ELECTROMAGETISM, SITE FORMATION, AND CONFLICT EVENT THEORY AT THE SAN JACINTO BATTLEGROUND AND WASHINGTON-ON-THE-BRAZOS, TEXAS

A Dissertation

by

DANA LEE PERTERMANN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2011

Major Subject: Anthropology

Electromagnetism, Site Formation, and Conflict Event Theory at the San Jacinto

Battleground and Washington-on-the-Brazos, Texas

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Approved by:

Chair of Committee,	D. Bruce Dickson
Committee Members,	Michael R. Waters
	Mark E. Everett
	Robert Warden
Head of Department,	Cynthia Werner

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ABSTRACT

Electromagnetism, Site Formation, and Conflict Event Theory at the San Jacinto Battleground and Washington-on-the-Brazos, Texas. (August 2011)

Dana Lee Pertermann, B.A, University of Minnesota; M.A., Illinois State University

Chair of Advisory Committee: Dr. D. Bruce Dickson

Conflict Event theory has the potential to change how archaeologists investigate battlefield sites. As a theoretical paradigm, *eventful archaeology* allows us to give agency to social-structure changing events, going beyond collect artifacts after the battle is over. Coupled with site formation processes, this model allows us to project battle elements to re-create the historical events that occurred at conflict sites. Within this theoretical framework, we can begin to understand why the conflict unfolded in a particular manner. Two sites of the Texian Revolution are particularly appropriate to this new theoretical model: the San Jacinto Battleground (SJB), the location of the last battle of the Texian Revolution, and Washington-on-the-Brazos (WOB), the location of the signing of the Texas Declaration of Independence.

Merging this theoretical model with an investigation of site formation processes (understanding the matrix in which the artifacts lie) and pulse-domain electromagnetic surveying allows for a much more robust approach to Battlefield Archaeology. Pulse-induction allows for the detection of discrete artifacts in the soil, and is a much more reliable method than the more commonly used magnetometry. Analyzing characteristics of the soil surrounding the artifacts then gives us a third line of inquiry as to why artifacts are in certain

locations in the archaeological record, allowing for an explanation as to their quality and quantity.

DEDICATION

Dedicated to Luke Young and Sam Houston, two of my personal heroes.

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CHAPTER I

INTRODUCTION OF THE PROBLEMS

Battlefields are the ultimate expression of power (Moore and Mangum 2007). Formal conflicts such as battles express the best and the worst of human nature: our excellent ability to organize and accomplish common goals, as well as our inability many times to solve differences without resorting to violence. While a time-capsule of how power was used at the time to achieve an end, battlefields are also powerful social tools after the conflict is over, being re-imagined to perform a cultural function. The study of myth by Levi-Strauss and others has shown the power such re-imagining can have (Lévi-Strauss 1963).

The study of conflict to date lacks multiple lines of inquiry in both methodology and theory. Investigations such as the one at the Battle of Little Big Horn have shown the value of archaeology in determining the actual battle plan and precise events that occurred during the battle itself to help clarify about the details of the battle using hand-held metal detectors that are common among amateur treasure hunters.

This dissertation follows the style of *American Antiquity*.

This methodology has led to a boom of battlefield archaeology research in the U.S. (Cooksey and Lynch 2007; Geier et al. 2010; Scott et al. 2000; Starbuck 2011), but has isolated Battlefield Archaeology from the larger theoretical concepts being developed in Archaeology and in Historical Archaeology specifically. It also has failed to incorporate Geoarchaeology, important as the objects of our interest are coming up out of the soil and sediment deposited between the event in question and today.

It is therefore vital that continued work in the field of Battlefield Archaeology begins to address theoretical questions of conflict and behavior that simply analyzing artifacts cannot answer. The question of human behavior, then, becomes one of possible diagnostic tools: Is the spatial patterning of artifacts, coupled with their arrangement and condition in the soil, diagnostic of human behavior during conflict?

Unexpected ruptures in material culture patterning present interpretive challenges for archaeological narratives of social change. The concept of the *event*, as proposed by William Sewell Jr., offers a robust theoretical vocabulary for understanding the sudden appearance of novel patterning in a society. Sewell defines historical events as sequences of happenings or occurrences that transform social structures by creating durable ruptures between material resources and their associated virtual schemas (2005). The *archaeology of event*, then, as outlined by Beck et al. 2007, expands on Sewell's social theory in terms of archaeology and material culture: "Thus conceived, events occur in three phases: (1) a sequence of contingent happenings produces (2) ruptures in the articulation of resources and schemas, creating (3) an opportunity for rearticulation within new frames of reference. This perspective has much to recommend it for archaeology because it explicitly and uniquely grounds the concepts of structure, structural change, and agency in materiality" (833). This new theory of understanding events and their connection to human behavior is now termed Conflict Event theory, or CET. In terms of Battlefield and Conflict Archaeology, then, this theoretical paradigm puts artifacts in their proper place by recognizing artifacts and artifact assemblages as a holistic expression of force, instead of happenstance objects of random behavior.

Texas is a perfect example both of the use of power for social change and the re-use of events for cultural expression and solidarity. Much of the culture of Texas today directly stems to the confluence of resources and desires of the days before and after the Texas Revolution. Two sites lend themselves well to this study of the use of power: the San Jacinto Battleground as the final battle between the Texian revolutionaries and the Mexican government, and Washington-on-the-Brazos, the location of the signing of the Texas Declaration of Independence.

The San Jacinto Battleground (SJB) (Figure 1[*]) is important due to its historical significance in connection with the 19th century Texas Revolutionary war and the subsequent founding of the Republic of Texas. SJB is the site of the ultimate 1836 battle, coming just a few weeks after the siege of the Alamo, and in which the Texian army under General Sam Houston routed the Mexican forces led by General Santa Anna. To place the battle in a better historical light, there is a need to closely examine actual events of the day by archaeological means. Despite the amount of time military historians have researched historical accounts of

[*] Maps courtesy of www.theodora.com/maps. Used with permission.

the battle, there are remaining uncertainties surrounding the precise directions and strength of attack, the places and forms of contact between the two armies, and the pathways of Mexican retreat. There, too, are conflicting eye witness accounts that cloud understanding of motives and artifacts recovered so far.

To date, all interpretation of the actual battle at SJB comes from primary source documents written well after the main event, such as the biography of Sam Houston (Yoakum 1855), and the autobiography of Antonio Lopez de Santa Anna (Crawford 1988). There has been little comprehensive archaeological work completed on this famous site, other than an initial survey by Carl Pierce at Texas A&M University and Moore Archaeological Consulting (Moore and Mangum 2008; Pierce 2005), but instead many smaller studies of sections of the park required under the laws of Section 106, such as Hole and Cartier's archaeological investigation of the north end of the battleground (1972) and Feit et al.'s test excavations near the Monument (2002).

The highest quality metal detectors can only reach a depth of approximately twelve to fifteen inches. Many of the desiccation cracks that form on this landscape are well over a foot in depth, and have been documented as deep as five feet in locations of common vertisol formation (Mermut et al. 1996). Work with more powerful electromagnetic systems may the potential to produce high-quality data while closing the learning-curve of the traditional hand-held metal detector (Benavides and Everett 2007), as the data can then be interpolated into the method by which artifacts move in such soil over time, giving us hard evidence of the relationship of vertisol formation and the change in orientation of independent objects in such formations. Due to these challenges, the simplistic methodology of using hand-head metal detectors at battlefield sites could possibly miss key components of the 1836 battle.

Washington-on-the-Brazos (WOB), shown in Figure 1 in relation to SJB, is a highly significant site due to its location: it was here that delegates from Texas signed of the Texas Declaration of Independence on March 2nd, 1836. Important men to this future history of Texas were present, such as Stephen F. Austin and Sam Houston. It is also of use archaeologically due to the short timeframe of the town's occupation: Anglo occupation can be detailed to a short two hundred years (Seigel 1971).

This research explores three basic questions and their relationship to each other: 1. Is there a relationship between metal artifacts (which comprise most of the battle-related artifacts recovered (Cooksey and Lynch 2007)) and their electromagnetic signature that can be utilized to discriminate ground anomalies before they are excavated; 2. How do cultural and environmental transforms affect the archaeological record being analyzed by the electromagnetic survey; 3. What can Conflict Event theory tell us about the artifacts once we have recovered them.

Electromagnetism is an underutilized tool in the archaeological exploration of battlefields and other potentially metal-rich historical sites (Simpson et al. 2009). Shallow-lying artifacts, along with copious clutter items, have previous been located by conventional hand-held metal detector sweeps done mostly by looters or a best amateur collectors, making eminent archaeological investigations important. However, the hand-held sensor signal is oftentimes restricted to a simple audio cue. More sophisticated metal detection can be achieved using transient electromagnetic (TEM) prospecting equipment such as the Geonics Ltd. EM63 system (www.geonics.com).

Michael B. Schiffer gives us a starting point for looking at site formation, excellently summed in his book *Site Formation of the Archaeological Record* (1987). Site formation processes from the original occupation to the present time are important to a complete understanding of a site's history. Both environmental and cultural transforms must be taken into account when interpreting the systemic context from the archaeological record (Schiffer 2002). Schiffer outlines many of the problems encountered when investigating sites with extensive activity from either cultural use post-event or changes to artifacts from changes to their natural environment. Once an object is deposited, site formation processes must be analyzed to determine the path it travels to reach the archaeological context it is recovered in.

William Sewell's work on social transformation is a chaotic and *eventful* approach to history events re-interpreted for archaeological investigations by Beck et. al (2007). This theoretical approach can allow the archaeologist for once to forgo rigid models of artifact prediction and appreciate the dynamic relationship between people, place, and thing through the development of CET. Despite processes that may have happened after the event in question has passed, we can interpret the systemic context in order to determine a site's historical significance and level of disturbance. While the study of site formation processes seeks to determine why any particular object was recovered in any particular location/condition, considering *eventful archaeology* allows for a more subtle line of questioning, essentially "Why did this particular object fall here?" We then are able to continue with the far more interesting question of "why did some*one* drop this object here?", which is part of the behavior patterns of truth that every archaeologist is interested in.

CHAPTER II

THE HISTORICAL NARRATIVE OF THE TEXAS REVOLUTION

> “I was, for some years, a member of Congress. In my last canvass, I told the people of my district, that if they saw fit to re-elect me, I would serve them as faithfully as I had done; but, if not, *they might go to hell, and I would go to Texas.* I was beaten, gentlemen, and here I am." Davy Crockett, April 1836 (Brands 2004: 330).

To fully understand the historical significance of SJB and WOB and their relationship to the patterning of the Texas Revolution, one needs to follow the relationship between Texas and Spain, which ultimately begins with Christopher Columbus. Circa 1493, Columbus claimed all of the Americas for the Spanish crown. Two hundred years went by with little change among the different native nations, and little interference by the Spanish. Alonzo Alvarez de Pineda and an expedition party along the Gulf coast were the first Europeans to see and chart the coast of Texas in 1519, looking for a water route to Asia. This expedition resulted in little change for the region, as no return expedition was arranged immediately, and Pineda’s financier, Jamaica’s governor Francisco de Garay, met a questionable end at Hernando Cortez’s dinner table (he was most likely poisoned) (Campbell 2003; Stephens 2010).

Settlement of Texas

Panfilo de Navarez was granted a royal contract to start a settlement in *La Florida*, the term the Spanish used for all land between the east coast of present-day Florida to Rio Panuco, in 1526, and sailed from Spain to the Caribbean in 1527 with 600 men. One hundred and forty men deserted when they anchored in Hispaniola (Campbell 2003; Stephens 2010). Navarez and another two hundred and forty two men, including his second in command, Alvar Nunez Cabeza de Vaca, were permanently separated from the rest of the men and the ships when they landed and went inland looking for gold. This group spent three months in Florida before building their own boats and trying for the coast of Mexico. Instead, they found Texas (Stephens 2010:36). The group was quickly captured by Native Americans living on the coast and forced into slavery. Only four men, Cabeza de Vaca, Alonso del Castillo, Andres Dorantes, and Dorantes' own slave Esteban, eventually escaped and made their way back Mexico. Figure 2[*] shows possible landing points and routes taken by these men as determined by various scholars. While trying to find their way home, these men also took careful note of the terrain, native plants, and different tribes that they encountered (Stephens 2010:37). The information that they imparted upon arrival in Mexico City influenced expenditure on a major expedition by Francisco Vazquez de Coronado to claim the land observed by de Vaca for Spain (Stephens 2010:38)

By the 17th century, the French were interested in Texas as well. LaSalle may have made the biggest change to the history of Texas by outfitting a colonial expedition to Louisiana in

[*] From *Texas: A Historical Altas* by Ray A. Stephens. Used with permission.

1684. He overshot the mouth of the Mississippi River and landed in Matagorda Bay. The expedition was a disaster; coupled with poor decision-making on LaSalle's part and a hostile relationship with the nearby Karankawa, nearly everyone in the colony died by 1687, if they had not deserted among the friendlier Caddo. Fort Saint Louis on Garcitas Creek is all that survives (Campbell 2003). This expedition roused Spain out of its lethargy towards Texas, as while they might not have been interested in it, they certainly didn't want the French colonizing there, accidently or not. In search of LaSalle's colony, the Spanish managed to explore much of the coast of Texas and a good deal of its interior. By 1690, Spain had appointed Alonso de Leon governor of the region, and tasked him with establishing a colony in the same area as LaSalle's fort had been (Stephens 2010:46).

History lays the fault of the beginnings of Spanish hostility to Native Americans in de Leon's lap, as he was insistent on building a military presence in Texas and did little to curb injustices and attacks by Spanish citizens on Indian camps (Campbell 2003). The Spanish explorers and colonists continued to have poor dealings with the Native Americans throughout their tenure, never quite understanding or even caring about cultural differences among the tribes living on their claimed land. Some blame must be given to the hierarchical construction of Spanish society, putting the Native American at the bottom of the social order, with little ability to move upwards, a system that inherently created social resentment and political unrest (Brands 2004; Davis 2004).

Coahuila y Texas was continually seen as the impoverished backwater of Spain's empire by those that governed the land. This attitude, coupled with the treatment of its people, ultimately caused the rupture of Mexico and other colonies from Spain (John 1996; Stephens 2010). On the flip side, the missionary work in Texana (a broad term used to describe the region) was moderately successful largely due to the work of Father Damian Massanent of the Franciscan Order (Stephens 2010:50). Father Massenent's interest of building missions dovetailed with the Spanish government's reluctance to spend much money on the development of Texas (missions were easily constructed and maintained). While ultimately failing politically, the Spanish government and culture were able to conquer much of the area religiously (Campbell 2003).

The wars in Europe also had a great deal of influence over the history of Texas. In 1763, the Treaty of Paris ended the Seven Years War, and saw the end of French colonial rule in the Americas. France ceded the northeast portion of its American claim to England, and the southwest portion to Spain. Spain gave Florida to England, as it was not contiguous to the rest of its land (Stephens 2010:64). This reshuffle of rule set up the opportunity for English colonists to raise their voices in grievance, as they were no longer beholden to the British military for protection against the French. Spain did participate in the American Revolution, though perhaps not as overtly as France did, concerned that the poison of revolution would leak over into Spanish America. They drove the British out of Baton Rouge, Natchez, Mobile, and Pensacola, and kept the Mississippi River free for the rebels to travel on and for supplies to travel through (Davis 2004). In gratitude, the newly formed U.S. Congress gave Florida back to Spain in 1783. These changes put more money into Texas, as the Spanish government authorized the building of cattle ranches and gave people money to start them, so long as they helped the American Revolution effort with cheap beef, which is still a major export product for Texas today (Campbell 2003).

In 1813 a rebellion in Texas was brutally crushed by the old Spanish government, eager to end the revolutionary movement started by the signing of the Mexican Declaration of Independence in 1810 (Campbell 2003). Ironically, achievement of Mexican independence from Spain in 1821 increased the likelihood of a war for Texian independence from the newly formed Mexican government (Davis 2004). The memory of that aborted revolt in Texas was not forgotten when the region changed governing hands. Mexico City began to fear the Anglo due to the constant hostility in Texas between Anglos, various Native American tribes, and Hispanics, discouraged loyal Mexicans from immigrating north (Hardin 1996). In the eyes of the Mexican government, something had to be done.

Stephen Fuller Austin, born in Virginia in 1793 and now considered the "Father of Texas", took up his father's deathbed wish to start a colony in central Texas. Moses Austin, his father, had been given the go ahead to colonize 300 families on the mouth of the Colorado from the outgoing Spanish government. By the time Austin reached San Antonio, the region had a new government, which seemed friendly to the idea of colonization and development, still smarting under the apathy of Spanish rule (Campbell 2003). Partnering with his father's old friend Philip Bögel, a Dutch citizen that had taken the invented title of "Baron de Bastrop", Austin established a colony on the mouth of the Colorado and one on the Brazos. In this way Austin and Bastrop (for whom the town of Bastrop, Texas is named), opened the floodgates of Anglo settlement. The populating of Texas seemed so successful that in the

Spring of 1825 Mexico passed the Colonization Act, which gave even the impoverished the ability to claim cheap land and pay for it over six years (Stephens 2010:75). The Mexican government, in its desire to develop land that had been neglected by the Spanish government, first planted the seeds of the destruction to the class system in Texas by allowing the lower classes to become land owners and ignoring the claims of the Commanches, Caddo, and Karankawa, to their lands. This Act did not take into account the Native American's claim to the land, and lead to further strife with native Texas peoples. East Texans, the farthest from Mexico City, rejoiced at the Act that quickly festered in frustration at being unable to gain clear land titles (Lack 1992). Relations between the government and the governed began to worsen from this point.

The Anglo settlers had their own ideas of justice and sovereign rule that caused friction with Mexico almost from the beginning. While Austin's colony flourished, the colonies of Green DeWitt and Haden Edwards did not easily recognize Mexico's right to dictate policy and appoint political overseers. Mexican oversight was particularly weak in East Texana, a lawless area that was set up as a buffer zone between Spain and English holdings in the last century (Lack 1992; Stephens 2010). This disconnect between what settlers expected from government and what Mexico City felt was prepared to offer continued to grow. When Edwards tried to bring in new colonists to Nacogdoches in September 1825, he angered the old settlers to the area by raising land fees and holding an election that put his own son as *alcalde*, or mayor, of Nacogdoches. As those new settlers that did not yet own land were allowed to vote in this election, the old settlers called the election fraudulent and complained to Jose Antonio Saucedo, the political chief of San Antonio. Saucedo decertified the election, and reported Edward's actions to the government in Mexico City. Mexico City then took the unheard of action of nullifying Edwards' *empresareo* contract. The men among the new colonists did not care. Thirty-six men from the new group "arrested" the previous *alcalde* and other officials. Saucedo sent a military force to Nacogdoches when he heard of this action. Edwards and his friends decided to turn this "coup" into a full-scale rebellion, declaring the Republic of Fredonia (Campbell 2003; Stephens 2010:78). The movement fell apart before any actual fighting took place, but Mexico City did not easily forget the rebellion started by Anglos.

