Penetrating Radar .................................................................................. 35
- Validation of Geophysical Results .......................................................................... 37

**Chapter 4: Historical Research, Geophysics, and Excavation Work Hand-in-Hand** 41-64

- Area 1: The Outer Fortification Trench and Other Anomalies ................................ 41
- Areas 2 and 3: Probable Subterranean Apartments ............................................... 49
- Area 4: Possible Corral or Large Protohistoric House ........................................... 51
- Area 5: Possible Hearth or Pit ............................................................................... 53
- Area 6: Small Circular Positive Anomaly ............................................................... 55
Area 7: Metal Debris.......................................................................................... 58
Area 8: Possible House Structure.................................................................... 59
Area 9: Linear Anomaly..................................................................................... 61
Area 10: Large Scatter of Metallic Debris......................................................... 62

Chapter 5: Conclusions and Future Research.................................................. 65-68
  Conclusions..................................................................................................... 65
  Future Research.............................................................................................. 67

Reference Cited.................................................................................................... 69-71

Appendix: Permissions for image usage............................................................ 72-75
Chapter 1: The Longest Site (34JF1) and the Taovayas

The Longest site (34JF1) is a fortified protohistoric Taovaya (Wichita) site located along the Red River on the private agricultural farmland of Kenneth and Brenda Longest in Jefferson County, Oklahoma. It is on a portion of the river that flows north to south after a large bend that diverts it from its typical course of west to east (Figure 1). Situated on the edge of a high, sloping ridge approximately 20 m above and 100 m east of the current Oklahoma bank of the Red River, the Longest site is in a strategically formidable position in terms of trade and for defense against enemies from the Texas side of the river.


The Longest Site (34JF1) was named San Bernardo by Athanase de Mézières in 1778 (Bolton 1914b:205-206), was included by that name on the National Register of Historic Places in 1982, and “remains an important location in Wichita history. It is significant for its historical information on Wichita relations with the French and Spanish colonies and as a native trade center for the area during the mid to late eighteenth and early nineteenth centuries.” [Drass 2007:10]
Its importance is augmented by historical accounts that describe site construction, the lives of its inhabitants, and the ways in which their relationship with Europeans changed over time.

Research Purpose

In the report from the only prior excavation there, Bell and Bastian state that the Longest site was likely a single occupation site (Bell and Bastian 1967:116) that was “flourishing between ... approximately A.D. 1750 to 1800” (Bell and Bastian 1967:114). They also suggested that the fortification was possibly representative of the one attacked by the Spanish Colonel Diego Ortiz Parrilla in 1759 (Bell and Bastian 1967:85). They go on to say that additional houses should be excavated in order to gain knowledge about their varying construction and to conduct settlement pattern investigation (Bell and Bastian 1967:114). Finally, they recommend that the fortification be excavated to “trace its size, nature and interior associated structures” (Bell and Bastian 1967:118). Indeed, they state that “excavations of the fortification ... [and] identification of interior subterranean structures would establish this identification [as the 1759 Taovayas fortification] beyond question” (Bell and Bastian 1967:114).

Rather than conduct a large-scale excavation toward these ends, the purpose of this research is to carry out a multidirectional approach to an archaeological investigation of the Longest site using geophysical techniques, inquiry into historical materials, and minimal hand excavation. The primary goal is to gather as much information from the site as possible with minimally invasive techniques. The fortification and proposed associated features should all be locatable using magnetometry, ground-penetrating radar, and electrical resistivity. Once a geophysical map is generated, previous archaeological records and historical information from several sources should inform interpretation of geophysical results. Lastly, minimal hand excavation of geophysical anomalies is expected to confirm their existence and facilitate identification.

Geophysical survey plays a very important role in noninvasive archaeology, in that most anthropogenic features exhibit physical or chemical contrasts to the surrounding soil in which they are contained and are often revealed in geophysical datasets. This research is meant to demonstrate methodology geared toward ethical exploration of archaeological sites by mitigating the destruction of
cultural heritage through the use of geophysical survey and historical research. In order to reach these goals, questions asked include:

1. Will geophysical survey be successful at 34JF1? If so, which methods are successful and to what degree?

2. Do historic accounts of the Taovayas village facilitate both interpretation of the geophysical results and feature identification through minimal excavation?

3. Through this methodology, can the fortification at the Longest site be definitively identified, according to Bell and Bastian’s qualifications, as the Taovayas stronghold involved in the battle with the Spanish in 1759?

The Longest site represents shared history between the Wichita, Spanish, French, and English since just before the American Revolution. This is a decidedly rare cultural resource which should be carefully studied with every effort given to conserve it for the Wichita people, as well as for future archaeological study with ever-advancing noninvasive methods.

*The Taovayas’ Southern Migration*

The Taovayas people at the Longest site were a subdivision of the Wichita language speaking group (Vehik 1992:311). Vehik (1992:328) states their lineage as, “connected to the Paniouassa of 1719 to Coronado's Tabas, and ultimately to a group of Late Prehistoric period Great Bend aspect sites around Marion, Kansas.” Protohistoric groups, originally located farther north in the Arkansas River Valley, were pushed southward in part because of disease-driven population loss, constant conflict with the Osage, and the need for increased trade of firearms and goods with the French (DuVal 2006:109-117). The Wichita subgroups migrated separately throughout a span of 200 years, at times aggregating due to the diverse social pressures mentioned above, and finally culminating in large, often fortified villages (Wedel 1988:31-33). Since 34JF1 is considered to have had only a single occupational period (Bell and Bastian 1967:116) from the mid-1750s to the early-1800s, and we know that it was the Taovayas people inhabiting it, a broad discussion of the history of Wichita subgroups is outside the scope of this research, but these histories are available (Newcomb 1976; Smith 2008; Vehik 1992).
John (1975:339) states that when the Taovayas’ migration occurred, the okonitsa, a person whose job it was to find a suitable location for their new village, discovered this remarkable site on the Red River in the early to mid-1750s. Its location on the boundary of the Western Cross Timbers and the Broken Red Plains (Figure 2) provided fine agricultural land, natural springs, abundant bison, nearby salt banks and stone quarries, and access to both sides of the river (Bolton 1914b:201-202). In the middle of the eighteenth century, due to its proximity to the navigable Red River and abundant resource availability that facilitated the production of goods in surplus, the Taovayas village located at the Longest site became one of two Red River Wichita villages engaging in lucrative business with up to a dozen French traders (Gibson 1981:24). Indeed, during Athanase de Mézières’ visit in 1778 he deemed these Twin Villages the “master key to the north,” naming them San Theodoro near modern-day Spanish Fort, Texas and San Bernardo, located two km east across the river at the Longest site (Bolton 1914b:205-206).

New Problems for the Taovayas

Having left their northern villages for this new location on the Red River, the Taovayas began a chain reaction of events that led to conflict with the Spanish in 1759. Through migration, they had avoided immediate danger from the powerful Osage and drove the Lipan Apache, their enemies, southward into Texas (Weddle 2007:4). However, the Taovayas were now positioned between these two enemies, and the latter were soon petitioning Spanish forces for protection at the mission of San Sabá in Texas (Gibson 1981:25). Thus, we see a scorned Apache people at least feigning desire for Catholic conversion to facilitate Spanish protection, and the Spanish building the mission of San Sabá in response to them (Smith 2000:28; Weddle 2007:4). Meanwhile, the Taovayas had been trade partners with the Comanche, who shared their disdain for the Apache, since 1746 (Smith 2000:26), and this dynamic did not change once they moved to their new village (John 1975:339). This complex situation between Spanish/Apache and Taovaya/Comanche allied groups led to an attack on the mission of San Sabá in 1758 by the Norteños, a confederated group of Native Americans including the Taovayas and other Wichita peoples, Comanche, Hasinai, and Caddo (Bolton 1914a:49).

The Norteños were not pleased when the Spanish proceeded with construction of the San Sabá mission and protective presidio 3 miles (4.82 km) away, as it would offer protection for the Apache after they raided or attacked northern villages (Smith 2000:28). There was continued friction with the Spanish because of Apache intrusions and in 1758, the Norteños gathered an allied force of 2000 warriors intent on killing the Apaches inside San Sabá (John 1975:297-298). On March 16, 1758, ten people were killed during the attack at the mission of San Sabá, including two Spanish priests (Bell et al. 1974:292). Meanwhile, Colonel Parrilla and his 59 soldiers had no defensive options against the large Norteño force at the mission, so he elected to defend his nearby presidio and its approximately 300 inhabitants, which ultimately was not attacked (John 1975:297-298). Three months later, a punitive campaign against the Norteños was approved by a Spanish administrative council (Bell et al. 1974:292), but it would be 16 months before Parrilla would get his opportunity for revenge.

During this interim the Taovayas constructed a palisaded fortification, surrounded by a moat and enclosing four subterranean rooms, for defense of their village against Apache and Spanish retaliation.
Furthermore, they gathered allies (Smith 2000:32) and stockpiled weapons, ammunition, and horses (Weddle 2007:10). With defenses in place, all they had to do was wait for the Spanish to proceed, but emboldened, they continued raiding Parrilla’s presidio and mission of San Sabá for horses and cattle (Weddle 2007:8). Finally, in September of 1759, Colonel Diego Ortiz Parrilla, Captain Juan Ángel de Oyarzún, and approximately 600 soldiers, militia, and Native American allies headed north for the Taovayas village (Weddle 2007:9). Along the way, Oyarzún would document the campaign daily.

On October 2, almost a month after leaving San Sabá, the expedition attacked a Youjuanes (Tonkawan) village that Parrilla reported had been involved in the attacks on San Sabá (Bell et al. 1974:294). As proof of their involvement, Parrilla offered that a San Sabá priest’s vestments and horses with his own brand were at the village (Smith 2000:31). During the attack, 55 Youjuanes were killed and 149 captured by the Spaniards, while 100 horses from San Sabá were recovered (Weddle 2007:120). Parrilla could have stopped here, but decided to continue on, and some of the Youjuanes captives offered to guide the Spanish expedition to the Taovayas village (Smith 2000:31). Five days and 25 leagues (approximately 105 km) of marching later, the Norteños attacked.