Interestingly, settlers from "upper" southern states such as Georgia and Virginia tended to settle in the northern portions of Texas, while settlers from "lower" southern states such as Louisiana and Arkansas settled in the southern half of Texas. This split is important, as most of the people from these upper-southern states were Protestants, unlike peoples from Louisiana surrounding states, who tended to be Catholic. These new Protestants did not usually comply with the requirement to only practice Catholicism when colonizing Texas, as Mexico simply did not have the means to enforce such a requirement (Campbell 2003). Also, Anglo settlers brought slaves to Texas, as the colonists felt that it was the most efficient way to raise cotton. Though slavery had been officially abolished in Mexico, the Mexican government turned a blind eye to slaves brought in by Anglos, so long as they were not sold publically and were used to the benefit of developing the land (Campbell 1991). These developments continued to divide the forming culture of Texas from Mexico.

By 1830, there were serious concerns in Mexico City about the number of Anglos in Texas. While many settlers were organized in colonies that had been created by contract from Mexico City, many more Anglo settlers were "illegal", or not settled under an *empresareo* (Lack 1982; McDonald 1982; Pohl 1989). In April of 1830, the Mexican Congress passed a law halting further immigration from the U.S. at all. Of course, this law could be by-passed if you had money or friends, which angered the settlers even more (Hardin 1996; Stephens 2010:74). Anglo settlers were outraged at what they saw was an unconstitutional law discriminating against those of Western European descent (Campbell 2003).

In the spring of 1833, Antonio López de Santa Anna was elected president of Mexico. By that winter, Santa Anna had repealed the Constitution of 1824 and the Mexican Congress passed a law calling for the forced disarming of all non-federally employed citizens. This so concerned Austin that he made his way to Mexico City to address the Congress to advocate for Texas statehood. Being ignored by the government, he wrote a rather impolitic letter to the major of San Antonio, suggesting that they should declare independence without government support. Austin was arrested at Santa Anna's orders on charges of sedition, and jailed for two years (Hardin 1996).

Santa Anna assumed full dictatorial powers in 1835, causing the province of Zacatecas to revolt in May of that year. Santa Anna crushed the revolt with the ruthlessness for which he was to become famous, killing over two thousand non-combatants (Hardin 1996). There are good reasons for his behavior, however. With the arrival of Sam Houston in Texas, Santa Anna believed that the U.S. was actively trying to gain Texas, as Sam Houston was seen as the personal envoy of U.S. president Andrew Jackson (Brands 2004). Revolts could not be tolerated, for fear of a sweeping call for him to step down. Because of this fear, the Mexican government then began actively enforcing the law prohibiting private citizens from possessing arms, with the recall of the cannon at the colony of Gonzales in September by the military commander at San Antonio de Béxar, Colonel Domingo Ugartechea. The six-pound cannon had been given to the colony in 1831 to defend against attacks by roving Native American tribes. The unit sent to pick up the cannon was escorted out of Gonzales by armed citizens (Campbell 2003; Hardin 1996).

This action made war nearly inevitable, as it was now a point of honor that Ugartechea's orders, as the commander of Béxar, be enforced (Brands 2004). Ugartechea sent Lieutenant Francisco Castaneda and a hundred dragoons to claim the cannon. Though Castaneda had no orders to actually attack the settlement, the citizens of Gonzales treated the sending of so many troops as an attack in and of itself, and started planning for an assault (Brands 2004). The knowledge of troops marching to Gonzales spread quickly, and the leaders in many of the other settlements began to send communiqués espousing war. The community of San Felipe sent out one such broadside, stating that the coming of Mexican troops' "real object is to destroy and break up foreign settlements in Texas" (Hardin 1996:35). It did not matter to the settlers that there was no factual basis for this claim. On the contrary, Santa Anna had specifically told his commanders to not incite violence without his direct orders (Crawford 1988). It is unclear if the Mexican military commanders gave much thought to how sending troops to a settlement would be perceived at the time. In the minds of the settlers, the army's actions spoke louder than their words.

When Castañeda arrived at the rain-swollen banks of the Guadalupe River near Gonzales, he was unable to cross. Castañeda established a camp, and Gonzales buried the cannon the general came for and called for volunteers. This army attacked early on October 2nd, 1835. Two Mexican soldiers were killed, and one Texian was injured when he fell off his horse during the skirmish. Over the next several days, volunteers continued to gather at Gonzales, and began to refer to themselves as the Texian Army (McDonald 1982; Pohl 1989; Hardin 1996). The settlement of Gonzales immediately took action, sending 18 armed men to meet the Mexican forces. Though there was some attempt to calm the situation, the settlers now had no wish to be calmed, and no reason (in their minds) to trust anything a Mexican official said or promised (McDonald 1982).

After learning of the rebels' victory at Gonzales, Cos retreated to Béxar with the bulk of his soldiers on October 5th. On October 10th, Texians in Matagorda decided to march on the Mexican garrison at Presidio La Bahía in Goliad, and the Mexican garrison surrendered after a 30-minute battle. Over the next several days, while the Texian army grew at La Bahia, Austin ordered that one hundred men remain at Goliad, under the command of Captain Philip Dimmitt. The remaining garrison was ordered to join the Texian army in marching on Cos' troops in Béxar. One week later, the men reached Salado Creek and initiated a siege of Béxar. The Texians gradually moved their camp nearer Béxar, and on October 27th had made camp at Mission San Francisco de la Espada (Stephens 2010). That afternoon Austin sent James Bowie and James Fannin with a contingent of men to find a closer campsite. The men realized that Mission Concepción was a good defensive spot (Stephens 2010:86). Rather than return immediately to Austin, as their orders specified, Bowie and Fannin instead sent a courier to bring Austin directions to Concepción. The next day, an angry Austin issued a statement threatening officers who chose not to follow orders with court-martial (Campbell 2003). General Cos had learned that the Texian Army was temporarily divided and immediately sent Ugartechea and troops to engage Bowie and Fannin's men. However, Fannin and Bowie were able to keep the Mexican army at bay until reinforcements arrived. The Battle of Concepción on October 28th, 1836 is considered by historians as the first major engagement of the Texian Revolution (Hardin 1996).

The Texian Army volunteers had little or no experience as professional soldiers, and by early November many had begun to miss their homes. As the weather turned colder and rations grew smaller, many soldiers became sick, and groups of men began to desert the army. On November 18th, however, a group of volunteers from the United States, known as the New Orleans Greys, joined the Texian Army (Hardin 1996). Unlike the majority of the Texian volunteers, the Greys looked like soldiers, with uniforms, well-maintained rifles, adequate ammunition, and some semblance of discipline. The Greys, as well as several companies of Texians who had arrived recently, were eager to face the Mexican Army directly. The Texian volunteers, however, began to become discouraged with the siege (Brands 2004). Within days Austin resigned his command to become a commissioner to the United States; the Texian Army elected Edward Burleson as their new commander. Burleson proposed that the army lift the siege on Béxar. Several hundred soldiers, including the New Orleans Greys, however, agreed to participate in an attack on December 5th (Hardin 1996:60). General Benjamin Milam and Colonel Frank W. Johnson led two columns of men into the city. For the next few days, they fought their way from house to house towards the fortified plazas where the Mexican soldiers waited. Milam was killed by a sharpshooter on December 7th. On December 9th, Cos and withdrew into the Alamo Mission on the outskirts of Béxar, where Cos presented a plan for a counterattack to his men. Cavalry officers believed that they would be surrounded by Texians and refused his orders. Around a hundred and seventy-five soldiers left and rode south. On December 11th, the Texians officially accepted Cos' surrender (McDonald 1982; Edmonson 2000).

Under the terms of the surrender, Cos and his men would leave Texas and no longer fight against the Constitution of 1824. With his departure, there was no longer an organized garrison of Mexican troops in Texas, and many of the Texians believed that the war was over. Burleson resigned his leadership of the army on December 15th and returned to his home. Many of the men did likewise, and Johnson assumed command of the four hundred soldiers who remained (Hardin 1996; Pohl 1989). In fact, the war was not over, but just beginning.

The Fall of Goliad and the Alamo

In late April 1836, General José Urrea marched into Texas from Matamoros, making his way north following the coast of Texas, thus preventing any foreign aid by sea to the Texian Army and allowing the Mexican Navy to deliver food and clothing to the Mexican troops (Edmonson 2000:39). After surprising Colonel Frank Johnson and his troops at the Battle of San Patricio, Urrea's forces defeated a small Texian force at the Battle of Agua Dulce on March 2nd, 1836 (Hardin 1996). Urrea then led his troops toward Goliad, where Fannin commanded four hundred and fifty of the only Texian Army troops outside the Alamo. Fannin made the fatal mistake of dividing his force by sending out one hundred and forty-eight Texians to Refugio. The Texians were again to be defeated (Edmonson 2000:33).

Fannin was then ordered by Houston on March 11th to abandon Goliad and retreat to Victoria, but delayed his retreat until March 19th. His force of about three hundred men were then caught on the open prairie at a slight depression near Coleto Creek. Overnight, Urrea's forces surrounded the Texians, brought up cannon and reinforcements, and induced Fannin's surrender under honorable terms the next day (Pohl 1989). About three hundred and forty of the Texian troops captured during the Goliad Campaign were then executed on March 27th, under Santa Anna's direct orders, widely known as the Goliad Massacre (Hardin 1996). Santa Anna had never planned to take prisoners, having requested that the Mexican Congress pass a resolution defining all rebels as pirates in October 1836 (Scott 2000:71). This cleared the way for Santa Anna to simply execute anyone that he deemed attacking Mexico, as pirates were not generally permitted trials during this time. It is unclear, however, if Texian recruits were aware of this resolution and its implications (Hardin 1996:102).

The Mexican army arrived in Béxar on February 23rd. The Texian garrison was completely unprepared for their arrival and had to quickly gather food from the town to supply the Alamo (McDonald 1982). By late afternoon the city was occupied by fifteen hundred Mexican troops (Stephens 2010). For the next thirteen days, the Mexican army besieged the Alamo. Although there were several small skirmishes that provided the defenders with much needed optimism, they had little real impact. Then, in the early hours of March 6th, the

Mexican army attacked the fort in what became known as the Battle of the Alamo. Almost all of the Texian defenders, estimated at between 182–257 men, were killed, including James Bowie, Davy Crockett and William B. Travis (McDonald 1982; Hardin 1996; Pohl 1989).

Signing of the Texas Declaration of Independence and The Runaway Scrape

In the early 19th century, Washington-on-the-Brazos (WOB) was a small but prosperous town on the Brazos River near modern-day Navasota (Figure 1). WOB had been the second town built by Stephen F. Austin with grant money provided by Mexico (Siegel 1971). The town became famous overnight in 1836 as the location of the Texian General Convention. This gathering would decide the fate of Texas with the site of the signing of the Texas Declaration of Independence on March 2nd (Campbell 2003).

The Independence Convention convened at Washington-on-the-Brazos on March 1st, 1836. Fifty-nine of sixty-one elected regional representatives attended the meeting (Stephens 2010). It was a contentious and difficult meeting, due to varying viewpoints on what should be done about Mexico's aggression, what should be in any new constitution, and the conditions under which the meeting was held, including freezing temperatures (Siegel 1971). Fighting between Mexico and rebel forces had broken out, and many of the delegates chaffed at being forced indoors instead of responding to Santa Anna's siege of the Alamo (Siegel 1971; Hardin 1996). Sam Houston was there at the request of the delegates, and made an impassioned speech which kept many delegates at their task (Siegel 1971). The Texas Declaration of Independence was signed March 2nd, 1836.

The desperate nature of the military situation became apparent when news of the massacre at Goliad reached the delegates (Siegel 1971). Following the signing of the Texas Declaration of Independence, Houston was conferred with the title of General of the Texian Revolutionary Army, and left immediately for Gonzales (Hardin 1996). On March 13th, Susannah Dickinson arrived at Gonzales and informed Houston of the fall of the Alamo. Houston gathered the forces there and began what was seen as a retreat towards Louisiana, panicking settlers in the area that the Texian army was abandoning them (Pohl 1989; McDonald 1982). The Texas Constitution was finished March 9th. On March 17th, as news reached Washington that the Mexican Army was marching towards the town, the delegates elected officers for the provisional government. The next day there was a panicked flight by the residents of the town towards Harrisburg (near the modern day city of Houston), considered more defendable than WOB. As people streamed towards Harrisburg, the news spread that Santa Anna was not far behind, swelling the numbers of families fleeing a dictator that was known for his cruelty. This panicked flight is now known in Texan history as the "Runaway Scrape" (Figure 3*) (Stephens 2010:99).

General Houston recognized that his small army was not prepared to fight Santa Anna. The Mexican cavalry, experienced and feared, was something the Texians could not easily defeat. Seeing that his only choice was to keep the army together enough to be able to fight on favorable grounds, Houston ordered a retreat towards the U.S. border, and many settlers also fled in the same direction (Barker 1901; Campbell 2003). There is speculation that one of the

* From *Texas: A Historical Altas* by Ray A. Stephens. Used with permission.

possible scenarios Houston envisioned was to actually lead his Texian army into Louisiana (U.S. territory), whereupon an invading Mexican army could be attacked not only by the retreating Texian army but also by American forces summoned from garrisons in New Orleans. That Sam Houston was an old friend of then U.S. president Andrew Jackson, and possibly had some communication during this crucial period, and Stephen F. Austin was in New Orleans during this time, lend a measure of credence to such speculation (Campbell 2003; Brands 2004). On its way toward Louisiana, the Texian army implemented a scorched earth policy, denying much-needed food for the Mexican army (Brands 2004). Soon, the rains made the roads impassable, and the cold season made the list of casualties grow in both armies (Dimmick 2006).

Santa Anna's army, always on the heels of Houston, gave unrelenting chase. The town of Gonzales abandoned by the rebels, was put to the torch. The same fate awaited Austin's colony of San Felipe. Despair grew among the ranks of Houston's men, and much animosity was aimed towards him for perceived cowardice at being unwilling to engage Santa Anna (McDonald 1982; Hardin 1996; Brands 2004). Figure 4[*] shows the routes taken by both Santa Anna and Houston and major conflicts before the engagement at San Jacinto.

Houston commandeered the Steamboat Yellowstone so as to facilitate their safe and orderly crossing of the Brazos River when the troops were prepared or should they be discovered. The Texians remained undiscovered for nearly two weeks, allowing the number of volunteers to increase and training them in military discipline (Hardin 1996). The Mexican

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[*] From *Texas: A Historical Altas* by Ray A. Stephens. Used with permission.

Army had no knowledge as to where the main body of Texans was during early April while the Texans knew the location of the three Mexican forces. It was not until Santa Anna arrived in Harrisburg and interrogated civilians there, that he learned Houston had been camped so near his own forces on the Brazos (Castaneda 1928). After crossing the Brazos, the Texan Army marched due east as Houston received reports from his scouts to the rear. This adds perspective to the speculation that Houston intended to flee into US territory. It was an option, but not Houston's preferred option-- he was looking for, and finally found, a weakness in Santa Anna's tactics (Pohl 1989). That weakness came in the form of Santa Anna's rapid pursuit of the provisional Texan government. Leaving the main body the Mexican Army behind at the San Bernard River, Santa Anna assembled a smaller unit of his best troops and hurried off toward New Washington on Trinity Bay just below San Jacinto (Hardin 1996, Edmonson 2000). It was at this time in which Houston turned toward Harrisburg to the southeast at the famed "fork in the road" (Brands 2004:441). From that moment, Houston was no longer in retreat, but rather leading the Army to find a place to confront Santa Anna on Texas soil (McDonald 1982).

Santa Anna tried to capture the provisional government now at Harrisburg by dividing his troops even further, just missing the group at the ferry of Morgan's Point. It is this impulsiveness of Santa Anna, coupled with his underestimation of Houston, that set of the circumstances of the final battle for Texas. Sam Houston had taken the raw troops that he had found at Gonzales northeast as a possible attempt to draw the Mexican Army into U.S. territory and bring the full force of the United States Army down on Mexico, though this is only historical speculation (Hardin 1996; Pohl 1989; Campbell 2003; Stephens 2010). He camped at Groce's landing along Brazos for ten days, drilling and training his men. Houston took delivery of the cannons dubbed the "Twin Sisters", as scouts brought two captured Mexican couriers with messages from the Mexican Gen. Filisola, with the information that Santa Anna's army was close at hand (McDonald 1982). In this way Houston learned that Santa Anna had split his army into two in order to pursue the provisional government. The time for battle had come. Table 2 is a chronology of the conflicts and important events leading up to the Battle of San Jacinto.

The Battle of San Jacinto

These few short days have been written about extensively in both contemporary and historical synthesis sources, including H. Yoakum's survey of Texas history which included imput from Houston himself (1855), Santa Anna's autobiography (Crawford 1988), Barker (1901), McDonald (1982), Hardin (1996), Campbell (2004), David (2004), Lack (1992); and Crisp (2005), to name only a few. Yet major details of what actually occurred are still to this day in dispute. Figure 5 shows slightly different maps drawn after the battle, from different sources, showing slight variations of the Mexican camp and troop movements. These variations would make a rather large difference in how the battle actually played out, though to date little attention has been paid to these differences. This is most likely due to a lack of synthesis archaeology at the site.

Both armies reassembled on the edge of Buffalo Bayou by Lynch's Ferry on April 19th, at Mrs. Peggy McCormick's cattle ranch. To prevent Mexican reinforcements from arriving, Houston ordered the destruction of Vince's Bridge (McDonald 1982; Hardin 1996) on the 20th. The first moves in the war game started with the Mexican dragoons faced up against the Twin Sisters. That morning, Houston ordered the first volley, but the dragoons turned away before they could fire (McDonald 1982). Santa Anna then fired his artillery, grapeshot that only went over the heads of the Texians (Castaneda 1928). Reports of the size of the artillery differ between a 12 pounder, a 9 pounder, and a 6 pounder, with no historical consensus between them (Hardin 1996). The Twin Sisters fired back, with reports disagreeing on whether both fired, or only one (Barker 1901; Pohl 1989). Sidney Sherman requested permission to attempt to capture the Mexican artillery, and Houston reluctantly agreed. Sherman's cavalry charged the Mexican line, driving the Mexicans back to their main line (Yoakum 1855). Because the Texian muskets could only be fired once before reloading, however, they had to stop their advance. The Mexican cannon fired shot again, and then advanced foot soldiers. This continued back and forth several times before combat ended for the day, with Houston being disgusted at Sherman's foolishness and Sherman feeling betrayed for Houston's unwillingness to fight (Pohl 1989). That night, Houston held his first, and last, council of war. Which was probably a good thing, as the council was divided as whether to defend or fight first (McDonald 1982).