Parrilla’s expedition saw 60 to 70 Norteños preparing to attack on the early afternoon of October 7, 1759, but as soon as the Spaniards began to resist, the Native Americans broke rank and fled through the woods (Weddle 2007:123). Parrilla’s men chased after them, and came out of the timber onto the sandy bank of the Red River, in plain view of the Taovayas fortification and the Norteños waiting for them to emerge (Bell et al. 1974:295). Many of the soldiers at the battle stated that there were up to 6,000 Norteño warriors, but Parrilla was careful to simply say in his official statement that there were more Norteños than he had in his party (Bell et al. 1974:296). During the battle, Oyarzún and Parrilla noted that across the river was, “at the short distance of a gunshot, a village consisting of tall oval-shaped huts enclosed by a stockade and moat, and that its entrance road is enclosed in the same manner. The road is winding, with its entrance toward the same river” (Weddle 2007:124). The battle lasted over four hours that day, with the Norteños exercising a well-designed battle plan in which cavalry would ride out and attack, then return toward the fortification and retrieve reloaded weapons from warriors on foot (John
Toward the end of the day’s battle, two Spanish cannons were placed where they would be most effective against their enemies, and were fired eleven times at the Taovayas fortification, cavalry, and infantry with no result but mockery by the Norteños (Weddle 124-125).

When it was apparent that the Norteños had the upper hand and were flanking Parrilla’s ranks, they broke and retreated, losing their two cannons along the way (Weddle 2007:125). That night, the Taovayas and their allies celebrated inside their fortification (John 1975:351) while Spanish captains offered 13 reasons to Parrilla for them to turn and go back to San Sabá. Some of their justifications were that the troops did not want to fight this enemy anymore and desertion had begun (Weddle 2007:128-129), that a “glorious feat has been performed” in finding and gaining intelligence about the enemy location (Weddle 2007:130), and lastly, that their troop would lose the battle if they stayed (Weddle 2007:131). Meanwhile, his scouts informed him that there was no way to effectively attack the Taovaya fortification and warned him of the continuous replenishment of Taovaya forces. Consequently, the next morning, Parrilla and his troops left for home.
Chapter 2: Understanding Primary Sources

*Reality Mediation*

Barber and Berdan (1998:30-31) write that, “The value of primary sources lies largely in their potential to provide factual (though, perforce, incomplete and selective) information on the past.” Indeed, primary sources are wonderful windows into actual occurrences in the past. However, here they note that there is “potential” for factual information, stressing that these sources are not all-inclusive snapshots of the past, but consist of only information that the author chose to include for one reason or another. To understand these documents, to get at what truth is presented by their authors, Barber and Berdan (1998) offer the *reality-mediation model*. They state that:

“The reality-mediation model offers a vision of the act of description, which it depicts as a complex interplay between the author and reality, not as a simple, almost mechanical, recording process ... they [historical documents] are reflections shaped by the authors’ experiences, convictions, and desires.” [Barber and Berdan 1998:33]

In effect, with their idea of reality-mediation, they provide researchers an analytical tool that takes into account the subjective nature of an author’s transcription of observed events into written documents, art, maps, oral stories…et cetera. Thus, rather than take every document as wholly factual, the researcher must attempt to understand it through the author’s eyes and to interpret what they wrote in light of their circumstances.

That being said, occasionally a document is perceived as false or incorrect through no fault of the author, indeed, it may not be untrue in any sense. At times, scholars misinterpret meaning or context in original documentation and report it incorrectly. This is evident when reviewing some maps pertaining to the Longest site. For quite some time, the Taovayas fortification was thought to be located on the Texas side of the Red River, so it would make sense that it would be symbolized there on some older maps such as Fanita Lanier’s stylized map from 1935 (Figure 3). Here, the fortification is shown with the Red River behind it as the Spanish attack from the south.

However, accounts from Antonio Treviño (Treviño, Antonio. 1765:106. Interrogation. (Translation) Box 2C21, Vol. 42. Pp. 81-113. Bexar Archives, University of Texas, Austin) and Juan Angel de Oyarzún...
place the village and fortification on the Oklahoma side of the river, commonly referred to as the north bank. This has most likely been misconstrued as meaning that one would look north across the river to see the fortification. For example, the artist’s rendition in Figure 4 (Duffield 1965:42) has rendered an improper representation of the fortification in relation to its position on the landscape, as seen by the placement of the north arrow which, if the north to south orientation of the river is taken into account (see Figure 2), is actually pointing east. This causes problems with reconciliation of the geophysical dataset and historic descriptions of features such as a secondary entrance on the east side of the fort described by Oyarzún (Lipscomb 2002:108). The soldiers’ position, described as across from the fortification on “high river bluffs” (Weddle 2007:128), now believed to be 20 m below and 100 m directly west, should not have been able to see the east side of the fort, let alone describe its entrance.

Figure 3. Stylized map of pre-1865 Northern Spanish Texas (Lanier 1935). Image used with permission from The Texas Map Collection (CN06085), The Dolph Briscoe Center for American History, University of Texas at Austin (See Appendix). Source: Carlock, Michael. Personal photo. February, 2013.
Figure 4. Artist's rendition of 34JF1 as Parrilla and Oyarzún may have observed it, including its fortification, the Comanche camp, and surrounding people. (Duffield 1965:42 Figure 2) Image used with permission from the Institute of the Great Plains, formerly CCHS (See Appendix).

What we find in historical documentation is simply an author's description and personal interpretation of actual events. The "primary concern in formulating the reality-mediation model is to produce a picture of how a description comes to differ from the reality it supposedly portrays" (Barber and Berdan 1998:38). Reasons for differences in reality and the author's description of
that reality include *selection* (omission of certain elements of reality), *emphasis* (an increase in degree of importance of a particular aspect of reality), *transformation* (modification of event details), and actual falsification of events, or *fabrication* (Barber and Berdan 1998:39-40). All of these modifications to a description of reality can be purposeful or accidental, malevolent or benign. They are products of the authors’ *mind-set* that includes their cultural and linguistic understanding of the event, personal desire to put forth a description that reinforces their concepts of reality and ideals, serves the purposes for documenting the event in the first place, and reflects the author’s ability to do so (Barber and Berdan 1998:40-41).

When investigating historical documents regarding the Longest site, it is important to keep in mind that they were produced by Europeans with diverse interests in the New World. Some were colonial soldiers intent on gaining and maintaining control over vast areas of land, some were craftsmen and merchants with desire for trade and wealth, and still others were diplomats or missionaries attempting to establish new relationships between Europeans and the Native Americans at the Longest site. Nevertheless, the authors of the primary historical accounts of 34JF1 were not single-minded. Rather, their varying reasons for being there colored the descriptions offered by each author in turn. Therefore, it is up to the researcher to see these documents for what they are and interpret them accordingly. They are diverse descriptions of an economically, militarily, and diplomatically strategic location that happened to be occupied by a very powerful and influential group of Native Americans, all during turbulent times of struggle for colonial power in the borderlands of a new and rapidly changing world.

Historic descriptions of the Taovayas village focus on several aspects of the settlement and its inhabitants. However, this research is mainly concerned with features of the village that can be observed and analyzed through geophysical and traditional archaeological means in light of historical documentation. Therefore, descriptions of the fortification and other structures are of utmost importance. Some documents describing these features include an initial account of the village and fortification by a Spanish missionary, a translation of a recently discovered diary kept by Juan Angel de Oyarzún during the 1759 punitive campaign against the Norteños (one that is
also considered to be the version offered as an official account by Colonel Diego Ortiz Parrilla in 1759), an official account by Antonio Treviño who was a captive of the Taovayas in 1765, and the last from Anthony Glass, an Irish trader who camped at the village from 1808-1809.

While discrepancies often occur between reality and an author’s description of such, the descriptions of the Taovayas village and fortification offered by the authors discussed below are considered mostly accurate for various reasons. Fray Zedano gathered his information about the fortification from many sources over an extended amount of time while conducting missionary work (Weddle 2007:9). He surely emphasized the construction of the fort and its coming role in the battle, since Colonel Parrilla was soon to depart from San Sabá. Colonel Parrilla and Captain Oyarzún are considered good sources for historical description because they were commanders on the battlefield, directly observing the fortification and its inhabitants from their posts, as well as receiving reports from their scouts overnight. Furthermore, they were officers in the Spanish military, expected by their superiors to make official, accurate statements about their enemies. While some questions remain regarding the number of enemy Norteños (Weddle 2007:127) and the presence of Frenchmen at the battle (Smith 2000:33), the descriptions of the fortification agreed with and supported those of Zedano (Weddle 2007:30,124).

In 1765, the Spanish soldier Antonio Treviño reported of his time as captive of the Taovayas. He had been seriously injured in an ambush in late 1764 (Smith 2000:40), but his valiance during the ensuing fight was regarded favorably by the Taovayas Chief Eyasiquiche who halted the attack and ordered him treated and taken back to their village (John 1975:370). He was given a “house, food, servants, and a woman,” (Smith 2000:40) and lived as an honored captive of the Taovayas for some time. However, as he “could not ... forget his country, his religion, and his family,” (Weddle 2007:51) his descriptions of the fortification and surrounding village can surely be taken at face value. They too, in turn, support the descriptions of Zedano, Oyarzún, and Parrilla.

Lastly, Anthony Glass was an Irish tradesman that lived among the Taovayas for a short period of time as an invited guest. His descriptions were not of the fortification, but of house
construction and the daily lives of the people of the village. As he was there somewhat diplomatically and had no reason for fabrication or otherwise altering the descriptions of their houses and village, he can be considered a viable source of factual information.

Historical Accounts of the Taovayas Village

The first known description of the Taovayas village was from Fray Francisco Zedano in written communication with Spanish governor Martos in June of 1759 (Lipscomb 2002:95). In this document, Zedano stated that “the village was located on a river and surrounded by dense woods … [was] encircled by a stockade and a moat … [and] the dwellings within the stockade had cellars that provided a safe haven for villagers if the settlement came under attack” (Lipscomb 2002:96). The date of this document clearly shows that information about the fortification was known to Parrilla before his punitive campaign which left San Sabá in September of 1759. This is contrary to John’s (1975:351) position that Parrilla had “never anticipated such an enemy stronghold.” In fact, Parrilla had a detailed description of the fortification, though he did not know its exact location (Lipscomb 2002:96; Weddle 2007:10). This earliest account of the Longest site contains information viable to this research because it describes the moat and interior subterranean cellars that should be readily observable in geophysical data and through traditional excavation.

The fortification was again described in a diary kept by Spanish Captain Juan Ángel de Oyarzún [translation by Lipscomb (Weddle 2007:123-128)] during Parrilla’s campaign against the Norteños. Oyarzún’s accounts were later transcribed by Parrilla to form his own “Testimonio de los Auttos” (Weddle 2007:137) which described the battle, village, and fortification. Colonel Parrilla was “a soldier of some renown” (Bolton 1914a:49) and a defeat at the hands of the Norteños would surely not bolster his political position. So, it is probably no coincidence that in his and Oyarzún’s descriptions of their losing battle at the Longest site, there were allegedly up to a 14 Frenchmen assisting the Native Americans (Weddle 2007:146). They describe a French flag flying over the fortification and “fife and drum” heard playing behind the fort walls during the battle (Weddle 2007:126). These details are not implausible because the Taovayas villages were prominent traders with the French at the time, yet they would prove difficult to
corroborate through geophysical or traditional archaeological efforts. However, other descriptions provided in these accounts lead to ascertainable research goals.

In Lipscomb’s translation of Oyarzún’s diary, the settlement was described as having a “stockade, which was skillfully made with loopholes and surrounded by a moat” (Weddle 2007:121). In agreement with the missionary’s prior statement, Oyarzún also wrote that all the inhabitants that lived in the large village surrounding the fortification had left their houses in favor of shelter inside it (Weddle 2007:126). Later, when their military company was stationed on the Texas side of the Red River opposite the fortification, Oyarzún states that there was, “a village consisting of tall oval-shaped huts enclosed by a stockade and moat, and that its entrance road is enclosed in the same manner. [The road is] winding, with its entrance toward the same river” (Weddle 2007:124). This winding entrance is the third feature that lends itself to the goals of this research.

Parrilla’s account (Parrilla, Diego Ortiz. 1759. “Testimonio de los Auttos: Parrilla.” Dunn Transcripts, 1759-1761, Archivo General de Indias, Audiencia de México. 92-6-22:unnumbered page after pp. 205. Bexar Archives, University of Texas, Austin.) describes the use of pedrero (cannons, or “rock-throwers”) (Manucy 1994:68; Mason 1978:279) during the battle that were designed to fire scatter projectiles such as grape shot. Armed with this information, there is an opportunity to investigate the possibility of future research at the Longest site. It is known from Oyarzún’s diary that the pedrero were placed at a range from the fortification that was “the most effective place to be found to test in every way [their] resistance” (Weddle 2007:124), and the infantry were “at the short range of an average musket” (Lipscomb 2002:109). Using this information, the area in which to survey for the battlefield can be delineated with effective ranges of eighteenth century smoothbore muskets and that of cannon fire with grape shot. When shooting at individuals, the range of a smoothbore musket in employ during the eighteenth century was no more than 100 yards (91 m) (Addington 1994:3), but if firing at a large group of people en masse, the range was far greater.

Using the range information for smoothbore muskets and grape shot fired from field cannon in a GIS to place distance buffers around the fortification wall nearest the battlefield (the west wall), it is possible to effectively gauge the area of the battlefield itself. Halleck (2009:291) states that the range of
grape shot is 300-500 yards (274 to 457 m) whereas Manucy (1994:69) quotes an effective range of 900 yards (822 m). Thus, a buffer of 650 m (to split the difference) seems reasonable for this research (Figure 5d). Furthermore, beginning with a known range of 91 m for smoothbore musket, distance buffers for containment of the infantry battle were set at 100 m (Figure 5a), conservatively out of effective range at 150 m (Figure 5b), and a probable maximum of 300 m (Figure 5c). This shows that, if historical accounts are to be trusted, the battlefield was most likely somewhere within the current riverbed and any future survey should be intensive within these ranges.

Figure 5. Distance buffers representing weapons ranges and delineating boundaries for the possible location of the Spanish/Taovayas field of battle (a) 100 m; (b) 150m; (c) 300 m; (d) 650 m. Satellite image source: “The Longest Site – Esri.” [Scale 1:8000 @ .3m Resolution] ArcGIS Map Service. Retrieved on August 5, 2012. http://goto.arcgisonline.com/maps/World_Imagery. Photo image source: Drass, Richard. “Longest Fort Area West.” Jefferson County, Oklahoma. March, 1967. August, 2012. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix).

Antonio Treviño, a short-term captive at the Taovayas village, describes the fort as:

“completely surrounded on the outside by an earthen rampart, close to more than a vara and a third [approximately four feet] in height, which serves them as an intrenchment, and, about four paces to the east and west, a very deep trench made so that no one can come close to the fortress on horseback. Inside there are four subterranean apartments
occupying all of its circumference, into which all of the people who cannot help with the defense of the said settlement retreat in time of invasion.” [Treviño, Antonio. 1765:107. Interrogation. (Translation) Box 2C21, Vol. 42. Pp. 81-113. Bexar Archives, University of Texas, Austin]

This more detailed description provides knowledge of the number of interior, subterranean rooms, a new understanding of the palisade in that there was also a roughly 1.5 m high “earthen rampart,” and that the moat was approximately 3 to 4 m wide. All of these features should be identifiable using geophysical techniques and traditional excavation.

Finally, an account of the village occurs in a diary written in 1809 by Anthony Glass, an Irish trader seeking permission to immigrate to Texas (John 1982:414). He was sent by United States Indian Agent John Sibley as an American representative of trade to a Wichita trading fair during the summer of 1808 and lived among the Taovayas from August of that year to March 1809 (John 1982:414). In this document, Glass states that he was offered an “invitation to the Chief’s house ... [but] preferred encamping near the great spring ...about 50 yards from the Chief’s house” (John 1982:416) and that the “abundant springs” they use come from a bluff 50 feet (~15 m) above the river (John 1982:417).

Indeed, Glass was not far off, as the fortification is approximately 20 m above the river. However, his accounts of the houses seem slightly askew, as he describes them as “70 or 80 feet [21 to 25 m] in diameter and 30 or 40 feet [9 to 12 m] high” (John 1982:417), which is considerably larger than the house structures found at the site (Bell and Bastian 1967) and seems unlikely. He also describes Taovayas forts as “of a very slender construction made of mud which they retire to when attacked by an enemy” (John 1982:422). Unless a large house or small fortification feature of the above dimensions is found, there is not much from Glass that we can hope to corroborate with geophysical and archaeological research, but his account offers us a welcome glimpse of the people at the Longest site just before the village disappeared.

Furthermore, Lipscomb’s (2002) original translation of Oyarzún’s description of the village agrees with Weddle’s (2007) edited version of Lipscomb’s translation on most points. However, the former translation points out that the fortification had two entrances (Lipscomb 2002:108), whereas the edited version states one winding entrance and a “narrow road in the bluff at the river’s shallowest part” (Weddle
2007:126). This is an interesting difference in interpretation of the same document that presents a good opportunity to use geophysical methods to investigate a historical account of the Longest site. Regardless of that outcome, all of these accounts of the Longest site are quite similar, and from them come numerous targets of interest for geophysical research. The moat, earthen rampart, and palisade making up the fortification, its winding entrance, the interior subterranean “safe-rooms,” and floors representing house structures are all probable features that should be represented in multiple geophysical datasets.
Chapter 3: Archaeological Investigation at the Longest site

Previous Archaeological Research

Undoubtedly the first excavations at the Longest site were conducted by artifact hunters interested in the novelties that the site had to offer. After over a century of probable collection of this sort (Drass 2007:8), there still remains a sparse scatter of protohistoric and historic artifacts that is churned up during periodic plowing. Before this project, professional research included one season of excavation occurring in two sessions that included a final unexpected two day period for mapping, testing, and aerially photographing the fortuitously exposed fortification feature (Bell and Bastian 1967:54, 84-85). There were two preliminary pedestrian surveys prior to the excavation, one by Robert Bell in 1955 and one by Tyler Bastian in 1964. Finally, there were two pedestrian survey updates conducted for the Oklahoma Archaeological Survey by Richard Drass in 1981 and 2007.

The first survey by Dr. Robert E. Bell is documented in an Oklahoma Archaeological Survey Record for 34JF1 (Bell March 15, 1955). This report includes a rudimentary map, a very short description of site location, and basic information about human remains and some artifacts that were associated with the site. One artifact of interest listed in the report is iron grape shot, which is a type of scatter projectile used in cannons which “was much used during the 1700s” (Manucy 1994:69). Finding this shot presents the possibility that this was indeed the type of ball used during the battle, and supports the use of distance buffers (Figure 5) for delineating the survey area for the battlefield.

The next survey was conducted and reported to the Oklahoma Archaeological Survey by Tyler Bastian (1964), in which he presents a more detailed description of the location of the Longest site and the artifacts observed there, but still provides a rather basic map. However, the map does show a low rise mentioned in the report that contained much bone, pottery, and chipped stone (possibly proposing a midden). When reporting on previous excavations, he stated that there were none, “but there are pot holes on the north side of the ravine,” (Bastian 1964) seemingly alluding that they were holes left by artifact hunters. This survey was the last conducted before the extensive excavations in the mid-1960s (Bell and Bastian 1967).
Excavations were conducted as a part of the Wichita Indian Research Project by Tyler Bastian with the Museum of the Great Plains under the advisement of Dr. Robert E. Bell (Bell and Bastian 1967:54). The project was split into two sessions, the first from November 15, 1965 to February 23, 1966, the second from June 6 to August 11, 1966, and a “final test was conducted on March 28 and 29, 1967, to examine the nature of a feature [the fortification] ... later defined by an aerial photograph of the site” (Bell and Bastian 1967:54). Some artifacts that have been found at the site include Native American pottery, clay pipes, clay figurines, lithic tools and projectile points, groundstone tools, gunflints, and European trade items such as beads, ceramics, gun parts, tinklers, and iron tools such as axes, hoes, and knives (Bell and Bastian 1967:85-111). The nature of these artifacts suggests that the site was primarily a French trade site most active from 1750-1800 (Bell and Bastian 1967:113-114). Also encountered were seven burials, five circular or oblong structures, 29 storage pits, and several proposed refuse mounds (Bell and Bastian 1967:67-85).