Santa Anna's General Cos arrived in the early hours of the 21st. Santa Anna received 700 more soldiers, increasing his total troop numbers to 1300, but they were not the seasoned military men he had requested, but raw recruits (McDonald 1982; Hardin 1996). Houston's men were agitated at this development, as though Houston still seemed to be unwilling to fight. Houston's scouts reported that Santa Anna had allowed almost all of his men to rest.

Not even Mexican sentries were posted. The army spent the morning with no news from Houston, and grew restless (Pohl 1989). Around three p.m., however, everything changed. Houston began giving order for troop movements from a battle plan that no one thought he had (Pohl 1989; McDonald 1982). A line of battle was formed with Edward Burleson in the center. Sherman's cavalry were on the left, and Houston placed the artillery on the right of the formation. According to an early biography of Houston, this line was formed at the treeline of the Texian camp, two ranks deep (Yoakum 1855).

A lone Mexican bugler sounded the alarm of the Texian advance at approximately 4:30 p.m. It took precious minutes for the Mexican officers to fully understand that Houston was attacking in the middle of the day, as they had not believed he would go on the offensive at all and attacking in the afternoon was unheard of (McDonald 1982). Several shots were fired by the undertrained Texian soldiers prematurely, with Houston ahead of the line in the line of fire (McDonald 1982). Once the artillery blew a hole in the hastily formed Mexican line, though, there was no turning back. With Anglos screaming "Remember the Alamo!", "Remember Goliad!" and Tejanos "*Recuerden el Alamo!*", Texian soldiers forced back what was left of the Mexican line. When there was no time to reload, the Texians used their guns as clubs and their bayonets (Barker 1901; McDonald 1982). Mexicans fleeing were shot in the back by the enraged Texians, and even those that made it to water were shot trying to swim to safety. The entire battle is said to have taken eighteen minutes, but the killing of Mexican soldiers and camp followers lasted until darkness fell (Castaneda 1928; James 1929; McDonald 1982; Hardin 1996). The horror of what happened after the main battle was over haunted soldiers the rest of their lives, with reports of the Mexican child drummer-boy being executed where he lay on the ground with his legs broken, and several eye-witness accounts speak of dead Mexican soldiers being scalped (Hardin 1996; Pohl 2006).

There is disagreement in the records when exactly Santa Anna fled the camp. Having reportedly been in the company of a beautiful mixed-race woman known to history as the Yellow Rose of Texas, he did not respond quickly to the sounds of the battle (Campbell 2003). His memoir claims that he left the battlefield only after most of his soldiers had fled, but other recollections state that he preceded his soldiers. This latter account seems most likely, as he surely would have most likely been killed in the frenzy after the Mexican line broke if he had still been in the camp (McDonald 1982).

Houston, however, was in the thick of the battle, and had two horses shot underneath him, shattering his ankle after the first fall. He was able to hobble, however, giving orders for men to guard captured goods from inside the Mexican camp. He remounted for a third time to accept the surrender of Gen. Alamonte and nearly 500 Mexican soldiers, whom the general had rounded up about a mile from the Mexican camp and ordered them to drop all weapons and bullets (Pohl 1989; Mangum and Moore 2011).

Nearly three hundred Mexicans died in the battle, and seven Texians (Hardin 1996). Women and children were also killed, as there were several women followed the soldiers as prostitutes and to help with domestic chores (Hardin 1996). The Texians camped on the land for a few more days, negotiating with Santa Anna once he was captured for the sovereignty of Texas. Most of the dead Mexican soldiers were simply left to rot on the battlefield, to the displeasure of the widow Peggy McCormack, who claimed that her cattle and pasture were ruined by the human remains. The lake that a large percentage of the Mexican troops ran towards is named in her honor (McDonald 1982). It is in this condition that the battleground of San Jacinto was left for several decades.

History of the San Jacinto Battleground and State Historic Site

Today, the battlefield is formally called the San Jacinto Battlefield and State Historic Site (SJBSHS). The land seems to have stayed open to grazing until William McCormick bought the land from the Mexican government in the 1820s (Yoakum 1855; Texas Parks and Wildlife Department 2010). He died in 1825. His wife, Peggy, took over the grant, and her and her sons ranched the land with some light farming before and after the battle. Peggy sued the Mexican government, the Texan government, and the U.S. government for perceived damage to the land from the battle. She never received any compensation. Peggy McCormick died in a house fire in 1903, and an initial area of the land was acquired by the state in 1906. The Daughters of the Texas Revolution raised money to place markers at key points noted by veterans of the battle (Texas Parks and Wildlife Department 2010).

In 1935, a project was commissioned by the State of Texas through the federal Works Project Administration to commemorate the centennial of the Battle of San Jacinto with a monument. This monument was modeled after the Washington Monument in Washington D.C., only taller, including the accompanying reflecting pool. The designers were Alfred C. Finn, an architect, and Robert J. Cummings, an engineer, both from Houston (Bullen 1938).

The building of a road from the ship channel to the monument site and the construction of the monument and reflecting pool themselves did untold damage to the site.

In the 1960s, the ship channel was widened and deepened, and the Battleship Texas was wet docked over the most probable area for Houston's camp. Due to this destruction, it is more than likely that no information remains to be gathered on the Texian side. A Visitor's Center and restroom facilities were added to the park in the 1990s (San Jacinto Battleground internal report 2010).

SJBSHS stayed much the same, with little archaeological work done, until the 21^{st} century. Improvements to the park's infrastructure have required archaeological surveys, but nothing comprehensive (Crouch 1994). Hurricane Ike in 2008 completely demolished several above-ground structures on park land, and damaged many others, including the *Battleship Texas*. Major archaeological finds have been made in the last several years, such as the surrender site of General Alamonte (Mangum and Moore 2011). This find has the potential for expansion of the park area in the near future (Mangum 2011, personal communication).

In 2010, a major environmental project was undertaken to remove the invasive flora species and reseed the park with native Texas prairie grass. This project is currently ongoing (Sipocks 2011, personal communication).

Sam Houston

> "Know all men by these presents that I, Sam Houston, 'late Governor of the State of Tennessee,' do hereby declare to all *scoundrels whomsoever*, that they are authorized to accuse, defame, calumniate, slander, vilify, and libel me to any extent." – noticed published in Nashville newspaper, 1831.

It is impossible to separate the uniqueness of Texas from the person and personality of Gen. Sam Houston. While Stephen F. Austin may be considered the "Father of Modern Texas," Houston has given us a father-figure to look up to and to emulate in terms of the quality that the phrase "Gone to Texas" signifies. In this modern age of cynicism, few other historical figures symbolize an entire culture so clearly.

Sam Houston (Figure 6) was born on March 2, 1793, in the Shenandoah Valley of Virginia, the son of Major Samuel Houston and Elizabeth Paxton (Haley 2002). Young Sam was only 14 when his father died and his mother moved the family to Maryville, Tennessee. In 1809, at age 16, Houston ran away from home, to avoid working as a shop clerk in his older brothers' store.

He went southwest, where he lived for a few years with the Cherokee tribe led by *Ahuludegi* on Hiwassee Island in Tennessee. Houston learned fluent Cherokee, and was adopted by the tribe, giving him the Cherokee name of *Colonneh*, meaning "the Raven." Finally he returned to Maryville in 1812, and at age 19, Houston founded a one-room schoolhouse. This was the first school built in Tennessee, which had become a state in 1796 (Pohl 1989; Stephens 2010).

In 1812 Houston reported to a training camp in Knoxville, Tennessee, and enlisted in the 39th Infantry Regiment to fight in the War of 1812. By December of that year, he had risen from private to third lieutenant. At the Battle of Horseshoe Bend in March 1814, he was wounded in the groin by a Creek arrow. His wound was bandaged, and he rejoined the fight. When Andrew Jackson called on volunteers to dislodge a group of Red Sticks from their breastworks, Houston volunteered, but during the assault he was struck by bullets in the shoulder and arm. He returned to Maryville as a disabled veteran, but later took the army's offer of free surgery and convalesced in a New Orleans, Louisiana hospital (Neely 1995).

Houston became close to Jackson, who was impressed with him and acted as a mentor. In 1817 Jackson appointed him sub-agent in managing the business relating to Jackson's removal of the Cherokees from East Tennessee to a reservation in what is now Arkansas. He had differences with John C. Calhoun, then Secretary of War, who chided him for appearing dressed as a Cherokee at a meeting. More significantly, an inquiry was begun into charges related to Houston's administration of supplies for the Indians. Offended, he resigned in 1818 (Haley 2002).

Following six months of study at the office of Judge James Trimble, Houston passed the bar examination in Nashville, after which he opened a legal practice in Lebanon, Tennessee. He was appointed attorney general of the Nashville district in late 1818, and was also given a command in the state militia. In 1822 Houston was elected to the US House of Representatives for Tennessee, where he was a staunch supporter of fellow Tennessean Andrew Jackson. He was widely considered to be Jackson's political protégé, although their ideas about appropriate treatment of Native Americans differed greatly. Houston was a Congressman from 1823 to 1827, re-elected in 1824. In 1827 he declined to run for re-election to Congress. Instead he ran for, and won, the office of governor of Tennessee, defeating the former governor, William Carroll.

On January 22, 1829, at the age of 35, Houston married 19-year-old Eliza Allen, the daughter of Colonel John Allen, who was a friend of Andrew Jackson. For unknown reasons Eliza left him only a few month into the marriage and returned to her father. Neither Houston nor Eliza Allen ever discussed the reasons for their separation; speculation and gossip accredited their split to Eliza being in love with another man (Haley 2002). In April 1829, in part due to the embarrassment of the separation, Houston resigned as governor of Tennessee and went west with the Cherokee to exile in Arkansas Territory. That year he was adopted as a citizen in the nation. There Houston cohabited with Tiana (anglicized to Diana Rodgers), a part-Cherokee widow in her mid-30s. Though he was still married under civil law he married her under Cherokee law and lived with her for several years (Haley 2002).

In 1830 and again in 1832 Houston visited Washington DC to complain of fraud which government agents committed against the Cherokee. While he was in Washington in April 1832, anti-Jacksonian Congressman William Stanbery of Ohio made accusations about

Houston in a speech on the floor of Congress. Attacking Jackson through his protégé, Stanbery accused Houston of being in league with John Van Fossen and Congressman Robert S. Rose. The three men had bid on supplying rations to the various tribes of Native Americans who were being forcibly relocated because of Jackson's Indian Removal Act of 1830. After Stanbery refused to answer Houston's letters about the accusation, Houston confronted him on Pennsylvania Avenue and beat him with a hickory cane. Stanbery drew one of his pistols and pulled the trigger; the gun misfired. On April 17 Congress ordered Houston's arrest. Pleading self-defense, he hired Francis Scott Key as his lawyer. Houston was found guilty, but thanks to highly placed friends (among them James K. Polk), he was only lightly reprimanded. Stanbery filed charges against Houston in civil court. Judge William Cranch found Houston liable and fined him $500. Houston left the United States for Mexico without paying the fine (Haley 2002).

Houston left for Texas in December 1832 and was immediately swept up in the politics of what was still a territory of the Mexican state of Coahuila y Texas. Attending the Convention of 1833 as representative for Nacogdoches, Houston emerged as a supporter of William Harris Wharton and his brother, who promoted independence from Mexico (Haley 2002). He also attended the Consultation of 1835. The Texas Army commissioned him as Major General in November 1835 (Hardin 1996). He negotiated a peace settlement with the Cherokee of East Texas in February 1836 to allay their fears about independence. At the convention to declare Texan Independence in March 1836, he was made Commander-in-Chief (Campbell 2003).

On March 2nd, 1836, his 43rd birthday, Houston signed the Texas Declaration of Independence at Washington-on-the-Brazos. He soon joined his volunteer army at Gonzales, but retreated before the superior forces of Mexican General Antonio López de Santa Anna. He met and defeated Santa Anna at the Battle of San Jacinto on April 21-22, 1836. Badly beaten, Santa Anna was forced to sign the Treaty of Velasco with Houston, granting Texas its independence. Although Houston stayed on briefly for further negotiations, he returned to the United States for treatment of his ankle wound (Pohl 1989).

Houston was twice elected president of the Republic of Texas. On September 5, 1836 he defeated both Stephen F. Austin and Henry Smith with a landslide of over 79% of the vote. Houston then served from October 22, 1836, to December 10, 1838, and again from December 12, 1841, to December 9, 1844. After the annexation of Texas by the United States in 1845, Houston was elected to the U.S. Senate, and served from February 21, 1846, until March 4, 1859. He was a senator specifically during the Mexican-American War, when the U.S. defeated Mexico acquiring most of the territory of what is now considered the southwest U.S. (Haley 2002).

Houston was concerned about the talk of secession, and was opposed to Texas withdrawing from the Union. In his passionate speech in support of the Compromise of 1850, echoing Matthew 12:25, Houston said "A nation divided against itself cannot stand" (Haley 2002). Eight years later, Abraham Lincoln would express the same sentiment. Houston also opposed the Kansas-Nebraska Act in 1854, and correctly predicted that it would cause a sectional rift in the country that would eventually lead to war, saying: " ... what fields of blood, what scenes of horror, what mighty cities in smoke and ruins– it is brother murdering brother ... I see my beloved South go down in the unequal contest, in a sea of blood and smoking ruin" (Haley 2002:389). He was one of only two Southern senators (the other was John Bell of Tennessee) to vote against the act. Despite the fact that he was a slave-owner, his strong Unionism and opposition to the extension of slavery alienated him from the Texas legislature and other southern States.

An elected convention voted to secede from the United States on February 1, 1861, and Texas joined the Confederate States of America on March 2, 1861. Houston refused to recognize its legality, but the Texas legislature upheld the legitimacy of secession. The political forces that brought about Texas's secession were powerful enough to replace the state's Unionist governor. Houston chose not to resist, but would not give in entirely. He was evicted from his office on March 16, 1861, for refusing to take an oath of loyalty to the Confederacy, writing:

> "Fellow-Citizens, in the name of your rights and liberties, which I believe have been trampled upon, I refuse to take this oath. In the name of the nationality of Texas, which has been betrayed by the Convention, I refuse to take this oath. In the name of the Constitution of Texas, I refuse to take this oath. In the name of my own conscience and manhood, which this Convention would degrade by dragging me before it, to pander to the malice of my enemies, I refuse to take this oath. I deny the power of

> this Convention to speak for Texas....I protest....against all the acts and doings of this convention and I declare them null and void" (Haley 2002:390).

After leaving the Governor's mansion, Houston traveled to Galveston. Along the way, many people demanded an explanation for his refusal to support the Confederacy. On April 19th, 1861 from a hotel window he told a crowd:

> "Let me tell you what is coming. After the sacrifice of countless millions of treasure and hundreds of thousands of lives, you may win Southern independence if God be not against you, but I doubt it. I tell you that, while I believe with you in the doctrine of States' rights, the North is determined to preserve this Union. They are not a fiery, impulsive people as you are, for they live in colder climates. But when they begin to move in a given direction, they move with the steady momentum and perseverance of a mighty avalanche; and what I fear is, they will overwhelm the South" (Haley 2002:391).

In 1862, Houston returned to Huntsville, Texas, and rented the Steamboat House; the hills in Huntsville reminded him of his boyhood home in Tennessee. Houston was active in the Masonic Lodge, transferring his membership to Forrest Lodge #19. His health deteriorated in 1863 due to a persistent cough. In mid-July, Houston developed pneumonia. He died on July

26, 1863 at Steamboat House, with his wife Margaret by his side. His last recorded words were, "Texas! Texas! Margaret…" (Haley 2002).

Sam Houston is buried in Huntsville, Texas. The inscription on his tomb reads:

A Brave Soldier A Fearless Statesman

A Great Orator A Pure Patriot

A Faithful Friend A Loyal Citizen

A Devoted Husband and Father

A Consistent Christian An Honest Man

CHAPTER III

CONFLICT EVENT THEORY

As archaeologists, we tend to look at individual artifacts and assemblages of artifacts with the most interest, missing the "forest for the trees." Likewise, these unique moments have not been properly appreciated in the discipline for their potential contributions to a theoretically robust understanding of culture change and the social utility (the usability) of conflict as an expression of power. Scholars often do not think of battles as processual phenomena; instead scholars have treated battles as snapshots of history, with lists of dates and types of weapons used.

William Sewell, Jr., proposed an "eventful sociology" in which historic occurrences are defined specifically as an "event that transforms social structures (2005:100). Historical events such as battles can be thus conceived as catalysts for substantive social chance, bridging the disciple divide between artifact recovery and human behavior. Assemblages of artifacts, then, acquire texture through these transformative events, and to reject eventful analysis is "to deny history to this most substantial part of our collective past" (Beck et al. 2007:833). These ruptures in the social fabric allow for the creation of new social structures, and should be studied accordingly.

At the center of Sewell's social theory of the event is the concept of structure. Sewell's perspective can be traced to Anthony Gidden's 1984 theory of Structuration (Sewell 2005). The theory of Structuration holds that all human action is performed within the context of a pre-existing social structure which is governed by a set of norms and/or laws which are distinct from those of other social structures. Therefore, all human action is at least partly predetermined based on the varying contextual rules under which it occurs (Giddens 1986) The relationship between social structure and agency (the ability of an individual or a group to make conscious choices) is thereby governed by the availability of resources to the agent. Without resources, all choices are regulated to the realm of wishful-thinking. As Beck et al. explain, Giddens suggests that the ability to command things and people (or the ability to command resources) is what allows structural change (Beck et al. 2007).

In Sewell's more robust theory, it takes both real social rules (though they are unbound and chaotic to the casual observer) and actual resources to create an *event*, (structural change). The reproduction of structures is always affected by the range and kinds of knowledge that social agents bring to any context of interpretation and action. The broader the range of intersecting schemas and resources that people draw upon for social action, the greater the risk to their existing structures and the greater the potential for structural change (Beck et al 2007:836).

> "A factory is not an inert pile of bricks, wood, and metal. It incorporates or actualizes schemas, and this means that the schemas can be inferred from the material form of the factory. The factory gate, the punching-in station, the design of the assembly line: all of these features of the factory teach and

> validate the rules of the capitalist contract" (Sewell 2005:241).