The latest surveys of 34JF1 were conducted by Richard Drass (1981; 2007). The first report further discusses the site and extant surface artifacts, while summarizing the findings from the 1965-1967 digs. It also notes that the site was nominated for the National Register of Historic Places in 1981. Drass (2007) summarizes the locational and basic information about the site in more detail and discusses artifacts and their locations observed during survey. Most importantly, the location of some metallic, possibly magnetic artifacts (hematite and iron) is mentioned which could account for some anomalies in the magnetic dataset discussed below.

The Longest site has been used agriculturally since at least 1892 (Bell: 1967:56), and has been plowed almost completely flat, leaving very little visual evidence of cultural features on the ground. Before the advent of geophysical prospecting in archaeology, lack of surface features drove the need for extensive trench exploration of a potential site. As a result of this practice at the Longest site from 1965 to 1967, approximately 1,274 m\(^2\) (approximately one-third of an acre) of test trenches were dug in order to locate structures and related features (Bell and Bastian 1967:60-62). There is no mention in the report of exploratory depth, so the volume of excavated soil from the trenches is unknown.
With the hit and miss nature of shovel test pits and trenches (Kintigh 1988), it is not surprising that only the final two trenches (21 m$^2$) uncovered the fortification ditch. Even then, these two trenches were dug only after the fortification was fortuitously exposed in the northern field. Mr. Longest had plowed the northern section deeper than usual and churned up an abundance of bison bone (Bell and Bastian 1967:59) that had been discarded in the moat, which clearly outlined the fortification in aerial photographs (Figure 6). This was the first usage of airborne remote sensing at the Longest site.

![Figure 6. Aerial Photo of the Longest site from southeast to northwest. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “Longest Fort Area West.” Jefferson County, Oklahoma. March, 1967. August, 2012.](image)

The fortification feature “coincided with the position of” the one described in historical accounts of the battle of 1759 between the Spanish and the Norteños at the Longest site (Bell and Bastian 1967:85). In their summary (Bell and Bastian 1967:118), they state that finding the fortification’s subterranean structures that were mentioned in historical documents from Fray Zedano (1759) and Antonio Treviño would “establish this identification [of the fort] beyond question, and this should be a goal of future
planning.” They also suggest that “the fortification should be carefully excavated to trace its size, nature, and interior associated structures” (Bell and Bastian 1967:118). Toward these goals, the 2012-2013 research presented here shows that, with what is known about the Longest site through historical documents, survey, and excavation, this measurement and definite identification of the fortification was facilitated using archaeological prospecting and minimal excavation to validate the geophysical findings.

Archaeological Geophysics: 2012-2013 Remote Sensing

The purpose of this section is to discuss advanced planning for fieldwork at the Longest site, the geophysical methods employed there, the principles behind them, and to discuss the results and some problems that arose during the research. Many factors can potentially have a negative impact on a project in terms of time and monetary cost, so mitigation of these costs through proper planning was imperative. While fewer archaeologists are typically needed for geophysical projects than for traditional archaeology, the expenses lie in other areas such as the cost of equipment or lost time because of something as simple as uncharged batteries. Project planning for geophysical survey at the Longest site included:

- ensuring good weather conditions for geophysical methods,
- having access to the site when the land was not in use agriculturally,
- arranging survey assistance in the field,
- locating a viable area for geophysical survey,
- preparing survey methodology,
- deciding on and obtaining the appropriate survey equipment.

Weather conditions were constantly monitored and planned around (but were rarely ideal), proper permission for access to the privately owned site was obtained from the landowners, and competent assistance was recruited well in advance of the project. The combined use of aerial photos and satellite imagery in a Geographical Information System (ArcGIS) provided the most probable area for the location
of the fortification, which allowed for the definition of a test grid and methodology for data collection before going into the field. Thus, the preferred grid location, size, and survey methods were clearly defined ahead of time and adhered to once there. Consideration was given to geophysical data quantity and quality as compared to remote sensing equipment and methodology in attempt to optimize production potential.

Kvamme (2008:65) writes that, “Remote sensing refers to techniques that acquire information about a subject through indirect means.” In archaeology, these techniques include but are not limited to, airborne methods such as the retrieval of satellite imagery from space or photographic representation of the earth’s surface from the air, and several ground-based geophysical technologies for subsurface data collection such as magnetometry, electrical resistivity, and ground-penetrating radar. Each method within these two broad domains has its own set of advantages and disadvantages. These lie in differential geophysical properties, size, shape, and pattern possibilities of targeted features, resolution of data retrieved, size of area to be studied, data-retrieval time and monetary cost of collection and processing. The goal was to understand these differences and use a combination of airborne and ground-based technologies in order to gain the best quality data in the most time and cost efficient manner.

**Airborne Remote Sensing.** The primary goal of the geophysical research at the Longest site was to relocate with high accuracy the previously observed Taovayas fortification. Giardino and Haley (2006:64) say that “precision georeferencing, or assigning of map coordinates, to [GIS] data layers is very significant ... [and] ... advanced knowledge of terrain features and land cover can assist in the formulation of survey methodology.” This is also true for advanced knowledge of targeted feature locations. Bell and Bastian’s survey and excavation in the mid-sixties provided the first physical evidence of the fortification in well over 150 years. For the very first time it was photographed from the air (Figure 6) and documented spatially as seen in the field sketch by Bell and Bastian (1967:Figure 30). However, since their survey the established datum for this portion of the site has been lost. In order to most efficiently relocate the fortification, it was necessary to use ArcGIS to georeference a historical aerial photo with unknown coordinates to a satellite image with known coordinates. In other words, *stretch* the oblique
aerial photo taken from a low angle to match locational information from the georeferenced satellite image recorded from a vertical angle.

Using common recognizable points represented in both images (ground-control points), it was possible to use ArcGIS to georeference the image of the fortification (Figure 7) with enough confidence to produce a reasonable grid layout and, in the interests of time and cost mitigation, plan ahead for data collection using ground-based methods. The fortification was approximately 15 m farther west than anticipated, due to a slight skew in the stretched photograph seen in the curvature of the fence line just east of the fortification (Figure 7). This skew occurred due to the lack of an adequate number of ground-control points in the 1967 photograph.

**Ground-Based Remote Sensing.** Many factors affect, to varying degrees, the performance of ground-based sensors and should be carefully considered before site survey. Properly chosen grid-size, spatial resolution, and instrumentation provide an excellent mosaic on which anomalous geophysical patterns can be seen. Kvamme (2005:427) lists five factors which contribute to feature detection by remote sensing. These include pattern recognition, targeted feature size, spatial resolution of the instrument, contrast between the geophysical target and the soil/other material surrounding it (*background depositional matrix*), and depth of features.

A fundamental principle of pattern recognition is that geometric shapes and groups of shapes in regular patterns are most likely human in origin rather than a natural occurrence (Avery and Berlin 1992:52). Hence, a discernible regular shape or pattern can often be interpreted as an anthropogenic feature. Large-area grids facilitate pattern recognition in that there is higher probability that entire geometric anomalies (features) will be contained within larger grids, and often a single large grid may contain several features. Other factors of concern are the size of the targeted feature and the spatial resolution of the instrument. Weymouth (1986:347) states that instrument spatial resolution should be at least half the size of the smallest desired feature to be detected. So if the feature is very small, instrument readings per meter should be very high, whereas if large features are expected then lower spatial resolution is acceptable. This lower resolution will also decrease the amount of data recorded, thus lessening the time required for data collection in the field and processing in the future.

Also, the proper sensor must be chosen in order to detect the characteristics of the geophysical targets desired. In order to detect a feature through remote sensing, there must be a physical *contrast* between it and the surrounding matrix that causes an anomaly in the dataset. If the targets are expected to exhibit magnet contrast, a magnetic gradiometer is advised, whereas features with minimal or no magnetic difference from the background matrix may display a difference in density or material, which would suggest a GPR or resistivity meter may be the best instrument to employ. Lastly, magnetometry is archaeologically viable to a maximum depth of only around 3 m, with the ideal range around 1 to 2 m (Kvamme 2006:222). If targeted features are deeper than this, possibly GPR or resistivity should be considered.
Geophysical Methods

The most common grid unit measures 20 x 20 m, but given the size of the fortification, limited time in the field and available assistance, a 30 x 30 m grid was deemed more appropriate. Adopting a 30 x 30 m layout at the Longest site allowed for the collection of 24 large grids rather than 54 smaller ones, thus saving the cost and time required to set up 30 additional grids and causing no loss in data quality. Another important consideration was the collection method involving the use of evenly spaced parallel transects (collecting data in one direction only) or zigzag transects (collecting data in both directions) when operating geophysical equipment. By eliminating the need to walk back to the origin baseline to begin a new transect, zigzag survey saved archaeologist field-hours by facilitating more rapid data collection. While parallel transects offer some advantages in data consistency, user-generated issues such as staggered data and striping can easily be corrected after survey during data processing in the lab (Kvamme 2006:241).

When deciding on instrumentation, feature depth was not a concern as previous excavation showed none deeper than approximately 1.5 m, which is well within range of most ground-based instruments. Magnetic differences between the background matrix and features were expected, but initial testing was conducted using magnetometry, resistivity, and ground-penetrating radar in order to determine their performance. The primary feature at 34JF1 is the 1 to 1.5 m deep trench surrounding the earthen embankment and fortification. It was tentatively measured at approximately 80 x 120 m (Bell and Bastian 1967:84) and was expected to contain multiple large interior subterranean rooms (Treviño, Antonio. 1765. Interrogation. (Translation) Box 2C21, Vol. 42. Pp. 81-113. Bexar Archives, University of Texas, Austin). Other anticipated “geophysics friendly” features included storage pits, hearths or other burned material, compacted structure floors, and metal artifacts, all of which should present discernible anomalies in the geophysical datasets.