It must be remembered, however, that resource accumulation is unpredictable: a town might burn to the ground; more men volunteer than predicted for a battle; poor planning can leave vital supplies behind. Such contingency in the accumulation of resources means that schemas are always subject to change. Sewell uses this relationship to explain agency as the "capacity to reinterpret and mobilize an array of resources in terms of cultural schemas other than those that initially constituted the array" (pp. 142–43). Not only is structural change the outcome of human agency, but agency is then the capacity to effect structural change.

Beck et al. (2007) link this theory of structural change to a concept of an event that can be seen in the archaeological record (2007), specifically called *eventful archaeology*. More specifically, then, an event reaches across multiple, interconnected structural domains to create durable ruptures in the articulation of resources and schemas, potentially undermining the existing structural network. However, just as not all occurrences produce ruptures, not all ruptures produce events:

> "A single, isolated rupture rarely has the effect of transforming structures because standard procedures and sanctions can usually repair the torn fabric of social practice. Ruptures spiral into transformative historical events when a sequence of interrelated ruptures disarticulates the previous structural network, makes repair difficult, and makes a novel rearticulation possible" (Sewell 2007:221).

Sewell suggests that events are marked by a heightening of emotion and an improvisation of ritual. Heightened emotions contribute to the instability of events and explain in part the unpredictable quality of their unfoldings. New ritual practices, in turn, may be invoked to sanction and formalize this emerging order (2005).

Events thus occur in three stages: (1) a sequence of context-dependent happenings produces (2) multiple ruptures in the articulation of resources and schemas, creating (3) the opportunity for creative rearticulation within novel frames of reference (Beck et al. 2007:835). The greater the diversity of interconnected structures disjointed by any particular occurrence(s), the more profound the event. This is not, however, to reject the significance of gradual, long-term processes in social change. Indeed, such processes—population growth and class formation—are important as they give context, or a level of measurable intensity, to the "eventfulness" of the occurrence.

The direction of the event (the precise path of its unfolding), however, cannot be predicted solely on the basis of context, however enabling that context may seem (Sewell 2005:227). Events, thus conceived, do not *change* the course of histories; rather, events *make* the course of histories, which follow no intrinsic pathway but the contingencies of occurrence, disjunction, and rearticulation (Beck et al. 2007:835). If schemas implicate the material form of their respective resources (a key premise of Sewell's theory), then eventful analysis is not limited to the simple historical facts, and battlefield archaeology can extend the study of events and conflict on a more colorful tapestry of human experience.

Battles are both contingent (subject to chance or unseen events) and contextual (interrelated to all events occurring around it); unique moments in time entrenched in circumstance (Beck et al. 2007:834). Conflict Event theory (CET), then, inspired by Beck et al.'s 2007 *Eventful Archaeology: The Place of Space in Structural Transformation* is the best theoretical model to date for describing the importance of these unique moments in time. The CET concept designation comes out of a special session at the 2011 Society for Historical Archaeology annual meeting in Austin, Texas. Simply put, Conflict Event theory states that it is conflict that has the ability to create social change, with the individual actors in any particular conflict are making conscious choices as to how that change is affected, which can then be seen in the archaeological record.

An analogy of CET would be the children's game of Telephone. This common game illustrates how a message becomes easily garbled through successive iterations. Within our analogy of CET, the initial, or causative event as described by Sewell, is the opening line of the game. Through time, cultural and environmental transforms change the opening line bit by bit, until the archaeological record that is excavated, the last child in our analogy, shows a significant difference than the opening line of the game. The myth of the last response, therefore, is only a relic of the first response, and must be interpreted to learn what the first line actually was.

No theory could better describe the events of the Texian Revolution, the Runaway Scrape, and the Battle of San Jacinto than CET. By situating the events of the Battle of San Jacinto and the days of the Texas Convention within both the contextual framework of the history that came before and the landscape that it occurred in, we can begin to gain a deeper understanding of this transformative *event* in terms of its meaning to the people who fought in the battle, and the people that took in the battle as part of their own cultural heritage.

CHAPTER IV

THE GEOARCHAEOLOGY OF THE TWO STUDY AREAS

"Every archaeological problem starts as a problem in geoarchaeology."

-- Colin Renfrew

Texas' uniqueness starts with its unique landscape. The State of Texas contains a great variety of geologic settings. The region's sedimentary record has been largely influenced by marine transgression-regression cycles over the past 600 million years, with a lesser but still significant contribution from tectonic activity over the past 30 million years. As shown in Figure 7, Texas is approximately divided in two by a series of faults (the Balcones Fault System) that strike southwest to northeast across the state (Swanson 1995). South and east of the faults, rocks are mainly Cenozoic sandstones and shales, underlain by salt domes (Levin 2009). North and west of the faults, there are a number of plateaus, which define the up-thrown block of the fault system. This enormous fault block is an area of extensive Cretaceous shale and limestone outcrops that formed during a long marine transgression. Nearly in the exact center of the state lies the Llano Uplift, best known by Enchanted Rock near Llano, Texas, part of the Town Mountain Batholith that comprises most of the uplift that that formed in the Pre-Cambrian (USGS 2011; Swanson 1995).

West of the Llano uplift, the surface rocks are late Paleozoic and early Mesozoic marine sediments. In the Trans-Pecos Region, near Big Bend and El Paso, there is another, smaller series of faults associated with extensive volcanic deposits, which are the only volcanic rocks in Texas. South of these, in Big Bend National Park, which lies in furthest west Texas along the Mexican border, the Marathon Mountains represent the remnants of an ancient orogeny (mountain-building event) - the same event that formed the Ouachitas (in Oklahoma) and the Appalachians (in the Eastern US) (Levin 2009).

In the early Mesozoic the Gulf of Mexico began to form, as the super-continent Pangaea split apart and North America separated from Europe. Because of this, there are few early Mesozoic rocks in Texas (Levin 2009). Deeply-buried salt deposits and marine limestones that date from the Mesozoic do exist, however, underlying the Gulf Coastal Plain. They were deposited in the young Gulf of Mexico before the Gulf Coastal Plain was formed, and so are covered by it today (Swanson 1995).

During the late Mesozoic (the Cretaceous), the sea transgressed widely onto the land and deposited massive limestones that are visible today in outcrops stretching from Austin all the way into West Texas, forming the Edwards Plateau geologic province. These deposits are so thick and wide-spread because nearly all of Texas was submerged under the last large marine transgression: an epicontinental sea known as the Western Interior Seaway. This shallow sea stretched all the way from the Gulf of Mexico to Canada, covering nearly the entire mid-section of North America. A large percentage of the rocks seen in Texas are limestone, deposited by this ancient seaway (Swanson 1995; Levin 2009).

In the early Cenozoic the Western Interior Seaway regressed, establishing the current Texas drainage system by leaving behind rivers that drain the higher, western portion of the state into the Gulf of Mexico (Wicander and Monroe 2010). These rivers flowed southeast and deposited large quantities of sediments (as deltas) along the southeastern coast of Texas in great thicknesses. So much sediment was deposited that the entire continental margin is weighed down and depressed. This in turn caused a series of normal faults to form, resulting in the Balcones Fault System (Swanson 1995). The subsequent deposition is what formed the Gulf Coastal Plain that composes most of eastern Texas today (Wicander and Monroe 2010).

The soil morphologies of the San Jacinto Battleground and Washington-on-the-Brazos State Historic Site reflect these geologic processes and sedimentary rocks that have shaped Texas. The uplift of West Texas and ensuing erosion give the Brazos the heavy sediment load which created the rapid deposition at WOB. The eventual transport of the finer clay particles to the Gulf, coupled with the climate cycles of extreme wet and dry, create the smectite found at SJB. Both of these soils are important to understand if we are to create a more complex picture of these historical sites.

Soil Morphology of the San Jacinto Battleground

The majority of SJB is underlain by the Beaumont Formation. This deposit is a body of Pleistocene-age river and delta sediments that was deposited by streams during one or more periods of high sea level (interglacials) before 35,000 years ago (Frederick 2007). The core of the Beaumont was described as an orange sandy clay and clayey sand. Most of these deposits contained small iron-manganese concretions. Although the Beaumont sediments were originally calcareous when deposited by streams during the Pleistocene, the period of prolonged weathering has generally leached the topsoil of calcium carbonate, which formed a B horizon containing nodules of secondary calcium carbonate (Frederick 2007).

The soil survey of Harris County mapped two variants of one soil series (Lake Charles Series A and B) across the Beaumont Formation deposits at San Jacinto Battleground State Historic Site. According to Frederick (2007), the Beaumont Formation exhibits the following major soil horizons at the San Jacinto Battleground:

A horizon: Black to dark gray (N 2.5/0, N/3/0, 10YR 2/1, and 2.5Y 2.5/1) clay, often with structure and slickensides; always noneffervescent with dilute hydrochloric acid; occasionally exhibited slickensides and Fe-Mn concretions.

Transitional or AB horizon: Very dark gray (N 3/0), dark gray to dark grayish brown (2.5Y 4/1) clay; always noneffervescent with dilute hydrochloric acid; commonly exhibited Fe-Mn concretions and occasionally carbonate nodules.

B horizon: Strong brown (7.5YR 5/6), light olive brown (2.5Y 5/3), light yellowish brown (2.5Y 6/4), yellowish red (5YR 4/6), and brownish yellow (10YR 6/8) clay to silty clay; ranged from noneffervescent to slightly effervescent reaction with dilute hydrochloric acid; typically exhibited calcium carbonate nodules often concentrated in horizontal bands between 5 and 10 cm thick, and often exhibited Fe-Mn concretions.

It is unclear how deep this investigation examined the soil profile.

The soil of the San Jacinto Battleground is of a very specific type of expansive clay known by the term *vertisol*. Vertisols are a soil classification described by the NSCS as having high amounts of expansive clays, minimal horizon differentiation, plastic and sticky soil consistency when wet (Natural Resources Conservation Service 2011). They also have distinctive subsurface failure planes called slickensides within a pedon (the smallest unit or volume of soil that contains all the soil horizons of a particular soil type, having on average a surface area of 10.76 square feet or approximately 1 square meter and extending from the ground surface down to bedrock) (Mermut et. al 1996; Van Breeman and Buurman 1998).

The area around the battle site is subject to perennial inundation and ground subsidence. The first measurement of the area relative to sea level occurred in 1898. The area is regularly measured, giving subsidence measurements of 1.5 feet in 1916, 2.6 feet in 1954, 6 feet in 1973, and an 8 to 10 feet of total subsidence since 1898 was measured in 1996 (Table 2). It should be noted that the ratio of difference in subsidence is rapidly increasing, most likely due to oil and gas extraction.

This idiosyncratic soil also presents unique challenges for archaeological analysis due to its water retention capabilities and problems of site formation processes that are characteristic to this region of the U.S. (Miller et al. 2010), which would have originally complicated the process of the battle itself due to difficulty in moving equipment and men in this soil, especially when wet (Dimmick 2001). Of the vertisol distribution in the U.S., over half of all vertisols in the U.S. are found within Texas (Ahmad 1996:33) (Figure 8). It is important, therefore, to have a strong understanding of vertisols and their behavior when attempting recovery material culture left in this soil.

Description of Vertisols

The soil gets its name from distinctive extreme mud cracks (properly terms desiccation cracks); vertisol being a merging of the words vertical and soil (Ahmad and Mermut 1996). A shrink-swell process is observed in vertic soils due to the ratio of expansive clays called smectite ($A_{0.3}D_{2\text{-}3}[T_4O_{10}]Z_2{*}nH_2O$) to moisture content, resulting in deep, wide cracks in the dry seasons; these swelling pressures can reach on average 1 to 5 kg/cm^2 in any particular pedon (Ahmad 1996). Vertisols are typically found between 50° N and 45° S of the equator (Ahmad 1996:3) (Figure 9). Major areas where vertisols are dominant are eastern Australia (especially inland Queensland and New South Wales), the Deccan Plateau of India, and parts of southern Sudan, Ethiopia, Kenya, Chad, and the lower Parana River in South America. Other areas where vertisols are dominant include southern Texas and adjacent Mexico, northeast Nigeria, Thrace, and parts of eastern China (Ahmad 1996).

The natural vegetation of vertisols is grassland, savanna, or grassy woodland. The heavy texture and unstable behavior of the soil makes it difficult for many tree species to grow, and forest is uncommon (Mermut et al. 1996). Therefore, vertisols are generally used for grazing of cattle or sheep. They are very hard when dry and very sticky when wet. It is not unknown for livestock to be injured by hooves falling into cracks in dry periods. However, the shrink-swell activity allows rapid recovery from compaction, and many wild and domestic ungulates do not like to move on this soil when inundated (www.nrcs.com; www.usda.com). Some, known as *crusty vertisols*, have a thin, hard crust when dry that can persist for two to three years before they have crumbled enough to permit seeding. When irrigation is available, crops such as cotton, wheat, sorghum and rice can be grown. Vertisols are especially suitable for rice because they are almost impermeable when saturated. Rainfed farming is very difficult because vertisols can be worked only under a very narrow range of moisture conditions (www.usda.com).

In the US soil taxonomy system (soils.usda.gov/technical/classification/tax_keys/), vertisols are subdivided into six suborders worldwide, but is the sub order *Usterts* that makes up the soil profile of the San Jacinto Battleground. Usterts have cracks that are open for at least 90 cumulative days per year. Globally, this suborder is the most extensive of the vertisols order, encompassing the vertisols of the tropics and monsoonal climates in Australia, India, and Africa. In the U.S., ustertic soils are common in Texas, Montana, Hawaii, and California (www.nrcs.com).

The Formation of Vertisols Features

The coefficient of linear extensibility (COLE) seems to be diagnostic of the range of heaving observed (Coulombe et al. 1996), and can be used to identify soils that seem to have displaced artifacts. The COLE is the ratio of the difference between the moist and dry lengths of a sample of soil to its dry length. The measurement correlates with the volume change of a soil upon wetting and drying. Hubble (1984) identifies five pedeogenic processes common to most vertisols, across their COLE range (only slickensides are a feature present in *all* vertisols):

1. Soil movement by swelling and shrinking that cause shearing (cracking) and the formation of slickensides.

2. Lateral and vertical movements of soil and incorporated materials associated with gilgai formation.

3. Churning, believed to be the slowest processes of vertisol formation.

4. The formation of organo-mineral complexations.

5. Weathering and the redistribution of soil products under conditions of restricted leaching alternating with drying.

Gilgai is an Australian aboriginal term meaning "little water hole," and it is this term that is used to describe the surface mound and depression microrelief features associated with this physical movement between wet and dry seasons (Patron 1974). Figure 10 shows a number of subsurface features of gilgai, including microhighs (A), microslopes (B), and microlows (C). Subsurface features bounded by major slickensides are chimneys (D), the intermediate position (E), and bowls (F). A surface exposure of a chimney is called a puff (Miller and Bragg 2007). Distance between microhighs and microlows is generally two to five meters; however, elevation differences between the top of a microhigh and the bottom of the adjacent microlow can range from 15 to 50 meters (Miller et al. 2010).

The two main processes in the formation of vertisol features are *churning* and *self-mulching* (Mermut et al. 1996). Churning is also referred to as *self-swallowing*, and is perhaps a better descriptor of the process. Churning occurs in combination with self-mulching, a layer of granules up to 3 mm in diameter usually 1-5 cm on the surface which can fall into desiccation cracks through the motion of the opening and closing of these cracks as the moisture content changes. Self-swallowing is a mechanical process which homogenizes the soil material in the upper part of the soil (Mermut et al. 1996:48; Wilding and Tessier 1988). Figure 11 graphically shows these formational processes, depicting the stages in the formation of vertic structures. It is the extreme change of moisture regimes between water-saturated and arid conditions that produces this process (Mermut et al 1996; Van Breemen and Buurman 1998:234). As a result, vertisols develop unusually deep and wide desiccation cracks in a polygonal pattern (Figure 12). The horizontal diameters of these polygons have been observed up to 4 m (Buringh 1968).

There are three main models that pedologists have developed over time to explain the creation and progress of vertisol formation. Each of these, in turn, has features that are of use to the archaeologist for the location of artifacts and the investigation of site formation processes. The models, in increasing order of acceptance by the Pedology community, are 1) *the differential loading model*; 2) *the pedoturbation model*; and 3) *the soil mechanics model*. The *differential loading model* was conceived by T.R. Paton (1974) during his investigation of gilgai features in Australia, in which soil moves from areas of high to low pressure as the surface soil with low plasticity exerts differential pressure on the more plastic underlying subsoil. As Wilding and Tessier (1988) point out, however, this is not a strong analogy for gilgai formation because of a lack of density differences between horizons or among gilgai elements, therefore the differential pressure assumed by Paton between the areas of different plasticity would not actually exist. This model, though to be respected as one of the first models in an effort to explain vertic features, is today the least accepted among pedologists (Mermut et al. 1996:58).

The *pedoturbation model*, developed by Buol et al. was used for some time in the 1980s, as it seemed to explain the build-up of pressure in the soil and the displacement of soil layers. This model simply states that the surface sloughs off into the desiccation cracks during the arid season, made possible by the break-up of the surface into a loose film of particulates through the movement of the surface cracks opening and closing (the self-mulching process described above). The cracks are then filled with the surface particulates, presenting a change in volume of the subsurface when the moisture increases and the cracks close. Rewetting, then, would induce swelling pressures that would displace the underlying soil layer up and sideways, creating the bowl-shaped gilgai features described above as well slickensides (Mermut et al. 1996). While this process of fine sediment falling into desiccation cracks over time has been shown to occur, it does not appear to create enough volume change over the time observed for gilgai formation. According to Wilding and Tessier (1988), it also fails to account for many relationships and features commonly observed in vertisols, such as the systematic depth functions of soluble salts, carbonates, and organic matter as well as the increase in mean residence time of organic matter with depth; the maximum development of slickensides below the depth of maximum seasonal cracking and infilling; and horizontally-bedded stratigraphic marker zones that are not physically distorted expect when in close proximity to slickensides.

The *soil mechanics model* developed by Wilding and Tessier (1988) is, to date, the most popular model among pedologists (Mermut et al. 1996), and should be the model adopted by archaeologist investigating site formation processes in vertic soils due to its ability to predict soil movement. According to this model, it is the formation of slickensides that is key to the development of the characteristic features seen in vertisols. Simply put, slickensides form when the swelling pressures exceed the internal strength of the soil, resulting in soil displacement (Mermut et al. 1996:55). As the shear strength of a soil is a function of cohesion plus the angle of internal friction, the extent of slickenside formation will depend on the bulk density of the soil, the ratio of clay content to sand and silt, and the specific clay mineralogy of the soil. When observed in 3D, slickenside patterns form thrust cones, with the vertex of these cones centered in the aforementioned micro-lows (Wilding and Tessier 1988; Eswaran et al. 1988; Miller and Bragg 2007).

The soil mechanics model is a much more robust and satisfying model for vertisol processes as it allows for vertisol formation through many different paths, not tied to a specific event as the particulates falling through desiccation cracks in Buol et al's model, or the need for a specific amount of plastic differentiation as in Paton's model. However the slickensides occur, gilgai formation is the result in clay-rich soils. This model then has portability to differing conditions around the globe.

Vertisols and Archaeology

While vertisols have been studied for many decades around the globe (ie: Matyas and Radhakrishna 1968; Fredlund and Morgenstern 1976; Yoshuda et al. 1983), most of the analysis of vertisols has had to do with farming and soil concerns (Aitchison et al. 1973; De Datta et al. 1988; Ahmad 1996; Ahmad and Muirhead 1996; Fredlund 1996; Yule and Willcocks 1996). The anthropological investigations that focus on the human interaction with such soils have also stayed in the area of farming (Miksicek 1987; Thomas 1990; Sluyter and Siemens 1992). Few studies have looked at the relationship between the soil and geoarchaeological techniques such as metal detecting and GIS, though there are several studies on the hydrological behavior of vertisols (Kutilek 1996; Miller and Bragg 2007; Kishne et al. 2009) and their chemistry (Coulombe et al. 1996; Driese et al. 2005; Stiles 2001). There are even fewer studies looking at site formation processes concerning the relationship between soil and artifact (Schiffer 2002); those that exist have focused on how the soil has affected the condition of the artifact and do not address any potential spatial movement of said artifact. Fundamentally, the soil system of vertisols should not be in any way considered inert and static but rather dynamic and active (Coulombe et al. 1996). The vertical movement of the soil due heaving, therefore, has direct correlation to archaeological concerns as the movement of the soil directly impacts the location and condition we find artifacts in (Schiffer 2002).

Chemical and Biological Concerns at SJB

There are several possible chemical and biological interactions in the soil at SJB that should concern the archaeologist. The moisture content of the soil, amount of organic matter present, and the pH due to microbial activity can create conditions extremely detrimental to artifacts (Karen Duston 2011, personal communication). The pH is a measure of the acidity or basicity of an aqueous solution. Pure water is said to be neutral, with a pH close to 7.0 at 25

°C (77 °F). Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline (Bates 1973). In a solution pH approximates but is not equal to pH, the negative logarithm (base 10) of the molar concentration of dissolved hydronium ions (H_3O^+); a low pH indicates a high concentration of hydronium ions, while a high pH indicates a low concentration. While these concerns cannot be fully addressed within the scope of this work, it is important to have a basic understanding of these characteristics and how they might interact, especially in connection with other soils, such as the alfisols of Washington-on-the-Brazos.

Humus, or humified organic matter, is the remaining part of organic matter that has been used and transformed by many different soil organisms. It is a relatively stable component formed by humic substances, including humic acids, fulvic acids, hymatomelanic acids and humins (Tan 1994). One of the most striking characteristics of humic substances is their ability to interact with metal ions, oxides, hydroxides, mineral and organic compounds, including toxic pollutants, to form water-soluble and water-insoluble complexes. Through the formation of these complexes, humic substances can dissolve, mobilize and transport metals and organics in soils and waters, or accumulate in certain soil horizons (Schnitzer 1986), creating a bioavailability of these metals to microbial organisms who cannot ingest solid metal.

Each of these concerns, on their own, should be considered by the archaeologist when investigating a site. When high moisture content, microbial activity, and a low pH are found together, the exchange of positive and negative cations and anions in the soil can create a set of conditions by which slightly to moderately acidic soils have the ability to break down metal objects much more rapidly than in other types of soil (Schiffer 2002), thereby creating a unique settling in which to understand extreme cases of artifact displacement and degradation.

Soil Morphology of Washington-on-the-Brazos State Historic Site

Alluvium is loose, unconsolidated (not cemented together into a solid rock), soil or sediments, eroded, deposited, and reshaped by water in some form in a non-marine setting (www.nrsc.com). Typically the grain size of alluvium is sand to silt (Monroe 2006). This is the parent material by which the soil at WOB is being created. The specific soil order found at the project site is *alfisols*. Alfisols form in semiarid to humid areas, typically under a hardwood forest cover. They have a clay-enriched subsoil and relatively high native fertility. "Alf" refers to Al and Fe. Because of their productivity and abundance, the alfisols represent one of the more important soil orders for food and fiber production. They are widely used both in agriculture and forestry and are generally easier to keep fertile than other humid-climate soils (www.usda.com). Alfisols have undergone only moderate leaching. By definition, they have at least 35% base saturation, meaning that Ca, Mg, and K are relatively abundant (www.nrsc.com).

According to the National Resource Conservation Service, the major soil series at the WOB project site is the Padina unit (Figure 13). The Padina unit comprises of loamy fine sand, with parent material from residuum weathered from Eocene sandstones of the Carrizo, Queen

City, Simsboro, and Sparta formations. It is well drained, with more than two meters to a restrictive feature (fragipan or bedrock). It is non-saline, and is neutral in pH (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

Alfisols and Archaeology

The neutral pH of a typical alfisol is ideal for the preservation of artifacts, both metal and non-metal (Schiffer 2002). However, alfisols are recognized as having a high level of bioturbation, being found commonly in loosely-compacted soil (Dincauze 2000), creating environmental transforms that disturb the systemic context of a site (Schiffer 2002).

The Padina soil series, specific in this region, has a smaller than average O horizon due to its formation under hardwoods. The lack of rooting by vegetation (due to the shade created by the hardwoods) does not allow for the development of enough humus to create sedimentation and deposition of artifacts by simple soil creation (Monroe 2006). Therefore, the past flooding of the Brazos River at this site should also be taken into account when considering artifact preservation, as rapid deposition is considered key to exceptional preservation (Rapp and Hill 2006).

CHAPTER V

ELECTROMAGNETIC GEOPHYSICS AND ARCHAEOLOGY

The electromagnetic (EM) induction method, traditionally used for mining, groundwater prospecting, geothermal exploration and geological mapping has recently grown more popular for near-surface applications (Fitterman and Labson 2005) such as archaeology. The perhaps more familiar ground-penetrating radar (GPR) technique is distinct from EM in the sense that it utilizes a higher frequency range (>1 MHz) for which wave propagation is the dominant characteristic (Annan 2005), making it sensitive to soil properties. Instead, EM senses the bulk electrical conductivity of the ground. The method utilizes low frequency (~1—100 kHz) time variations in diffusing electromagnetic fields (Schieber 1986).

There are two fundamental ways in which to induce a magnetic current: frequency (or continuous wave and transient (or pulse) induction (Pasion 2007; Everett 2011). The two types are useful depending on the research design of a specific project. Frequency domain methods produce a constantly-changing primary magnetic field, coupled with a receiver that continuously measures the secondary field produced by the ground/objects in the ground in response. This creates a map broadly characterizing changes in the soil, useful for finding differences in geologic strata or buried structures (Everett 2005). A transient time-domain electromagnetic system inserts the sub-surface with a finite pulse primary field, thereby changing the magnetic field abruptly. This method allows for detection of discrete anomalies in the soil (Everett 2011). The rate of decay directly corresponds to the material properties and the shape of the buried target (Pasion 2007:4).

There are three basic targets that electromagnetic induction becomes useful for detecting: electrically resistive; intermediate; and conductive. At battlefield historical archaeological sites the best EM geophysical method is one that is optimized to sense conductive targets in the soil, such as discrete metal objects. A transient electromagnetic system, then, would be the best choice for this type of field research. The Geonics Ltd. EM63 (www.geonics.com) is a time domain metal detector that generates a time-dependent primary magnetic field which fluxes through a buried metal object, inducing eddy currents on the target which in turn generate a secondary magnetic field recorded by the system. The secondary field is diagnostic of the geometry, depth of burial, orientation, and electrical conductivity of the target. The sensitivity of the EM63 is tuned to respond strongly to conductive metal objects, either ferrous or non-ferrous. A much smaller response is recorded from iron oxides, saline groundwaters, and other conductive materials constituting or located in the soil (Everett 2011).

There have been few archaeological investigations that have utilized electromagnetic induction beyond the mapping applications of magnetometry. Conyers *et al.* (2008) has used electromagnetic data to map the floodplains of meandering rivers in Cambodia. Other investigations that have used EM for archaeological purposes have studied, for example, Medieval structures (Bongiovanni et al. 2008) some other stuff (Creasman 2009), and more stuff (Verdonck et al. 2009). Simpson et al. (2009) evaluated the coil configuration of several popular EM systems for use in detecting archaeological anomalies, giving much-needed insight on the effectiveness of electromagnetic systems. There has been extensive research into the detection and discrimination of unexploded ordinance using electromagnetic geophysics (Pasion 2007). A good resource for past and ongoing work in this field is through the U.S. Department of Defense at www.serdp-estcp.org. EM methods have also been used in ground hydrology to acquire measurements of apparent electrical conductivity for the purposes of determining groundwater recharge rates (Cook and Kilty 1992), establishing the relationship between discharge variation over time and electrical flow (Akbar 2001). The cation exchange capacity and behavior of cations and anions within the double layer at the surface of clay particles are also important considerations to the archaeologist using electrical equipment as discussed earlier in this study (Coulombe et al. 1996; Akbar 2001). Other EM studies have focused on the spatial mapping of salinity for estimates of soil productivity (Corwin and Leasch 2004; Triantifilis 2009).

Object Discrimination

Experience with landmine and unexploded ordnance (UXO) clearance operations, a similar type of activity that also uses electromagnetic geophysics, indicates that false alarm rates are typically as high as 99% (e.g. Broach *et al.*, 2006). While there is no evidence to suggest that UXO-contaminated sites contain, on average, similar distributions of targets and clutter as historical battlefields, it is anticipated nevertheless that false alarm rates at the latter should be high enough to warrant a considerable effort at their reduction.

The best way to determine significance, or a lack of significance, then, is through the analysis of the decay curve. Figure 14 shows decays curves of known objects in various orientations completed by Leonard Pasion in 2007. Pasion shows that the orientation of an anomaly does not significantly impact the object's decay curve, meaning that it is still possible to recognize a decay curve of a given object despite the object being at various orientations in the soil (Pasion 2007). This is an important point; though we may not be able to say with certainty what a particular buried target is, it is possible to say with some certainty what it is *not.* This gives the EM63 an advantage over other prospecting equipment, in terms of the level of certainty of significance buried targets, being relatively immune to background noise and more diagnostic of target shape and size (Pasion 2007:4).

Some research indicates that soils of high-clay content such as the soil of SJB could pose a difficulty with artifact detection using electromagnetic induction techniques, as it is thought in some circles that small clay lenses less than 1m in diameter could produce a cluttering effect (Pierce 2010), producing anomalies that may be interpreted as battle artifacts and raise the false-alarm rate, especially if they become moist from recent precipitation or other geo-hydrologic processes. This concern has been considered in the methodological design of this investigation, and found to not be an overriding factor at the control site. The EM response level of a typical mid-sized (characteristic size, several cm) battle-related metal artifact is approximately ten millivolts above the background noise level. When several targets are in close proximity there is an increase of the electromagnetic response in the area, making specific discrimination difficult through the EM63 data set (Pierce 2010), but not in the actual detection and locating of an anomaly. In other words, while many metal artifacts lying close together in the soil may create a reading with the EM63 that is hard to interpret, the soil does not mask that there is, in short, something there. While soil properties in themselves can affect electrical response in terms of diluting signal strength, the amount of soil does not distort the signal to a degree that significantly affects EM response (Everett 2011), only amplification. This makes target discrimination possible in areas of heavy deposition, and difficult in areas with high artifact to square meter ratios. Preliminary work completed at a control site, however, shown in Figure 15, indicates a correlation between the object density and shape in relation to its EM63 signature that allowed for continued work within the project hypothesis.

Conflict Event Theory and the EM63

Using the specific system of the Geonics EM63 electromagnetic system to answer questions about the nature and intensity of an event is of greater utility than using other common methodologies such as using conventional hand-held metal detector or conducting tradition random-sampling largely due to two reasons: 1) the EM63 system's relatively shallow learning curve in use; 2) and ability to collect and retain data, giving the potential for multiple analyses beyond even the initial research design.

In our analogy of Telephone mentioned previously, it is vital to gain as much information as possible about the relic of the opening line. While the EM63 gives a fuzzy and indirect indicator of this relic, thereby being twice removed from the actual event, it is the best method available of viewing this relic, thereby allowing interpretation to begin of the original opening line.

Electromagnetic target discrimination may also allow for a more subtle approach to battlefield conservation, creating a data set that can be studied without excavation. Investigations such as the one at the Battle of Little Big Horn (Fox 1997) have shown the value of archaeology in determining the actual battle plan and precise events that occurred during the battle itself to help clarify about the details of the battle. In this case, however, after the initial investigation is complete, it is now impossible to return to the site with more sophisticated methods and re-examine the battlefield in tact: all of the artifacts have been excavated, and the data that new methodologies could have obtained is gone.

While the initial cost of systems like the EM63 seems prohibitive (the cost of the Geonics EM63 ranges between $30,000 and $50,000) (www.geoincs.com), the value of quality data collection in itself cannot be overvalued. One person collecting data over a large area is preferable to many individual hand-held metal dectectorists with uneven skills and unequal motives when consistency and repeatability are desired.

CHAPTER VI

WASHINGTON-ON-THE-BRAZOS

Washington-on-the-Brazos near Navasota, Texas, is considered to be "The Birthplace of Texas" (www.birthplaceoftexas.com) due to being the location of the signing of the Texas Declaration of Independence. Archaeologically, the site then becomes particularity useful in correlating early 19^{th} century artifacts, given the short range of the Anglo occupation of this area as a townsite, between 1829 and 1906 (Siegel 1971).

Research on significant artifacts was coupled with the search for buildings of unknown archaeological location from the old town. There are several buildings referred to in historical documents of WOB whose positions are no longer known, such as a horse stable area listed near SP1.11 in Figure 16 and in the area indicated by the red circle in Figure 17, which is a map of the original townsite drawn by Dana Morris in 1979 (Morris 1978; 1979).

Experience with landmine and unexploded ordnance (UXO) clearance operations, a similar type of metal detection activity that also uses electromagnetic geophysics, indicates that false alarm rates (the indication of a target of interest (TOI), yet upon excavation it turns out to be clutter, a target of not of interest) are typically as high as 99% (Beneviedes and Everett 2007). While there is no evidence to suggest that historical sites contain, on average, similar distributions of TOI's and clutter as UXO contaminated sites, it is anticipated that false alarm rates are probably high enough to warrant a considerable false alarm reduction effort on the part of the archeologist.

Site Plan and Methodology

The investigation specifically looked at the nature of the transient electromagnetic response of subsurface metal targets as a function of size, depth, orientation, and shape, which in turn provided the investigation team with a focus for preliminary test excavations. These data give the archaeologist a powerful tool in reducing unproductive dig-time.

Geophysics

The primary resource for detecting artifacts at WOB was the EM63 electromagnetic system (Figure 14). The EM63 logs data as it is pulled along a line. The footprint of the instrument, slightly larger than the 1.0 m x 1.0 m transmitter size, is a measure of the ground surface area that is scanned by each reading. Horizontal locations of detected anomalies can therefore be determined to within ~0.5 m. Depending on the EM63 line spacing in a survey block, data overlap can occur, which is desirable since the redundancy provides more accurate information about the anomaly's location. For this reason, 0.5 meter line spacing was used, creating thirty-four lines of data per survey block. The northeast corner of Block A was designated the zero marker for anomaly coordinates. The survey area covered was 85 m x 65 m, divided into five blocks 17 m by 65 m for regularity of data collection (Figure 15). In total, 5525 m^2 were surveyed.

Archaeology

Excavation of anomalies was undertaken in locations associated with anomalous readings from the EM63. Unit size (either 1.0 m x1.0 m or 2.0 x 2.0 m) was determined by the anomaly strength indicated by the EM63. In total, 27 m^2 were excavated based on anomaly strength (Figure 16). Blocks, units, and artifacts were assigned provenance designations with an alpha-numeric system. Each block received a capital letter, A-E. Units in an individual block were then each given a small letter a-z, depending on the number of units excavated in a block. If a unit proved to have more than the causative anomaly, it was assigned a number based on the pedeogenic level it was found in. The depth that each anomaly was found in was recorded with a total station, as well as the x,y coordinates from the zero reference noted in Figure 17. Therefore, Db3 would designate an artifact found in Block D, unit b, level 3.

Units were excavated using shovels and trowels down to the depth of the anomaly. Excavated soil was then water-screened with a ¼ inch mesh. Unit Db was initially opened in order to gather data on the large area in the middle of the survey site as a control unit, where few to no anomalies were recorded, in order to determine if there were anomalies the EM63 might not be recording. As more ceramics were found in unit Db than in any other unit, a number of test units around it were opened, recovering additional material. These finds required a modification to the artifact designation system, as multiple artifacts were found in the same soil level. Table 1 lists all anomalies recovered and their depth.

Results

Geophysics

All excavated units produced artifacts, giving a 100% recovery rate of anomalies sought. Figure 18 is the graphic representation of channel 1 from the EM63. The colors represent intensity of the magnetic field produced by the anomaly, measured in millivolts (mV). These targets were then sorted by significance, with more intense colors given highest priority; the further the color deviates from the green background, the higher probability of historic significance (Pierce 2010).

The spatial distribution of artifacts both horizontal and vertical is a telling indication of the cultural activity conducted in the area, and can be more informative than the specific artifacts themselves. (Schiffer 2002). The horizontal distribution of artifacts in Figure 18 shows no significant concentrations of metal that would be indicative of such a structure.

Cables used in an Army Corps of Engineers bank stabilization project dating between 1955 and 1962 (Siegel 1971; Skaggs, personal communication) were among the strongest anomalies found, indicated along the northern edge of Block B and straddling Blocks D and E. Two of these cables were found approximately thirty-five centimeters below the surface, twenty meters apart, and roughly perpendicular to the riverbank (Figure 19).

Artifact Analysis

A total of 283 anomalies were recovered, 13 of which are modern debris (Table 3). The metal artifacts found varied between farm implements and modern garbage, while the ceramic artifacts consisted of high-end porcelain, high-quality washing basins, and transfer print of some rarity. A breakdown of the types of artifacts found in included in Table 2. These artifacts are consistent with the currently known use of the site in the 20th century, and within the findings of the 1995 and 1996 archeological investigations (Carlson 1995; Kuehn 1996). None of the metal found, beyond the short “t-post” stake, were indicative of the 19th century.