Magnetic Gradiometry. Rather than generate a magnetic field and read responses to it (active instrumentation), a magnetic gradiometer is a passive instrument that reads the total existing magnetism caused by the earth’s magnetic field plus that of whatever anomalous materials may be located underneath its sensors (Kvamme 2006:206). The distinctive magnetic characteristics of many
anthropogenically altered materials cause them to be highly visible in magnetic datasets. In fact, Kvamme (2006) states that:

“Magnetometry is one of the most productive prospecting methods employed in archaeology. It is a method that responds particularly well to the archaeological record ... [and] ... rapid data acquisition rates of current instrumentation allow large areas to be surveyed in relatively small amounts of time.” [Kvamme 2006:205]

Burned or fired materials will exhibit changed magnetic qualities due to realignment of magnetic components through heating and cooling (Lockhart 2010:238). Therefore, cooking pits, hearths, and previously burned structures exhibit visible magnetic variance in gradiometer surveys. Furthermore, Lockhart (2010:238) explains that there are differences in topsoil and subsoil magnetism caused by “microbes, organic matter, and naturally occurring ferrous oxides.” Consequently, if a hole is dug through the topsoil, left open for a given amount of time, and eventually filled with materials and soils other than the original topsoil, there should be a difference in magnetism between the background matrix and the location of the filled-in hole, as well as a detectable difference where the originally removed soil is deposited. Finally, highly magnetic materials like iron or most steel alloys that are often found in modern agricultural areas such as the Longest site, create huge dipolar anomalies which, if they are not the primary geophysical targets, can cause major problems during data collection and processing.

All of the targeted features at the Longest site, including the moat, earthen rampart, alleged subterranean rooms inside the fortification, hearths, and storage pits are expected to exhibit some or all of the above magnetic characteristics. Due to the length of occupation at the site, the previously dug features (the trench, pits, structures, and rooms) were expected to be filled with material and soils other than the original soil that was pulled from them, consequently displaying different magnetic characteristics than the current surrounding matrix. Considering Kvamme’s affective factors above, given the size of the fortification, its related features, and the expected anomalous magnetic qualities of all principal targets, it was deemed most appropriate to use magnetic gradiometry to carry out the full area survey of the proposed location of the fort. Afterward, electrical resistivity and GPR methods were used for comparison in select, smaller sections.
The magnetic survey at the Longest site was conducted using a Bartington-601 dual fluxgate gradiometer in 30 x 30 m grids with 0.5 m transects heading south to north, taking 8 samples/m for a resolution of 12.5 x 50 cm/sample (16 measurements/m²). Apart from structure postholes and individual non-metallic artifacts, this resolution was small enough to capture most any feature that was expected at the site. These data were then processed using Geoplot software and IDRISI GIS. Magnetic anomalies included those of a positive, negative, and dipolar nature, with some in readily recognizable geometric shapes (Figure 8).

![The Longest Site (34JF1)](image)

**Figure 8. Examples of anomalies in the magnetic dataset for the Longest site.**  
a.) Positive in black; b.) Negative in white; c.) Dipolar

Positive readings (Figure 8a) indicate an increase in magnetism (Kvamme 2006:216) in a specific area such as a burned structure or a location of added soil for a mound or filled in pit (Kvamme 2006:218). Negative readings (Figure 8b) may indicate the removal of magnetic material (soil) possibly during the digging of recessed houses or ditches (Kvamme 2006:219) for example. Finally, dipolar anomalies (Figure 8c) represent highly magnetic material, often iron or some types of steel, which are quite visible and disruptive in a magnetic dataset. Complete results for the entire survey grid are shown below using a shading gradient with positive represented in black and negative in white (Figure 9).
Figure 9. Magnetometry results from the Longest site (Fall 2012) processed using Geoplot software and IDRISI GIS.
As expected, the fortification outline was readily detected (Figure 9) in the magnetic dataset due to the nature of its construction and eventual refill of the moat. Furthermore, based on their geometric shapes, anomalous magnetic characteristics, and knowledge gained from historical accounts, there are several other geophysical targets of interest located within the survey area (Figure 10). Initial interpretations of other possible features were that:

- Area 1 is a cluster of curvilinear anomalies on the south side of the fortification. Initially, this was thought to be the outer moat, earthen rampart, and an interior room, or a possible entrance into the fortification.

- Areas 2 and 3 are linear anomalies that possibly represent two of the interior subterranean rooms mentioned in Antonio Treviño’s account of the Longest site.

- Areas 4 and 8 are large circular negative anomalies. The smaller of the two (area 8) was thought to almost certainly be the location of a house, whereas area 4 was regarded as a potential corral, as it was considered far too large to be a house.

- Areas 5 and 7 contain two dipolar anomalies that represent probable metallic debris.

- 6 is a circular positive anomaly suggesting a possible storage pit.

- Area 9 is a geometric anomaly with a right angle, which is almost assuredly an anthropogenic feature which represents a probable trench or secondary entrance into the fortification.

- Area 10 is a large cluster of dipolar anomalies that is a probable location of a historic farmstead house or barn.
Figure 10. Anomalous areas of interest in the magnetic dataset at the Longest site.
Once these areas of interest were determined on the magnetic map, resistivity and ground-penetrating radar surveys were conducted to determine their effectiveness. Also, test excavation units were placed in locations most likely to show physical evidence of the source for the geophysical anomalies (validation) while causing the least amount of impact upon the site.

**Electrical Resistivity.** Electrical resistivity works on electrical principles, in particular, current flow through varying materials under the earth’s surface. In this respect, it differs from magnetometry in that it is an active method, which introduces an electrical current via metal probes into the subsoil and measures the amount of resistance present (Somers 2006:110). The resulting resistance value is the measured quantity (in Ohms) of resistance to the current flow in the ground between electrodes connected to the resistance meter. In other words, the resistance measured is determined by the physical characteristics (resistivity) of underground material and the electrode configuration of the instrument. Among other things, soil resistivity depends on the moisture in the soil, soil density, and porosity (Weymouth 1986:319). Thus, if these properties of the soil are not conducive to current flow, the resistivity method will not work. The soil must have enough free ions in moisture to conduct electricity and it must be able to retain this water in times of shortage, so if the pores in the soil matrix are too large, water is lost and conductivity is adversely affected (Weymouth 1986:319-320).

This is a fairly straightforward method that measures resistance caused by not only the material itself, but the amount of material present (Lockhart 2010:238). If conditions are favorable for resistance survey, altered materials in the soil matrix are often identifiable in the resistivity dataset. Items such as ditches or storage pits potentially hold water and exhibit low resistance to current flow, whereas stone walls would cause high values (Kvamme 2005:434). Measurements are recorded by the instrument in a standard .txt format and, through processing software, arranged in a grid format containing rows and columns, thus defining the spatial resolution of the dataset. Once the data are placed in a grid, a continuous gradient palette is assigned to the range of values which produces a basic image of the subsurface with low resistance values typically represented in white, and high in black.

Resistance survey at the Longest site was conducted in the grids where the magnetic data indicated the northern side of the fortification. The soil is a sandy loam that was recently plowed, so it
was quite porous and dried very quickly without crops present. Furthermore, it was extremely hot with very little rain, which left the soil dry and not optimal for resistance survey. A Geoscan RM15 was used for data collection that included five 30 x 30 m grids with 1 m transects, defining a spatial resolution of 1 x 1 m, or 900 measurement points per grid (Figure 11a). During processing in ArchaeoFusion software, these data were de-spiked to remove excessively high values from the dataset and then interpolated to provide estimates of probable values between them. This provided a very good approximation of what the values would be if collected in the field at .5 x .5 m or 3600 measurement points per grid. Finally, a low-pass mean filter of 3 x 3 cells was applied to the interpolated data to smooth the image (Figure 11b).

Figure 11. Electrical resistivity data showing the northern boundary of the fortification at the Longest site. a) Unprocessed data; b) Interpolated and smoothed data.
While data quality surely could have been better, the method worked well under poor conditions, as seen when compared to the magnetic map of the same area (Figure 12a, b, and c). Interestingly, the center of the fortification boundary as seen in the resistivity dataset seems to be located slightly further south than in the magnetic map. This is probably due to the differing nature of the physical characteristics being detected by each machine respectively. The image may reflect small differences in the way the two instruments are recording values from the location of the earthen rampart which is now plowed flat and the moat, thus changing the image visually. Whatever the case, resistivity seems to be a viable geophysical method to use at the Longest site, preferably conducted during a slightly wetter season than was this survey, possibly after a harvest but before plowing.
Figure 12. Gradiometer and electrical resistivity survey data. (a) Magnetic data showing the northern fort area; (b and c) Outline comparisons between magnetic and resistance data.
Ground-Penetrating Radar. Ground-penetrating radar is a near-surface geophysical survey method that uses a dual-antenna system from which a radar signal is transmitted into the ground from the forward antenna, is reflected off of contrasting subsurface boundaries caused by “buried objects, features, bedding contacts, or soil units” (Conyers 2006:136), and then recorded by the receiving antenna in the rear of the GPR unit. The amount of time that it takes for a wave to complete this cycle (two way travel time or “twtt”) varies with changes in the physical or chemical characteristics of two adjacent contrasting materials (Conyers 2007:332). These property differences cause variation in relative dielectric permittivity (RDP), which is a measurement of the velocity of radar energy through the ground that is constant for each unique subsurface material (Conyers 2006:140). The differences in RDP are what delineate the boundaries between two materials from which only a portion of the radar signal is reflected back to the GPR receiving antenna, creating a wave in the GPR data. The rest of the energy continues until reflected by another boundary, creating another wave, and so on until the energy is dissipated into the ground (Conyers 2006:140). High contrast in RDP between two materials creates high amplitude waves (Conyers 2007:332) and vice versa. Naturally, GPR can be rendered ineffective by a lack of contrast in RDP or by materials that hinder or absorb radar energy through high conductivity such as clay and wet soils (Kvamme 2005:437).