Ceramics found at the site were varied and diagnostic, ranging from the 1830s to the 1880s (Carlson 2010, personal communication). Porcelain, yellow ware, stoneware, whiteware, majolica, pearlware, several different types of glazes and slip as well as several colors of transfer ware were recovered (Figures 21 and 22). A few of the actual types of vessels represented by the ceramics and glass could be identified, including a flow blue washing basin, 19th century window pane glass (Roenke 1978), and a historic bottle. There was also one lone bone button (Figure 23) recovered dating to the early 19th century (Epstein and Safro 2001).

As seen in the Table 3, the oldest ceramics and glass trend towards the lower excavation levels. This may indicate that they are in a stratigraphic order, despite possible colluvial movement. This conclusion is further evidenced by the finding of strikingly similar sherds in units Db and Dc, in roughly the same level. One ceramic sherd recovered included a marker's mark (Figure 24). This marker's mark is identifiable as the mark of John Ridgway and Co. of Staffordshire, England (Figure 25). This mark was in use from 1841-1855 (Kowalsky and Kolwalsky 1999:320).

Geoarchaeology

The sedimentation of the Brazos River floodplain is considerable in this area, depositing several feet of sand and clay between 1836 and today. Soil profiles were consistent across the survey area, depending on elevation. This was determined by an examination of the different soil layers exposed during excavation. Unit Db was excavated the deepest, as it seemed to have the best likelihood of a high combination of artifacts to soil profile information (Figure 26). The distribution of sand, silt and pebbles in stratigraphic context indicates an undisturbed alluvial setting, as does the well-developed pedeogenic layers shown.

Verbal confirmation of the project by the Brazos River Authority and the Army Corps of Engineers was obtained through a knowledgeable party, Tom Scaggs, retired superintendent of WOB, and in a history of Washington-on-the-Brazos written by Stanley Siegel (1971:99). The braided cable in Figure 20 is part of a system still in place to maintain the slope along the Brazos River. It is not known how far this system extends outside the project area. The project seems to have been abandoned, as the cable uncovered in Block E has snapped in two, consequentially not creating the tension needed to provide stabilization to the river bank.

This stabilization project was extremely intrusive to the site, and may be the reason that the area near the river is relatively free of anomalies (other than the cables themselves), as the Corps would have most likely scraped off a significant amount of surface in order to create anchors for the cables slicing through the bank (Scaggs 2010, personal communication). The cable anchors were not found in this investigation, being deeper than the current archeological project had time or budget for. The project permit also did not cover disturbing ACOE projects.

With the artifacts found at 25 cm and lower trending towards the 19^{th} century (with a few exceptions, possibly due to site formation processes), it is possible to estimate the sediment deposition rate of the Brazos River on this site. Very few artifacts were found deeper than 60 centimeters, giving a maximum possible depth to the occupational surface of 1836. If the Brazos has therefore deposited 60 centimeters of sediment on this site in 174 years, on average the river deposits 2.9 cm of sand, silt, and clay on the site every year. Of course, the regular flooding of the Brazos must be taken into account, as well as sediment deposition of colluvium from the southern slope of the project area. Even so, almost three centimeters of sediment a year has implications for site preservation concerns that should be planned for, as this rate of accumulation will only continue to make archeological investigations difficult in this area.

CHAPTER VII

THE SAN JACINTO BATTLEGROUND

The San Jacinto Battleground, between the Buffalo Bayou and the San Jacinto River, is the most significant site of the Texas Revolution, being the location of the final battle between Texian forces and the Mexican army. It is also the most under-researched, and perhaps the most looted (Matthews 2011, personal communication). Based on previous work by numerous hand-held metal detector sweeps of the site (Moore 2004; 2009; 2010), the battlefield is known to contain many buried metal artifacts, both ferrous and non-ferrous, associated with the 1836 battle. In addition, the site hosts copious extraneous metal clutter, a legacy of various land-use activities, including tourism and battle re-enactments, following the conflict.

Site Plan and Methodology

Work was conducted in two phases: phase 1 consisted of 3 blocks labeled A, B, and C measuring 25m x 35 m each. This was the original field site for Carl Pierce in 2005 (Pierce 2010). The survey area covered for phases I and II can be seen in Figure 28. Blocks A, B, and C (Phase I) are outlined in black at the south of the aerial photograph. No artifacts were excavated from Block A as it was determined to be nearly cleared of artifacts by the EM63. This is most likely due to overlap by Moore Archaeological in the previous field season. Blocks California, Oregon, Washington, Nevada, and Louisiana were surveyed in phase II.

All Phase II blocks were 25m x 25m except Louisiana, which was constricted to 25m x 10m due to trees. Excavation of anomalies was undertaken in locations associated with anomalous readings from the EM63. Unit size (either 1.0 m x1.0 m or 2.0 x 2.0 m) was determined by the anomaly strength indicated by the EM63. Units were excavated using shovels and trowels down to the depth of the anomaly. Excavated soil was then water-screened with a ¼ inch mesh, and artifacts were bagged.

Soil samples were also taken from areas in Phase II to characterize the soil. Six twelve inch cores were halved. One half was dried at 105^{o}C to determine moisture content, and the other half was heated to 500^{o}C to determine the fraction of organic carbon in the sample. Five of these cores were processed by students of the Environmental Geology class taught by Dr. Karen Duston at San Jacinto College in Houston, TX. A separate sample was tested by the author at the Soil Science Laboratory at Texas A&M University for the purpose of gaging accuracy. A homogenized soil of all five coring areas was also created using 2.5 x 3.5 inch hand corers, taking five samples from around the original coring area. Five 50 grams of soil were separately heated to 500^{o}C with equipment provided by San Jacinto College, and a separate 50 grams was analyzed with Texas A&M equipment. Another 50 grams was heated to 900^{o}C and the CO_2 gas collected, to determine the difference in organic carbon detected.

Results

Phase I Geophysics

The electromagnetic data of Blocks A, B, and C (Figure 29) were provided courtesy of Carl Pierce. The data was plotted with software developed by Mark E Everett in order to create a graphic representation of mV strength at each channel. Anomalies were prioritized for excavation based on mV strength and horizontal distribution from this data. The significance envelope was determined by the size of the anomaly vs. voltage output (the larger the spread of the anomaly and the stronger color is interpreted as an anomaly of significance).

Phase I Archaeology

There are some very interesting artifacts in this assemblage, though none are diagnostic of the battle. The artifacts, including a baseball, currency, picnic items such as soda cans, pieces of concrete pipe, and several items of historic metal, show the varied use of the area since the fateful battle in 1836 (Table 4). The most intriguing artifact recovered in the Phase I assemblage is a metal hook imbedded in the asphalt layer discussed below. A number of the historic metal pieces recovered could very well be from the battle, being found stratigraphically in the same layer as other more definitive items were excavated in (Mangum 2011, personal communication).

An asphalt layer was found in both the Austin and Ansen units at approximately 10cm depth. This tar-like substance was found to be above another layer of primarily oyster shells. The bolts recovered in Houston I and II, coupled with the asphalt layer, may be what is left of the road built by WPA workers in 1935 to expedite transport of materials from the ship channel to the present location of the San Jacinto Monument . While there are no documents known to detail the construction of this road, the building of the road itself is mentioned in documents pertaining to the construction of the Monument (San Jacinto Museum of History 2010), and EM data provided by Dr. Allison Henning of Rice University seems to indicate a road-like structure under the soil (Figure 38). If the road can be dated to the 1930s, then the bolts may be remnants of the building of the Monument itself.

Although the Austin unit was only excavated to 50 cm, the presence of slickensides, microtopigraphical lows and movement of the A and B horizon could be seen. Figure 34 is a vertic chimney discovered in this unit. There are hundreds of this microtopographic lows and highs throughout the site, indicating that gilgai formation is occurring. Figure 35 is a picture of the ground surface in the project area before excavation, showing the distinctive polygonal mudcrack formations, with significant spacing.

Phase II Geophysics

Figure 36 shows the processed EM63 data for all phase II blocks. Block CA showed almost no significant artifacts, most likely due to overlap by a previous survey and recover project conducted by Moore Archaeological in 2006. Block OR had data recovery issues due to equipment failure. Otherwise, the data give useful insight to the spatial patterning of artifacts in this location. Moving farther away from the road improved artifact detection considerable, both in terms of significance of artifacts and findablility.

Phase II Archaeology

Figure 37 is the site plan of Phase II. Twenty units in total were excavated during this phase, ranging between 2x2 m and 1x1 m units, based on the strength of the electromagnetic response. Table 4 is the artifact log for all anomalies recovered in Phase II. There were some interesting artifacts, but none clearly diagnostic of the battle.

Many of the anomalies recovered were labeled as modern trash, including aluminum soda cans, metal bottle openers (Figure 38), aluminum pull-tabs, and a rubber baseball. Other finds were debris from park maintenance, including a modern fence “t-post” and concrete pipe fragments like the ones found in units of phase I.

The most interesting artifact is a metal disk found in the Louisiana block (Figure 39). Still unidentified after conservation, this intriguing artifact is similar to disks found in previous surveys at the battleground, though much smaller (Mangum 2011, personal communication). Historic nails and other historic metal found indicate use of the park for farming and ranching up until it was acquired by the State. As iron would not survive in this acidic soil for the length of time necessary to make it battle-significant, lead or ceramics would be the best indicator of battle elements.

Geoarchaeology of Phase II

Table 6 shows data produced from the analysis of moisture content, pH, porosity, calcareous content, and fraction organic carbon of the soil samples taken from areas in Phase II. There is an arguable relationship between pH, moisture content, and the organic matter.

A stratigraphic profile of the project area was created (Figure 36). This shows the under-developed gilgai formation, coupled with the intrusion of the oyster shell bed and tar road location across the field site.

CHAPTER VIII

DISCUSSION AND CONCLUSIONS: EVENTS, ARCHAEOLOGY, AND GEOPHYSICS

Events, as described in this paper, have a spatial and assemblage pattern unique to other assemblages in the archaeological record (Norton 2011). Conflict event theory allows us the opportunity to see these assemblages for their true worth in describing the sequence of actions surrounding the time in question. In other words, finding and interpreting the relic of an event is the goal of CET, in recognition of the importance of understanding the myths that make up our society.

It is important, then, when investigating conflict within the framework of CET to try to gain a comprehensive perspective of the landscape and the archaeological record of the area in question. These two investigative requirements necessitate the use of methodologies such as electromagnetism and site formation processes as two tools that allow for the creation of a holistic picture of the event in question.

Electromagnetic Geophysics

We can conclude that what vertical and horizontal displacement there is on a given site will not change an object's electromagnetic response to the point of making it look like something else. The analysis of the Riverside control group, SJB, and WOB artifact decay curves seem to provide evidence to this hypothesis. However, at this time, it seems difficult to definitely determine exactly what a particular target is with the aforementioned EM data set due to the low numbers of artifacts found at both sites. The point, however, is that it does seem possible to determine what it is not.

Creating electromagnetic data sets such as the ones shown here for both battle sites and significant historical archaeology sites allows for a more nuanced analysis of these sites. Without lifting one shovelful of dirt, significance (or non-significance) can be shown to an area, thereby saving both time and money on a site. Geophysics must be a part of any collection of evidence that bares upon CET because of the relationship of this theoretical model and spatial patterning. The EM63 is currently seems to be the best geophysical system for a discrete object data collection, as there are no other systems that can reliably detect the relic of the event occurrence with as much precision.

Site Formation Processes

Even the soil, then, becomes part of the narrative of this event, and is vital for and understanding of CET. Understanding the soil characteristics of vertisols allows us to picture real men and real behavior on this landscape: men falling off horses that have lost their footing in the sticky mud; Mexican soldiers flailing in the wet clay locals call gumbo as they try to flee for their lives against a foe that feels nothing but rage. The chaotic nature of these eighteen minutes cannot be fully actualized without linking these data to this event.

The soils of SJB are very different, which has implications for the quality of the event relic we can collect and interpret from. While both sites seem to have rapid deposition (or have had in the past), the low pH and high clay content of SJB is a major concern to artifact preservation. While gilgai formation is not developed enough to disturb artifact stratigraphy as originally thought, the slight movement of artifacts, coupled with this pH factor and the high moisture content of the smectite clays is possibly elevating the bioavailability of iron in the soil to microbial organisms, and accelerating the degradation of artifacts left in the soil (especially iron objects).

Events

Events leave a different kind of material culture than day-to-day living; the discrete 18 minute battle leaves behind material signatures that mark actual historic episodes that can be recognized. Archaeological assemblages, then, created by the social events surrounding them, can tell us with precision the real-time story of the event; the massive piles of musket balls ties back not only to the extreme anger and hatred of the Texian Army against Santa Anna and Mexico for real and perceived abuses, but the decision of Gen. Alamonte to save as many of his men as he could. As we gain more of the material culture of the battle through systematic excavations, more of the true time-line of action of this event can be determined.

Conflict Event theory also reminds us that it is important to model not only the actual historic occurrences in context, but the usability of such structural changing events. Anthropologist Holly K. Norton summed up Conflict Event theory best: "Events have power. They carry meaning for the people who experience them and for the places in which they are experienced" (Norton 2011). After the original conflict is over, individuals often decide to continue to re-make their society with the event as a centerpiece. This use of events is always conscious: society creates its own myths to create values that the society wishes to express. This can be clearly seen in the battle cry of the Texian Army at the Battle of San Jacinto: "Remember the Alamo!" The revolutionaries, within this theory, were eager to fight Santa Anna and his army not out of blood-lust, but from the desire to create a Texan identity based on the "Gone to Texas" spirit of Davey Crockett's statement before he died. The need for the *event* of the Battle of San Jacinto was the agency of the Texians wishing to literally tell Santa Anna to "go to hell." After the Civil War, this need became acute, and the "Gone to Texas" myth grew stronger than it perhaps was in anti-bellum Texas (Buenger 2010, personal communication).

It takes two to make a battle. In remembering Sewell's argument that novel patterning requires a series of ruptures that the current social structure beyond repair, it is important to also acknowledge the Mexican involvement and failures in the conflict. Mexico City had not the resources or the experience to successfully navigate the social pitfalls of this time. They had just become a sovereign nation themselves only a decade before, and were still unsure of what that all entailed. With the rise of Gen. Santa Anna, his disregard of the Constitution, and the brutal response of the uprising in Zacatecas, we have the ruptures needed for a true event to take place.

These lines of inquiry are more difficult at Washington-on-the-Brazos, due to the ephemeral nature of the signing of the Declaration of Independence. However, the Runaway Scrape may not be so; if we were to look for discrete markers of a group on the run in the archaeological record, instead of looking for prove that they *did* run, we can begin to re-create the actual behavior and intensity of the event as Beck et al. describes. Though Sewell says events are essentially unpredictable, CET gives these events a sense of creative force: someone, a group, perhaps a whole community, *planned and demanded* that an event would take place. It should be recognized that there were two previous gatherings of delegates in other Texas towns in 1833 and 1835. It was not until the rules (the need for liberty) matched the ability to access resources (the arrival of Sam Houston, who had military experience; the fall of the Alamo and Goliad; the personal intervention by Santa Anna himself) that the event of the signing of the Declaration of Independence occurred, and the Battle of San Jacinto commenced.

Future Research

CET is a new theory, and as such is in need of more data to completely understand the relationship between the spatial patterning of artifacts and human behavior through the study of many other conflict sites. A future research priority is to tell the story of the Texas Revolution as a series of powerful events which gave birth to a nation and restructured an entire culture through the investigation of the archaeological record.

More work also needs to be done on the relationship between electromagnetism and archaeology, including a full-scale comparison of hand-held metal detectors and larger electromagnetic systems. The EM63 has vast potential for a large amount of data collection with minimal effort. This is preferable to using hand-held metal detectors and numerous surveyors for the control of the quality and quantity of data, though it is understood that current budgets make this decision difficult.

Other research topics in need of completion would be a long-term research design of the response of objects in vertic soils. There is a gap in the current literature of outlining the path and change in condition of objects in the soil over a long period of time. An important data set, especially in Texas, would be for a long-term study of object movement in a controlled setting, allowing for the natural development of vertic soils over a period of several decades.

Preservation concerns at battlefield sites have changed drastically over the last hundred years. It is important to recognize the history of the area after the battle in creating the archaeological record we see today. The special needs of battlefield preservation have not been considered much in the US for sites other than those from the Civil War. There is currently also a strong push at SJB to return the landscape back to as much of the original prairie as possible. This re-creation of the battlefield landscape holds a unique challenge for archaeology: is the cost/benefit ratio of the information gained by digging up the battlefield and destroying the landscape too high? These considerations must also be addressed when planning new research.

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APPENDIX A

FIGURES

Figure 1. Map of Texas. Locations of WOB and SJB are red and blue stars, respectively. Maps courtesy of www.theodora.com/maps. Used with permission.

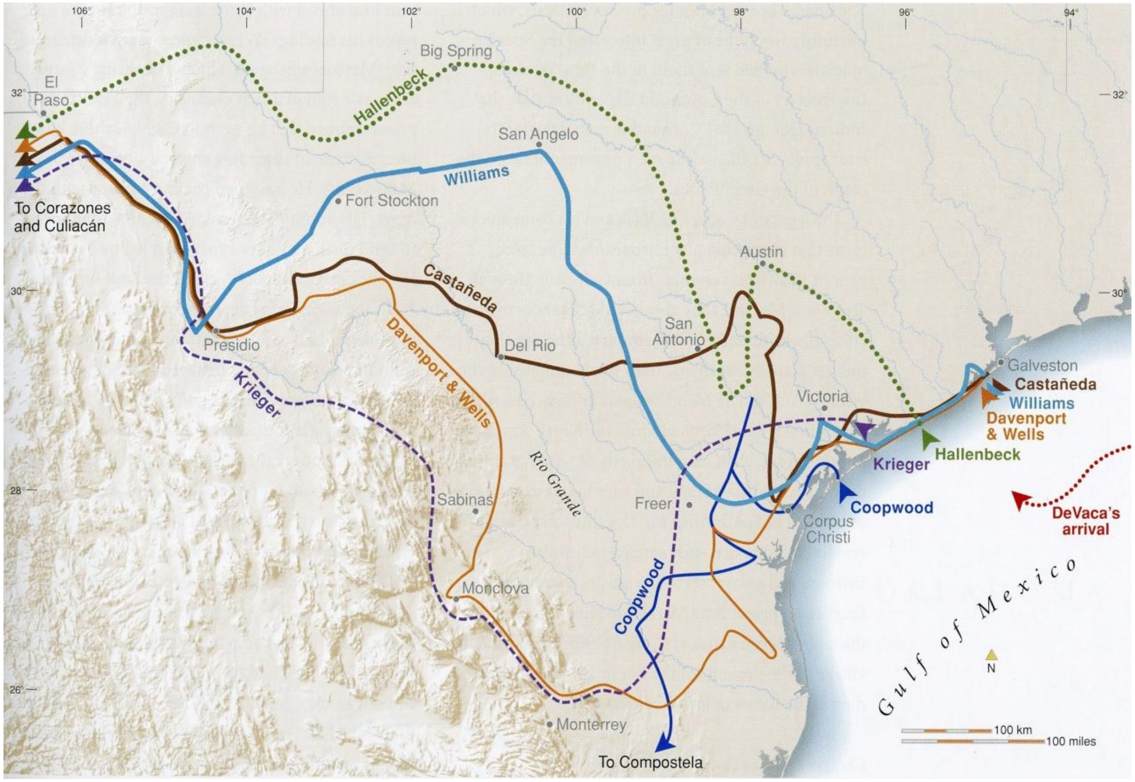


Figure 2. Possible routes Cabeza de Vaca and his men took after landing on the Texas coast.