When conducting GPR survey, radar signals are transmitted from the antenna as the archaeologist moves it along a transect of the survey grid. Along this transect, radar energy is transmitted at manually chosen horizontal intervals (traces) and with a set number of vertical samples per trace. For example, a 20 x 20 m grid could be set up to contain 20 traces per meter with 512 samples per trace. This would produce 400 traces per transect with 512 cells of vertical data per trace, culminating in a single transect of data in a spreadsheet (grid) with 400 columns and 512 rows of data. This is in effect a vertical profile (slice) of the subsurface matrix, similar to pulling a slice of bread from the middle of a loaf and observing the interior. When many adjacent vertical profiles are placed side by side, they produce a three-dimensional cube of data. Since there are data in vertical samples within each trace, every profile can be “time-sliced” horizontally by two-way travel time as well. Much like hand excavating an archaeological unit in measured levels, this provides the ability to see horizontal data “surfaces” in plan view, separated by time measured in nanoseconds (nS).
In September of 2012, GPR survey was conducted at the Longest site in Area 1 (Figure 10). This area includes anomalies of interest in the magnetic data that were large and contrasted heavily with the surrounding matrix, thus seemed probable for detection using ground-penetrating radar. It is important to note that when this survey was conducted, it had not rained and had been very hot for some time, leaving the soil very dry. Figure 13a shows the magnetic data for the three very large curvilinear anomalies, which were the primary targets for GPR survey in Area 1. The survey was conducted in a 30 x 30 m grid with .5 m transects, recording 50 traces per meter and 512 samples per trace for a three dimensional spatial volume of 1500 columns x 60 rows x 512 samples.

![Magnetic data](image1.png)

**Figure 13.** Area 1: (a) Magnetic data in nT; (b) GPR data time slice at 21-27 nS during dry conditions. (September 2012).

Data processing was conducted using free online software, “GPR Process” (Conyers 2010), in which the data were configured to provide .25 x .25 m resolution by interpolating the x-axis for 120 points from the 60 known, and designating 120 evenly spaced known data points on the y-axis. These data were then sliced in 6 nS time slices in GPR Process and smoothed using a 3 x 3 m low-pass filter in IDRISI GIS. Figure 13b shows the clearest time slice (21-27 nS). Similarities between the magnetic and GPR datasets are apparent, as some anomalies in the magnetic map are also represented in GPR reflections. Unfortunately, it had rained heavily for a few days prior to broader survey in the spring of 2013, so the soil was waterlogged and was seemingly less conducive to ground-penetrating radar (Figure
Hence, GPR is another viable geophysical tool for future research at the Longest site, preferably during dryer conditions and before plowing (to mitigate noise in the data).

Figure 14. Area 1: GPR data time slice (20-28 nS) during wet conditions (May 2013).

Validation of Geophysical Results

After data collection, the process of validation (ground-truthing) is necessary in order to better interpret the sources of the anomalies in the geophysical map. This is important not only for feature identification, but for establishing their physical characteristics and position in the surrounding matrix. Validation of geophysical anomalies can be accomplished through the use of historical maps, documents, photographs, and anecdotal information from local residents (Hargrave 2006:270), but most often by excavation. In some cases, the instrument may detect an obvious geophysical anomaly, but upon hand excavation no associated feature is found. The anomaly may be represented by slight differences in soil characteristics (Hargrave 2006:281) such as density differences between the floor of a structure and
surrounding matrix, or soil makeup in the case of biological remains in a storage pit. Therefore, no matter how tempting, the geophysical map cannot necessarily be read like a plan-view map or photograph of the archaeological site (Hargrave 2006:270).

Deciding where to excavate at the Longest site was somewhat clear-cut, given the size of most of the targeted features and prior knowledge gained through historical documentation of what most anomalies represented. However, locating and validating dipolar anomalies is a special case. In order to do so, the location of the highest positive and negative readings must be known. Once known, if using a GIS, one need only measure the distance between the two and calculate one-third of that distance from the positive high reading. This is the approximate location of the source for the dipolar anomaly (Weymouth 1986:344). On the other hand, if the locations of high readings are known but GIS is unavailable, the Distance Formula must be employed. For example, Figure 15 represents a dipolar anomaly in the geophysical dataset for the Longest site.

Calculations for distance (d) and location (d/3) in Figure 15 are as follows:

\[
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}
\]

- x,y coordinates for High + = 68.25,63
- x,y coordinates for High - = 69.25,64.75

\[
d = \sqrt{(69.25 - 68.25)^2 + (64.75 - 63)^2}
\]
\[
d = \sqrt{1^2 + 1.75^2}
\]
\[
d = 2.0156 \text{ m}
\]
\[
d/3 = 67.18 \text{ cm}
\]

Thus, the location of the source of the anomalous reading should be approximately 67 cm away from the high positive reading on the straight line between the two highs, or approximately in the center of the proposed 1 x 1 m excavation unit in Figure 15. After calculation for dipolar anomaly source location and review of the historical accounts describing expected features, the chosen excavation units were mapped onto the magnetic dataset (Figure 16).
Figure 15. Dipolar anomaly, probable location of its source, and the preferred location of a 1 x 1 m unit for validation.
Figure 16. Location of excavation units for geophysical validation.
Chapter 4: Historical Research, Geophysics, and Excavation Work Hand-in-Hand

The purpose of this research was not simply to do a geophysical survey of the Longest site, but to combine research of historical accounts, geophysical survey with multiple instruments, and hand excavation in order to gain the most complete understanding to date of Mézières’ San Bernardo. None of the historical information herein is previously unknown, but gains new life in light of a geophysical map and traditional archaeological excavation of the subsurface features represented in the geophysical datasets. Through these means, the goal was to gain as much information as possible while mitigating destruction of this archaeological record. All validation of possible features was conducted by Richard Drass of the Oklahoma Archaeological Survey, volunteers from the Oklahoma Archaeological Society, and myself using traditional archaeological excavation and 100 percent screening through one-quarter inch mesh. The ten excavated areas included seven 1 x 1 m units, six 1 x 2 m, one 1 x 3 m, one 1 x 4 m, and two 1 x 5 m trenches for a total of 36 m$^2$ of excavation. Features were not encountered until deeper than 30 cm below the current surface, as this was the depth of the agricultural plow zone at the site.

Area 1: The Outer Fortification Trench and Other Anomalies

Available eighteenth century historical accounts from Zedano, Oyarzún, Parrilla, and Treviño state that there was indeed a moat surrounding a palisade, that it was “three to four paces wide and a vara and a half deep [1.25 m] ... [and] ... four subterranean apartments occupying all of its circumference.” Also, the previous archaeological investigation provided a preliminary measurement for the fortification ditch of 80 x 120 m and 120 cm deep (Bell and Bastian 1967:84). Thus it was expected that an 80 x 120 m trench anomaly 3 to 4 m wide would be evident in the geophysical datasets, and that through excavation it would be found to be around 1.25 m deep.

While not complete, the outline of the fort is an unmistakable positive anomaly in the magnetic map (Figures 9 and 10) and is visible in the resistivity data (Figure 12). Measurements in GIS show that the fortification measures between 80 to 85 m east-west and 125 to 130 m north-south at its widest discernible points, and at almost every point assessable the trench is approximately 3 to 4 m wide. As a result of high magnetic disturbance, the trench anomaly seemed to become less visible when in close proximity to strong dipolar anomalies (e.g. Figure 10: north and south of area 10). It also seemed to fade
when its orientation followed the initial north-south transects (e.g. Figure 10: north of area 9). Some later attempts were made to improve results in these grids by collecting magnetic data along east-west transects, but the fortification trench anomaly was still not visible. Because of the three similar and seemingly parallel anomalies located therein, the southernmost Area 1 (Figure 10) seemed to be the ideal place to excavate in order to validate the geophysical anomalies that represent the possible moat, palisade, and one of the interior rooms.

Validation of the anomaly thought to be the outer moat was conducted in Area 1, Trench a (Figures 17 and 18). Area 1a is a 1 x 5 m excavation (S64-E78 to S68-E78) that exposed a ditch measuring 3.25 m wide at the top and 100 cm deep at its deepest, which corroborates nicely with Antonio Treviño’s description of the surrounding moat. Faunal remains and several artifacts were removed from this ditch, suggesting that at some point the moat was used as a trash disposal area. Upon excavation, this portion of the anomaly was considered to be part of the moat surrounding the fortification and to be representative of its entirety. In Trench b (S61-E78 to S62-E78), a post mold measuring 45 cm in diameter and 80 cm deep was observed at approximately 40 cm below the current surface (Figures 17 and 19). Its size suggests that it is a palisade post, while its shallowness implies the possibility that the palisade posts were placed within the earthen rampart and into the soil beneath it.