After *Texas: A Historical Altas* by A. Ray Stephens (2010).

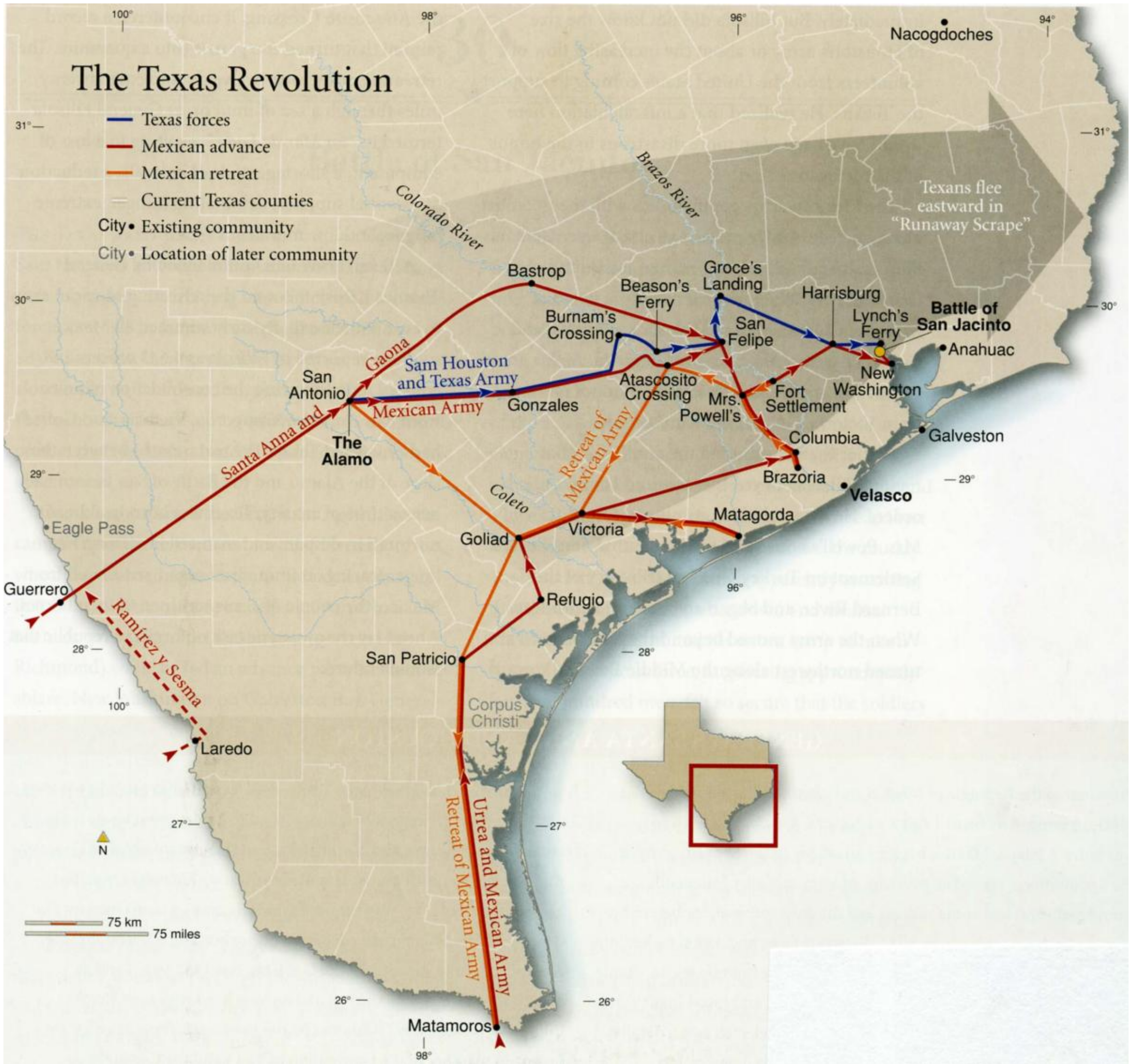


Figure 3. Map of Mexican and Texian Army movements during the Texian Revolution. After *Texas: A Historical Altas* by A. Ray Stephens (2010).

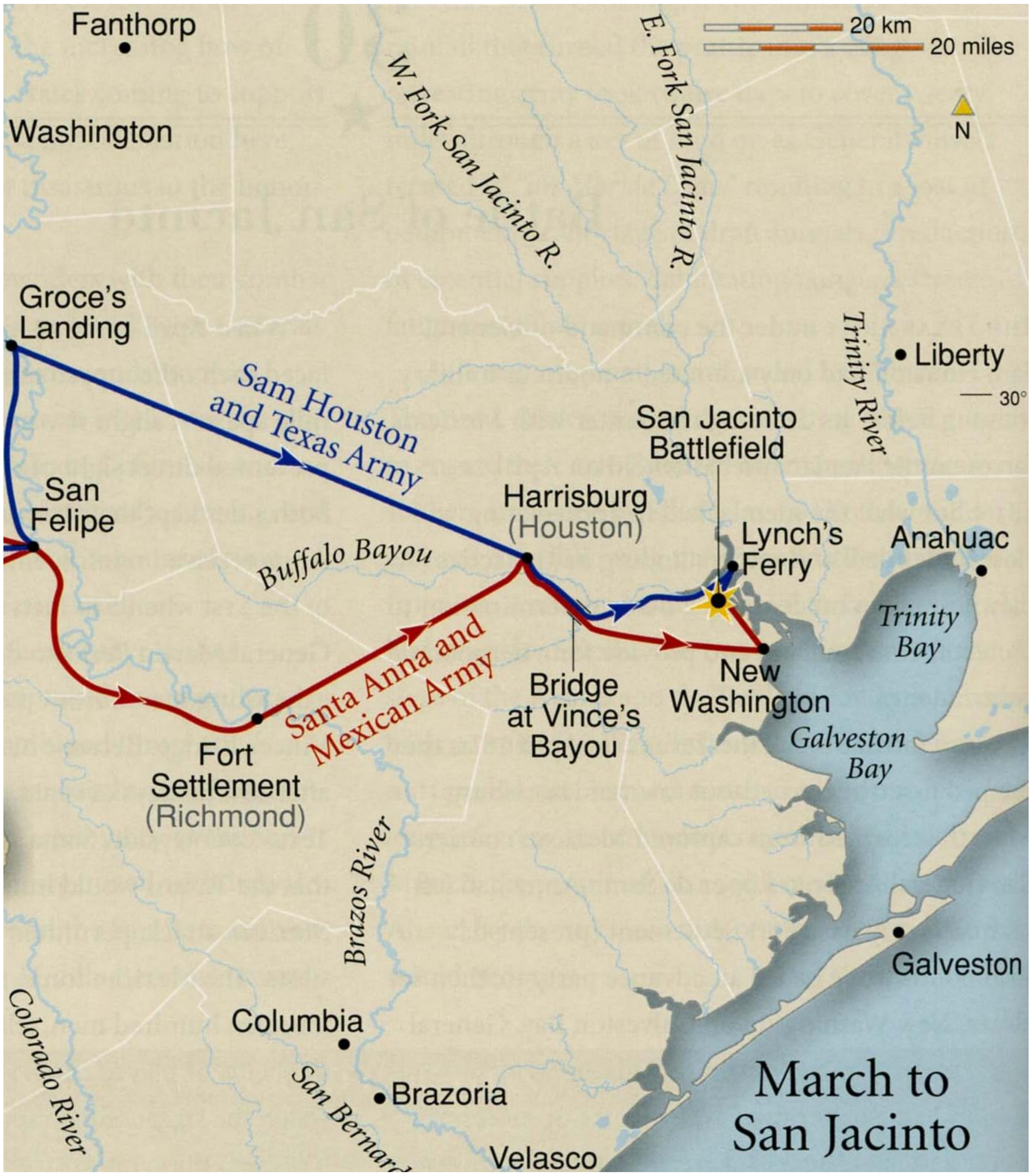


Figure 4. Movement of Houston and Santa Anna's armies during the final drive to San Jacinto. After *Texas: A Historical Altas* by A. Ray Stephens (2010).

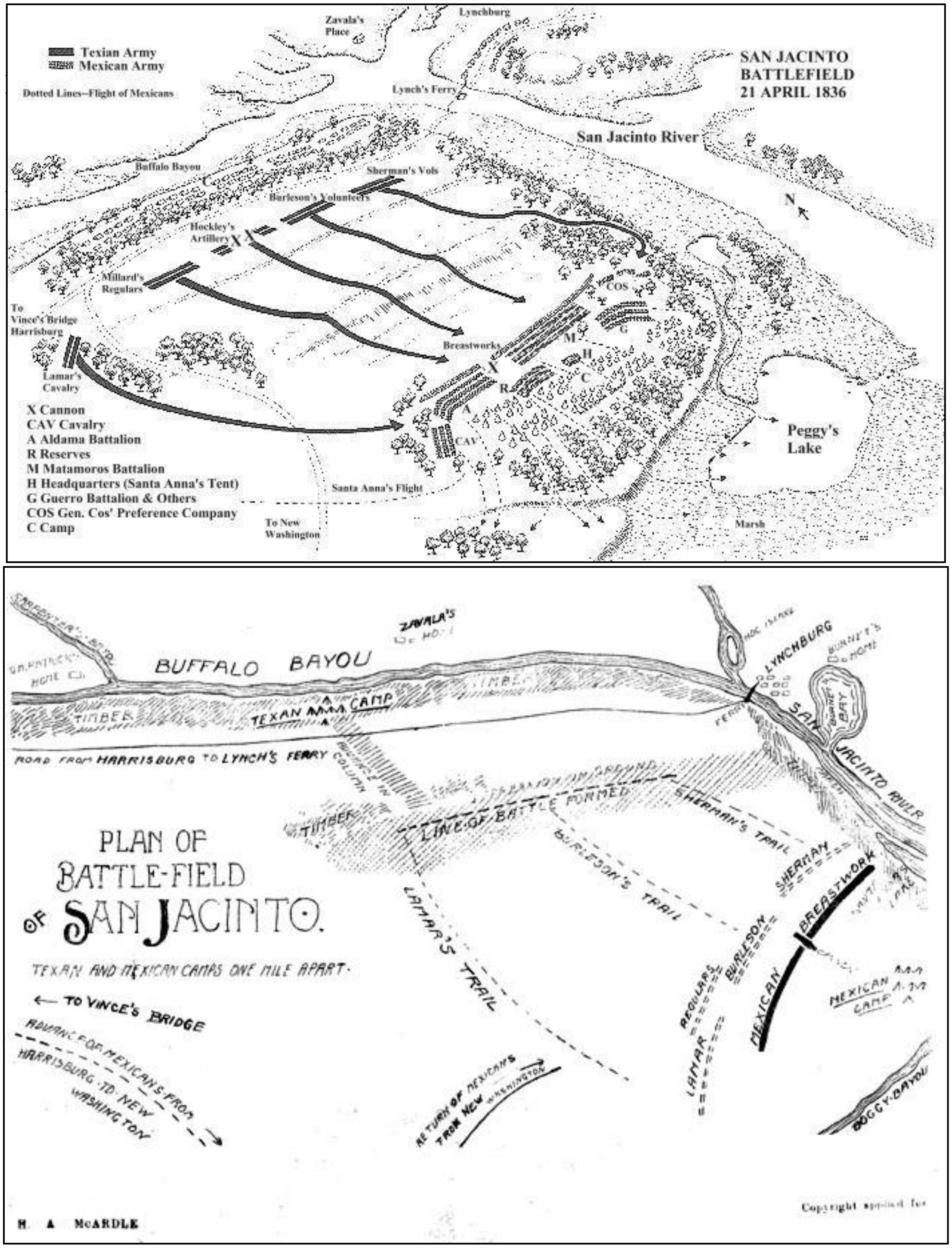


Figure 5. Maps of the Battle of San Jacinto. Top Hardin (1996), Bottom McArdle 1906.

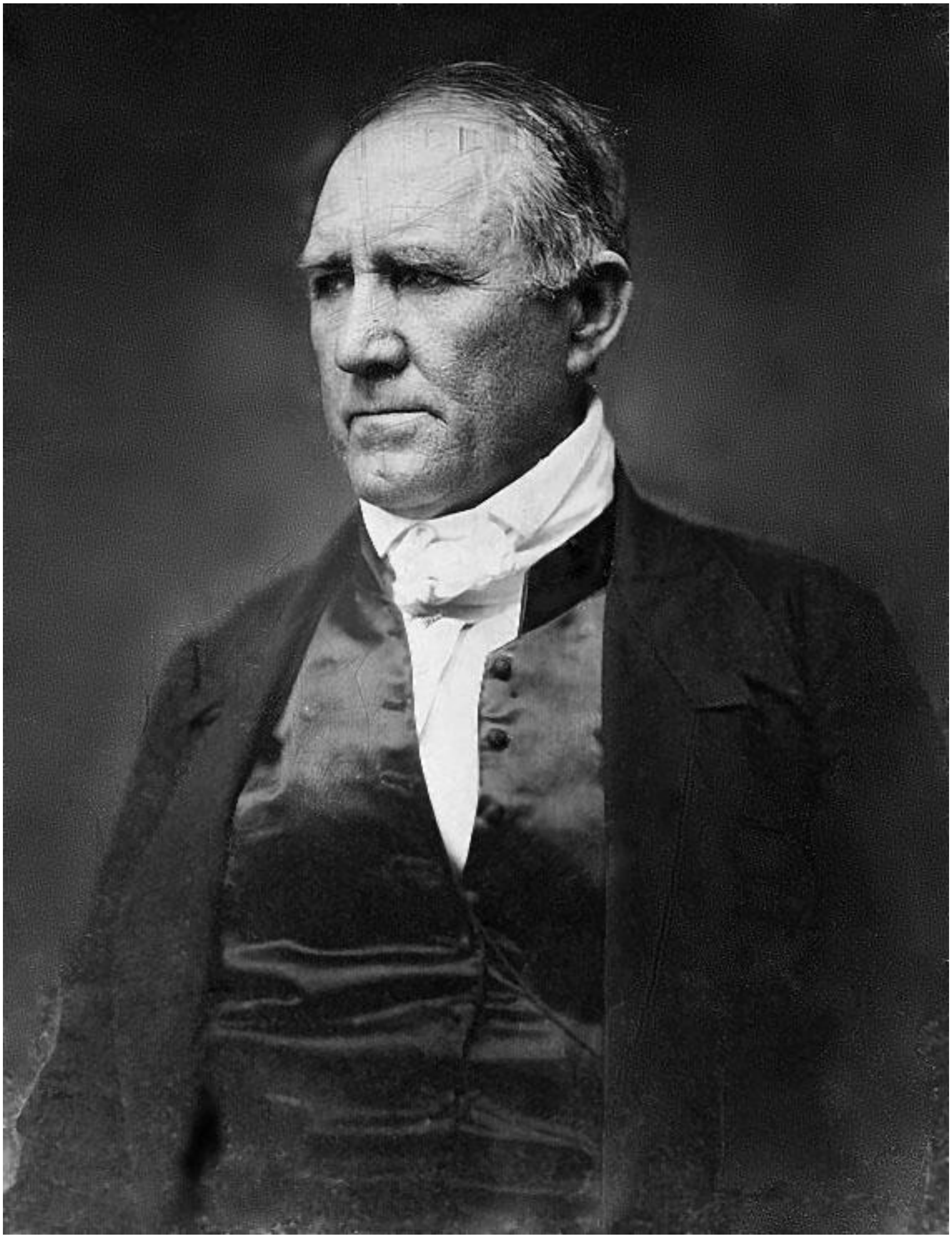


Figure 6. Sam Houston.