Area 1c (Figures 17 and 20), a 1 x 4 m trench from S56-E78 to S59-E78 with one 1 x 1 m unit unexcavated, was of interest because of the anomaly’s similarity to the moat in Trench a. Indeed, the anomaly proved to be another ditch measuring 3.5 m wide but only 60 cm deep. No historical documents known to this author describe an interior ditch other than the four subterranean rooms, so identification of this feature remains for future research.
Figure 17. Validation Area 1. (a) fortification moat; (b) probable earthen embankment and palisade; (c) unknown shallow ditch feature; (d) probable subterranean room.
Figure 18. Area 1a: West wall profile of S64-E78 to S68-E78 showing a probable moat feature. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “S65-S68E78.” Norman, Oklahoma. November, 2013.
Figure 19. Area 1b: West wall profile sketch of S61-E78 to S62-E78 showing a probable post palisade post mold and storage pit. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “S56-S62E78.” Norman, Oklahoma. November, 2013.
Finally, the northernmost anomaly in Area 1d is extremely large and was only partially excavated during the validation phase. Area 1, Trench d (Figures 17 and 21) was a 1 x 4 m trench (S50-E78 to S53-E78) that exposed the southern wall of a trench feature with a depth of 110 cm and a post mold in the floor. Given the size of the anomaly in the geophysical map and the location of the post mold in its interior, this anomaly is considered to be one of the historically documented subterranean apartments discussed above. These are all very large features, so complete excavation is not feasible, but with the exception of the unknown ditch feature, these test excavations seem sufficient to provide initial identification. In summary, it seems that the anomalies in Area 1 most likely represent the historically documented moat, palisade embankment, an unknown trench, and one of the four subterranean rooms.
Figure 21. Area 1d: West wall profile sketch of S50-E78 to S53-E78 showing a probable subterranean structure. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “S50-S53E78.” Norman, Oklahoma. November, 2013.
Areas 2 and 3: Probable Subterranean Apartments

One trench measuring 1 x 10 m (N35-E58 to N35-E67) with two 1 x 1 m units unexcavated, was placed across the width of the anomaly in Area 2 (Figure 22 and 23). The ditch feature exposed was approximately 8 m wide at the top, 6.5 m wide at the bottom, and 130 cm deep. There was a 50 cm wide step or bench feature on the west wall of the ditch at a depth of 60 cm. There was burned roof fall present and, similar to the possible subterranean room in Area 1d, there was a post mold in the floor. All of this evidence suggests that this is another of the subterranean rooms presented in historical documents from Fray Zedano, Oyarzún, Parrilla, and Treviño.

Figure 22. Area 2. (a) Bench step and post hole; (b) continuation of trench feature. Photo facing east.
Figure 23. Area 2: North wall profile of N35-E58 to N35-E67 showing probable subterranean structure. (a) western five 1 x 1 units. (b) eastern five 1 x 1 units. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “N35E58-E67.” Norman, Oklahoma. November, 2013.

The anomaly in Area 3 (Figure 24) was similar in characteristics to that in Figure 22. In order to verify that this was a feature, a 1 x 3 m trench (N22-E99 to N22-E101) was excavated to a depth of 100 cm, which exposed what is indeed another ditch feature. The excavation was incomplete in that only the east side of the feature was exposed, and the floor was not reached. While this seems initially to be another subterranean room, verification will depend on locating the floor, post molds such as the ones found in the probable rooms in Areas 2 and 1d, or possibly a step feature similar to the one found in Area 2.
Area 4: Possible Corral or Large Protohistoric House

In Area 4, a possible circular feature is evident measuring approximately 40 m in diameter (Figures 10 and 25). The intent of excavation in Area 4 was to locate the outside perimeter of this large negative anomaly with two 1 x 2 m test trenches (N56-E111 to N60-E111 with a 1 x 1 m unit unexcavated). While the excavations did not delineate a boundary for the feature, they did expose a shallow midden and three post molds (Figure 26). The anomaly seems to be superimposed on the fortification trench, which suggests the fort was no longer there when this unknown feature was in place. This anomaly may represent a circular corral, as no housing structure this large is expected at the site. However, in April of 1778, during a visit from Athanase de Mézières, the Taovayas leaders "commanded
that a very large dwelling should be erected” (Bolton 1914b:205). Also, in September of 1808, Anthony Glass described the houses of the Taovayas as being 70 or 80 feet (21 to 24 m) in diameter and 30 or 40 feet (9 to 12 m) high (John 1982:417).

There is no evidence in the documents from either of these men that the fortification as it was in 1759 was still present at the time of their writing. Mézières describes the area, village, structures, and even the daily lives of the village inhabitants in detail (Bolton 1914b:201-204), but makes no mention of the fortification. Anthony Glass describes the Taovayas forts as “of a very slender construction made of mud which they retire to when attacked by an enemy” (Weddle 2007:31). This most certainly is not a description of the fortification present during the battle of 1759.

Figure 25. Area 4, Trench a and b.
Given that the 80 x 120 m fortification shown in the geophysical datasets may have been gone by 1778, and that there are historical accounts of large structures being present at the Longest site after that time, the possibility remains (however improbable) that this is a very large house structure, or possibly a smaller, later fortification as Anthony Glass described. This interpretation is reinforced by the magnetic data in that the anomaly is negative in polarity, which suggests probable removal of topsoil during some type of construction (Kvamme 2006:219). Conversely, constant cattle activity in a corral could potentially cause removal of topsoil. However, if this was the case, organic waste and possible resultant bacteria left behind by an animal herd should cause a positive rather than negative anomaly in the magnetic dataset (Kvamme 2006:217).

Area 5: Possible Hearth or Pit

This anomaly was chosen for excavation because it represents a singular dipolar anomaly (Figure 27a) as opposed to large conglomerations of such seen in Area 10 (Figure 11), and its location within a possible circular anomaly seen faintly in the magnetic dataset (Figure 27b). The dipolar nature of this anomaly suggested either metallic or fired material. Upon excavation of a 1 x 1 m unit (S42-E98), metal wire (Figure 28c) was found in the plow zone, which probably caused the dipolar anomaly. Soil discoloration seemingly caused by organic material occurred at approximately 35 cm below the current surface (Figure 28a) and continued to the final excavated depth of 40 cm. Charcoal flecks and larger pieces were present as well (Figure 28b). This is likely a cultural feature that was not positively identified.
as either a storage pit or hearth. Nevertheless, its location would warrant its further investigation and that of the boundary of the possible circular feature surrounding it.

Figure 27. Area 5, Unit a. dipolar anomaly and possible circular feature.
When describing the practice of storing food underground in storage pits at the Longest site, Anthony Glass (1808) said, “they bury these bags of Corn in the ground and so artfully conceal the place that if an Enemy should ... come in their absence ... they would not find their corn” (John 1982:422).

During the 1965-1966 excavations at the Longest site, storage pits were measured with a maximum diameter of up to 190 cm and a depth of 77-114 cm depending on the type of pit (Bell and Bastian 1967:80). Area 6a contained a positive anomaly that measured approximately 2 m in diameter (Figure 29) on the magnetic map. As discussed above, areas that are dug out and then filled at a later time often exhibit positive magnetic qualities. These characteristics led to the assumption that this was a possible storage pit.

A 1 x 2 m trench (S16-E86.5 to S16-E87.5) was excavated with the expectation that it would intersect the boundary of the anomaly (Figure 29). Excavation to 60 cm exposed bone, charcoal, and soil discoloration where predicted (Figure 30) and auger testing showed the feature extended to 90 cm on the west half of the unit, whereas the east half contained sterile soil. Given the positive nature of the anomaly and similarities in size and depth to those previously excavated at the Longest site, this feature is most likely a storage pit.
Figure 29. Area 6a: Positive anomaly measuring approximately 2 m in diameter.
Figure 30. Area 6a. South wall profile of a probable storage pit. Image used with permission from Richard Drass at the Oklahoma Archaeological Survey, University of Oklahoma (See Appendix). Source: Drass, Richard. “S16E86.5-E87.5.” Norman, Oklahoma. November, 2013.
Area 7: Metal Debris

The dipolar anomaly located here (Figure 32) is indicative of metallic debris, which causes large spikes in magnetism displaying both the north and south poles. A 1 x 1 m unit (S26.5-E81) was excavated in order to verify that metal was the source of the anomaly (See Figure 15 for anomaly location process). Modern, metallic fragments were scattered throughout the area in the plow zone, and no feature was encountered by 40 cm below the current surface. The use of a metal detector did not reveal any other metal in the unit, so excavation was abandoned and the source of the anomaly was considered to be a scatter of modern agricultural debris. The positive anomaly associated with and slightly south-southwest of this dipolar anomaly is a possible area for future research, as it is quite large and seems similar to the possible storage pit in Area 6a.
Area 8: Possible House Structure

Anthropogenic features typically exhibit geometric shapes, and dug out features or high traffic areas are often revealed as negative anomalies in magnetic datasets. Previous excavation at the Longest site exposed circular structures with dimensions of 10 x 10 m and 6 x 6 m, an oblong structure measuring 4 x 15 m, and a possible 10 x 10 m structure (Bell and Bastian 1967:73-74). The circular negative anomaly in Area 8 measures approximately 10 m in diameter (Figure 33) and in context with the surrounding area in the magnetic dataset (Figures 9 and 10), seems to represent an anthropogenic feature, possibly a house floor. Three 1 x 1 m units (S11, S13, S15-E146) were excavated in order to establish the presence of a structural feature (Figure 33). When no floor was exposed through a depth of
40 cm, an auger test and shovel test to 60 cm was conducted in the southernmost unit (Figure 34), also with negative results.

Figure 33. Area 8 contained three 1 x 1 m unit excavations with no features present.

While this anomaly clearly suggests an anthropogenic origin, no feature characteristics were seen during excavation. This may mean that the feature represented by the anomaly is deeper than expected or was not detectable by the archaeologists in the excavated stratigraphic profile. Future research should include further investigation of Area 8 using other geophysical instrumentation and possibly a trench excavation designed to intersect the boundary of the expected feature.

Area 9: Linear Anomaly

Due to time constraints, no excavation was conducted in Area 9. However, the magnetic dataset clearly shows a linear anomaly continuing the curvilinear trench located in Area 1c (Figures 17, 35a and 35b). This trench ends perpendicularly to the probable location of the outer moat feature which is not represented in the magnetic data in Area 9. Perhaps this trench provided some form of irrigation to, or drainage from, the inside of the fortification. It is also possible that this is the secondary entrance on the east side of the fortification that is mentioned in Lipscomb’s first translation of Oyarzún’s diary (Lipscomb 2002:108). As this anomaly is on the east side of the fortification in the magnetic map, the eastern orientation of this possible entrance would fit Oyarzún’s description, even if there was confusion regarding fort location and cardinal directions as discussed above (Figures 3 and 4). Definitive identification of this anomaly is left for future investigation.
Area 10: Large Scatter of Metallic Debris

This area represents a cluster of dipolar anomalies measuring approximately 35 x 35 m (Figure 36). Previous excavation less than 100 m southwest of the fortification revealed a nineteenth century cellar (Bell and Bastian 1967:63, Feature 15) around which was the densest scatter of historic artifacts (Drass 2007:8). Also, Drass (2007:14) notes that the Longest family collection of artifacts includes two hematite stones and iron gun parts. The location of the historic structure and magnetic material in the
collection suggests that the dipolar anomalies in Area 10 likely represent farmstead debris such as fencing or iron nails with possible protohistoric artifacts.

Figure 36. Area 10 is a large cluster of dipolar anomalies.

Unfortunately, this area is positioned atop the suspected location of the primary winding entrance into the fort described by Oyarzún in 1759 (Weddle 2007:124). Thus the possible presence of this entrance “toward the same river,” is obscured in the magnetic dataset. Because it is not susceptible to negative effects from metal debris, future geophysical research in Area 10 should include another attempt with resistivity under wetter conditions and further between plowings to improve conductivity. If geophysical methods continue to be unsuccessful at relocating the western entrance or fortification
boundary in this area, then placing an excavation trench perpendicular to the possible location of the outer moat (as interpreted in the magnetic dataset) would be suggested.

Historical documents and previous archaeology suggested that the Longest site may be the location of the Taovayas village and fortification involved in the battle with the Spanish in 1759. In Bell and Bastian’s summary, they state that finding the fortification’s subterranean structures would “establish this identification [of the fort] beyond question, and this should be a goal of future planning ... [and] the fortification should be carefully excavated to trace its size, nature, and interior associated structures” (Bell and Bastian 1967:118). The research presented above facilitates positive identification of the fortification and subterranean features using archaeological prospecting, research into historical documents, and minimal excavation to validate geophysical findings.
Chapter 5: Conclusions and Future Research

Conclusions

The purpose of this research was to exemplify a multidirectional approach to an archaeological interpretation of the eighteenth century Taovayas village and fortification located on the Red River bordering Oklahoma and Texas. The battle in 1759 between Spanish colonials and a confederation of Native Americans at the Taovayas village led to several Spanish primary documents describing the people that lived there, the fortification and surrounding village, and the battle itself. Investigation of the Longest site (34JF1) in Oklahoma presented a remarkable opportunity to combine information gained from historical documents, archaeological prospecting using geophysics, and traditional excavation techniques in order to garner a more complete understanding of this important archaeological site. Research questions included measuring the success of differing geophysical methods, the usefulness of historical accounts when interpreting geophysical results and pinpointing excavation, and assessing this methodology as a way to definitively identify the fortification at the Longest site as the historic Taovayas stronghold.

Bell and Bastian (1967) stated that this site was possibly the location of the Taovayas’ battle with the Spanish in 1759 and that the fortification likely represented the one from historical accounts (Bell and Bastian 1967:114). They suggested that in order to positively identify 34JF1 as this well documented site, excavation of the fortification and associated interior rooms should be included in future research (Bell and Bastian 1967:114). This research was aimed at continuing their work by identifying these features and possibly locating additional features that would corroborate with historical accounts of the Taovayas village. However, rather than using excavation as the primary means of exploration, the focus was on geophysical and historical research as a way to better understand the site before excavation.

This research began with an assessment of the effectiveness of geophysical techniques at the Longest site. Due to lack of available time in the field, a principal research focus was on cost in regards to time required for data collection and the success of varying geophysical techniques in locating anthropogenic features over broad areas. While ground-penetrating radar and electrical resistivity
methods provided viable results, magnetic survey proved to be the most efficient and provided the clearest data. Therefore, magnetometry was conducted for wide-area survey, whereas GPR and resistivity data were used sparingly.

This process facilitated successful relocation of the fortification at the Taovayas village along with some associated features. Results for each geophysical method used at the Longest site can be improved upon, but were quite satisfactory. Areas 1-10 above contain examples of each type of magnetic anomaly at the site, and are representative of the expected features as described in historical documentation. In all but one case (Area 8), excavation of the anomalies in the magnetic dataset provided validation that they were indeed representative of subsurface features or metal artifacts. Also, through research of historical documents, expected features were identifiable once excavated.

Information gleaned from primary and secondary documents provided valuable insight when interpreting the anomalies representing these features in the geophysical data. Several of these documents describe varying aspects of the Taovayas and their village. Initially, the fortification was described by Fray Francisco Zedano as a palisaded structure with an associated earthen embankment and moat surrounding subterranean rooms. This description was substantiated by Colonel Diego Ortiz Parrilla and Captain Juan Angel de Oyarzún after a failed punitive campaign in 1759 aimed at retaliation for the Native American attack on San Sabá the year before. During the battle on the river next to the Taovayas village, they saw a large palisaded fortification with a winding entrance leading to the river. Also, Antonio Treviño, a captive at the village in 1765, described in detail the fortification, moat, earthen embankment, and subterranean rooms. For this research, these possible features represented significant targets for geophysical survey, and descriptions found in historical documents facilitated interpretation of the anomalies in the geophysical data.

Precisely directed and minimal archaeological excavation at the Longest site was a testament to the value of geophysical survey in archaeology. Historical documents informed interpretation of the magnetic dataset, which revealed the location of the Taovayas fort and adjacent area. This allowed precision placement of 36 m$^2$ of hand excavation units, thus conserving this important part of Wichita cultural heritage while increasing archaeological knowledge. This minimal excavation provided validation
of most interpretations of the geophysical anomalies, and seems to have confirmed the historically
documented locations and dimensions of important targeted features such as the moat, palisade, and
interior subterranean rooms. In the end, locating these features through geophysics and excavation
support the identification of the Longest site as the eighteenth century village and fortification of the Taovayas involved in the battle with Parrilla and Oyarzún in 1759.

Future Research

This thesis only scratches the surface of possible geophysical research at the Longest site. Due
to the demonstrated success of magnetometry, resistivity and ground-penetrating radar at the site, all
future archaeology there should begin with these techniques. All three methods described above have
the potential to provide a map of the entire site, lending information relevant to settlement pattern and the
ability to pinpoint excavations. Furthermore, while the surface area of site-wide test excavations during
Bell and Bastian’s research (1,274 m$^2$) cannot be directly compared to that of this project (36 m$^2$), it
remains clear that properly conducted geophysical research will prevent much unnecessary destruction of
valuable cultural resources.

During research of primary documents and prior archaeology at the Longest site, information
regarding the location of soldiers during the battle shed light on where the battlefield might be found.
Oyarzún provided general descriptions of where Spanish cannons were located, and how far the soldiers
were from the Taovayas fortification by stating that they were within an average gunshot. This allowed
the usage of distance buffers in a geographical information system to delineate boundaries within which
the battle most likely occurred (Figure 5). The location of the battlefield would lend great insight into the
observations provided by Oyarzún and Parrilla, as their point of view when describing the fortification’s
primary and secondary entrances, palisaded corrals, and the associated Comanche camp could
potentially change ideas of where these might be located on the landscape. Assuming the battlefield is
still represented in the archaeological record, it is most likely located within the distance buffers presented
above (Figure 5), probably somewhere in the current riverbed.
Also, in various maps and illustrations, the site seems to be incorrectly situated in relation to the proposed battlefield. The fortification is sometimes represented on the Texas side of the river (Figure 3), or the river next to the village is shown trending east-west instead of north-south (Figure 4). This is probably attributable to the Oklahoma side of the river being commonly called the “north bank.” This simple misconception can cause drastic differences in possible feature location when using firsthand accounts of the village. In the future, this possibility should be kept in mind when reviewing historical documents describing the Longest site. Lastly, while there is no reason to doubt the validity of the translations available for this research, fluency in Spanish would allow the researcher personal interpretation of meaning within the document. This would provide a richer understanding of the reality described in the narrative.

When conducting archaeological research, it is all too easy to become overly caught up in method and theory and to forget about the actual people involved in creating the archaeological record in the first place. Combining physical methods with historical description allows the researcher to give deeper meaning to the features and artifacts, to “flesh them out” with historical detail and get at not only what was there, but why it was. The fortification at the Longest site is not simply an anomaly in a geophysical dataset or a feature meant to be excavated. Through the firsthand accounts discussed above and others, we see this location as representing a vital piece of the Taovayas culture in the eighteenth century, the home of a vibrant people and a source of prestige, protection, and power in a wildly changing political atmosphere.
References Cited

Addington, Larry H.
1994 *The patterns of war since the eighteenth century*. Indiana University Press, Bloomington.

Avery, T. E., and G. L. Berlin

Barber, Russell J., and Frances F. Berdan

Bastian, Tyler

Bell, Robert E.

Bell, Robert E., and Tyler Bastian

Bell, Robert E., with Edward B. Jelks and W.W. Newcomb

Bolton, Herbert E.


Conyers, Lawrence B.

Conyers, Lawrence B.

Conyers, Lawrence B., Jeff Lucius, Martha West, Pyoosh Rai, and Prashant Kumar

Drass, Richard
Drass, Richard, and James Clanahan
2007 Update of Archaeological Records Regarding the Longest Site (34JF1).
Manuscript on file, Oklahoma Archaeological Survey, Norman.

Duffield, Lathel F.

DuVal, Kathleen

Giardino, M. G., and B. S. Haley

Gibson, Arrell Morgan

Halleck, Henry Wager

Hargrave, Michael L.

John, Elizabeth A. H.
1975 *Storms Brewed in Other Men’s Worlds.* Texas A&M University Press, College Station.

John, Elizabeth A. H., and Anthony Glass

Kintigh, Keith W.

Kvamme, Kenneth L.


Lanier, Fanita
1935 *Map of an Historic Area in North Texas Known as the Three Forks of the Trinity River: From the Advent of the First White Man to the End of the Confederacy, 1541-1865.* [1.25 inches to 10 miles]. In Texas Map Collection. The Doph Briscoe center for American History. The University of Texas at Austin.
Lipscomb, Carol A.  

Lockhart, Jami J.  

Manucy, A. C.  

Mason, W. M.  

Newcomb Jr., W. W.  
1976 *The People Called Wichita.* Indian Tribal Series, Phoenix.

Parrilla, Diego Ortiz  

Smith, F. Todd  

Somers, Lewis  

Treviño, Antonio  

Vehik, Susan C.  

Weddle, Robert S., and Juan Ángel de Oyarzún  

Wedel, Mildred Mott  

Weymouth, J.W.  

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