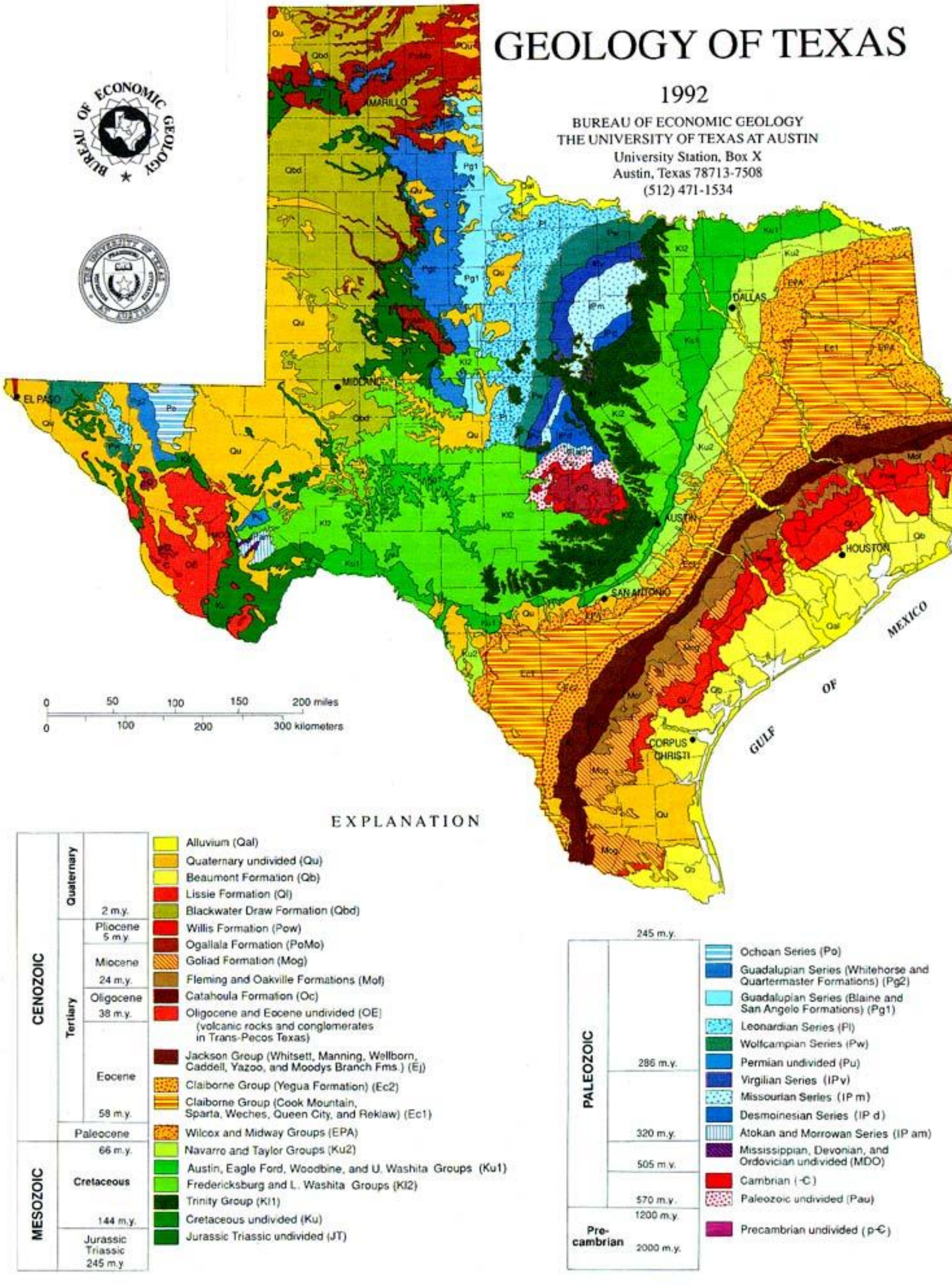


Figure 7. Geologic map of Texas.

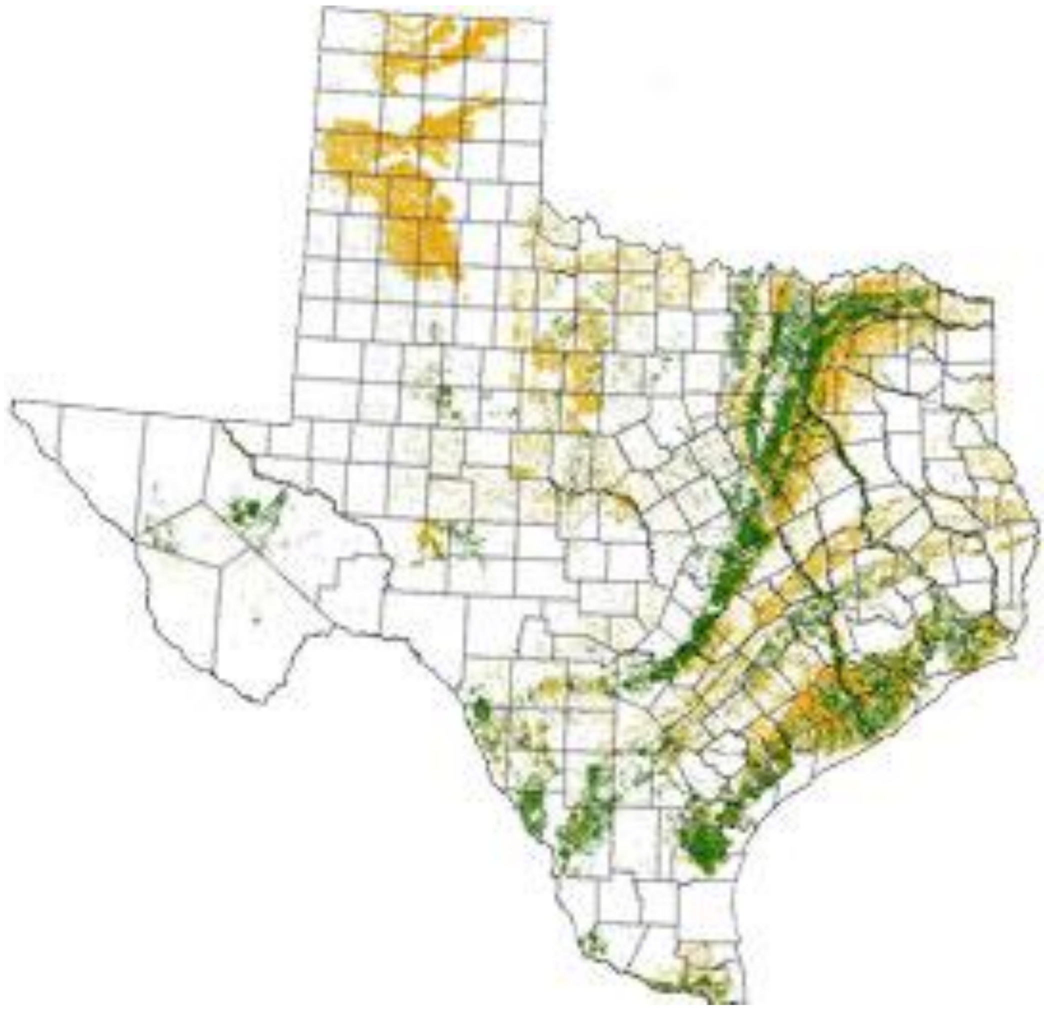


Figure 8. Distribution of vertisols in Texas (www.nscs.com). Note the expanse of vertic soils in the Houston area.

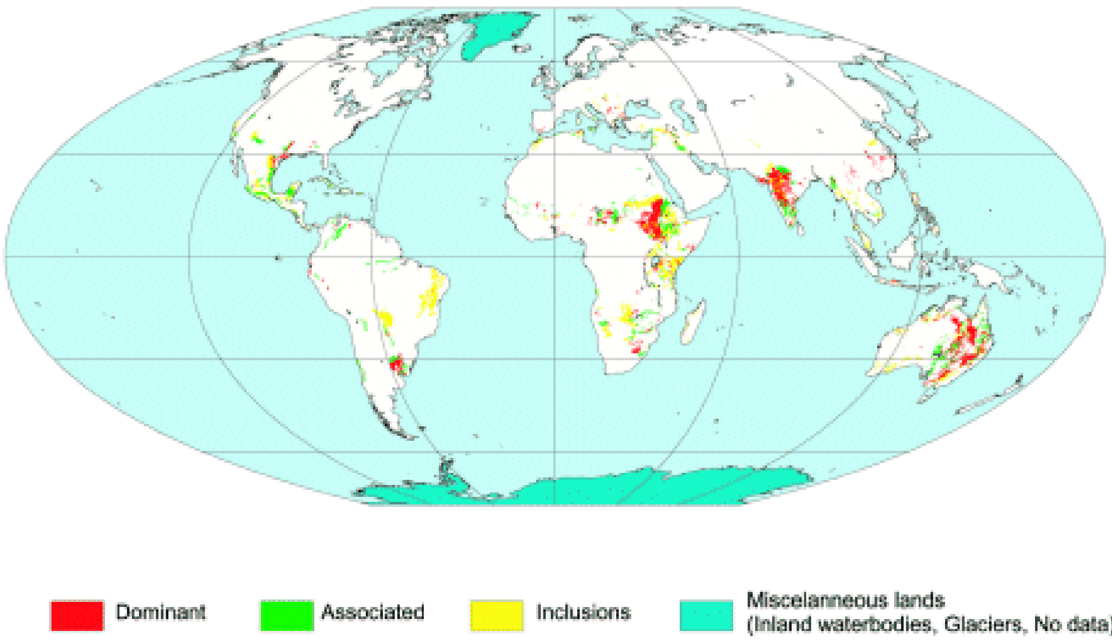


Figure 9. World-wide distribution of vertisols (www.fao.org).

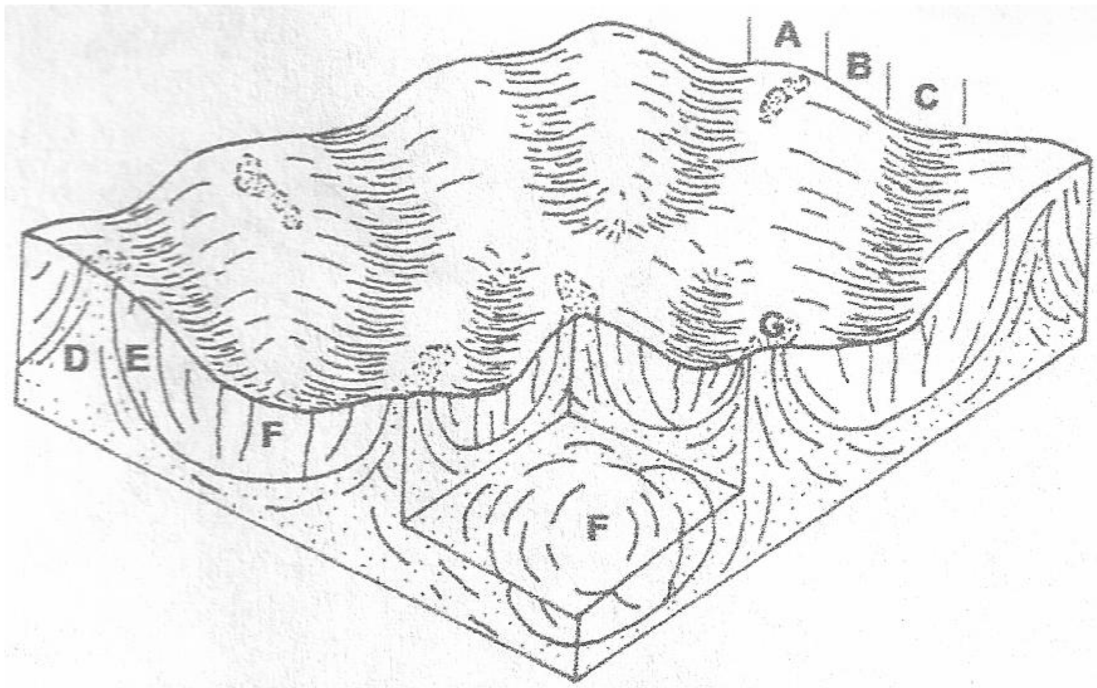


Figure 10. Gilgai features, including microhighs (A), microslopes (B), and microlows (C). Subsurface features bounded by major slickensides are chimneys (D), the intermediate position (E), and bowls (F). After Miller and Bragg 2007.

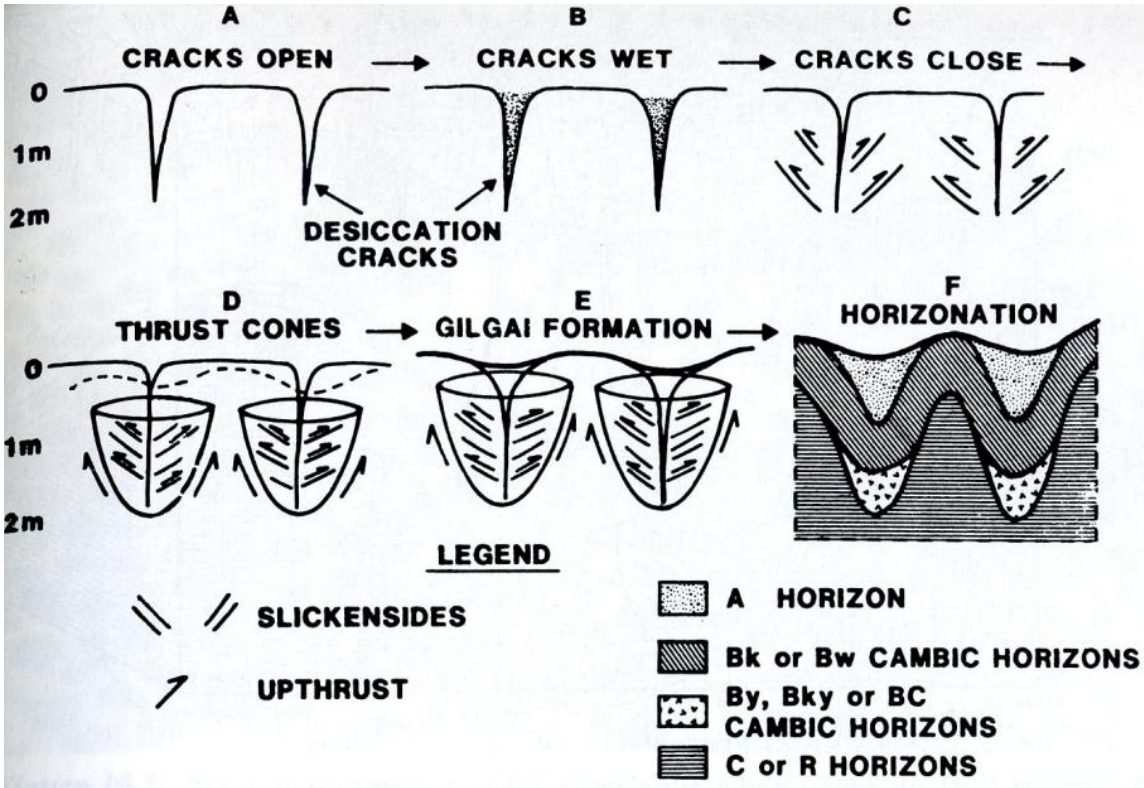


Figure 11. Vertisol feature formational processes, showing the movement of the soil and its relationship to gilgai features. From Wilding and Tessier, 1988.

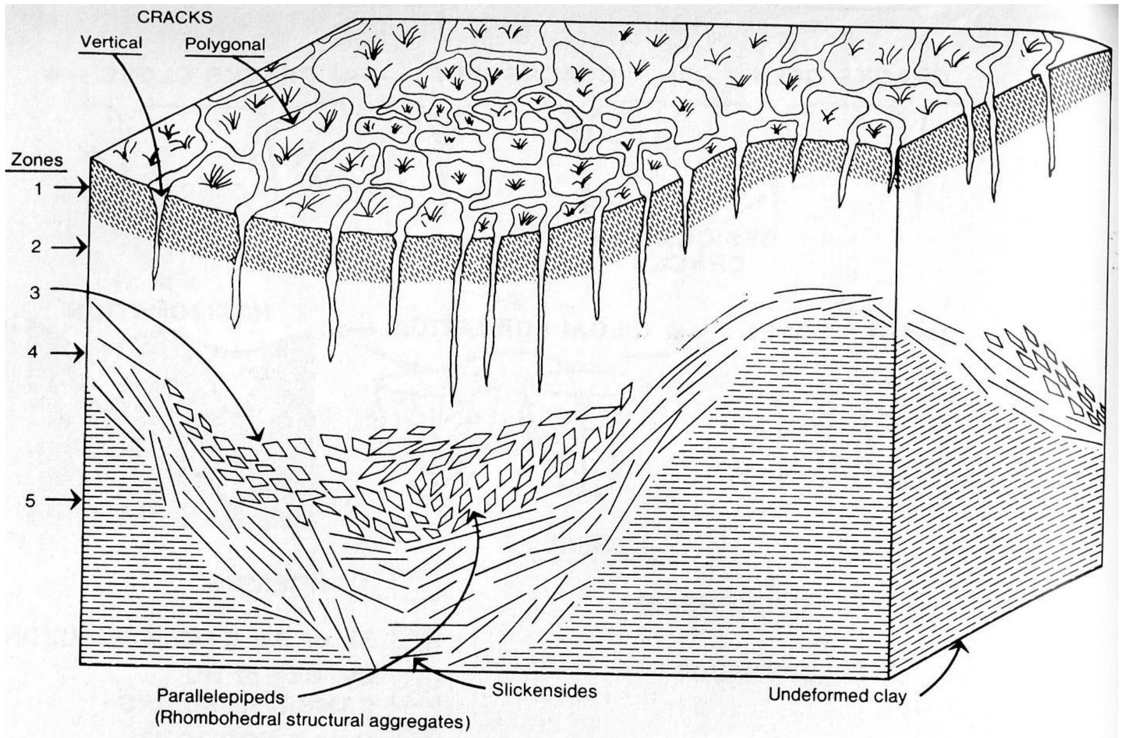


Figure 12. Stylized cross-section of a well-developed vertisol pedon, showing the different zones and structures that can be present. After Eswaran et al. 1988.

Figure 13. Well-developed undisturbed gilgai in Texas vertisols (Miller and Bragg 2007). This level of development is rarely seen in the vertisols around the coastal regions of Texas, but found instead in the plains of Central Texas.

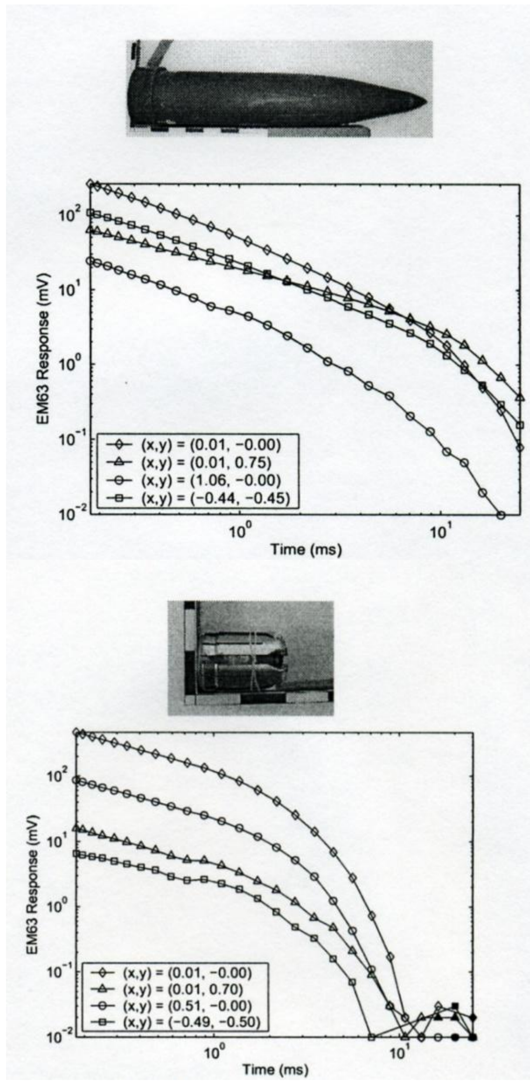


Figure 14. Electromagnetic decay curves of UXO in various orientations.

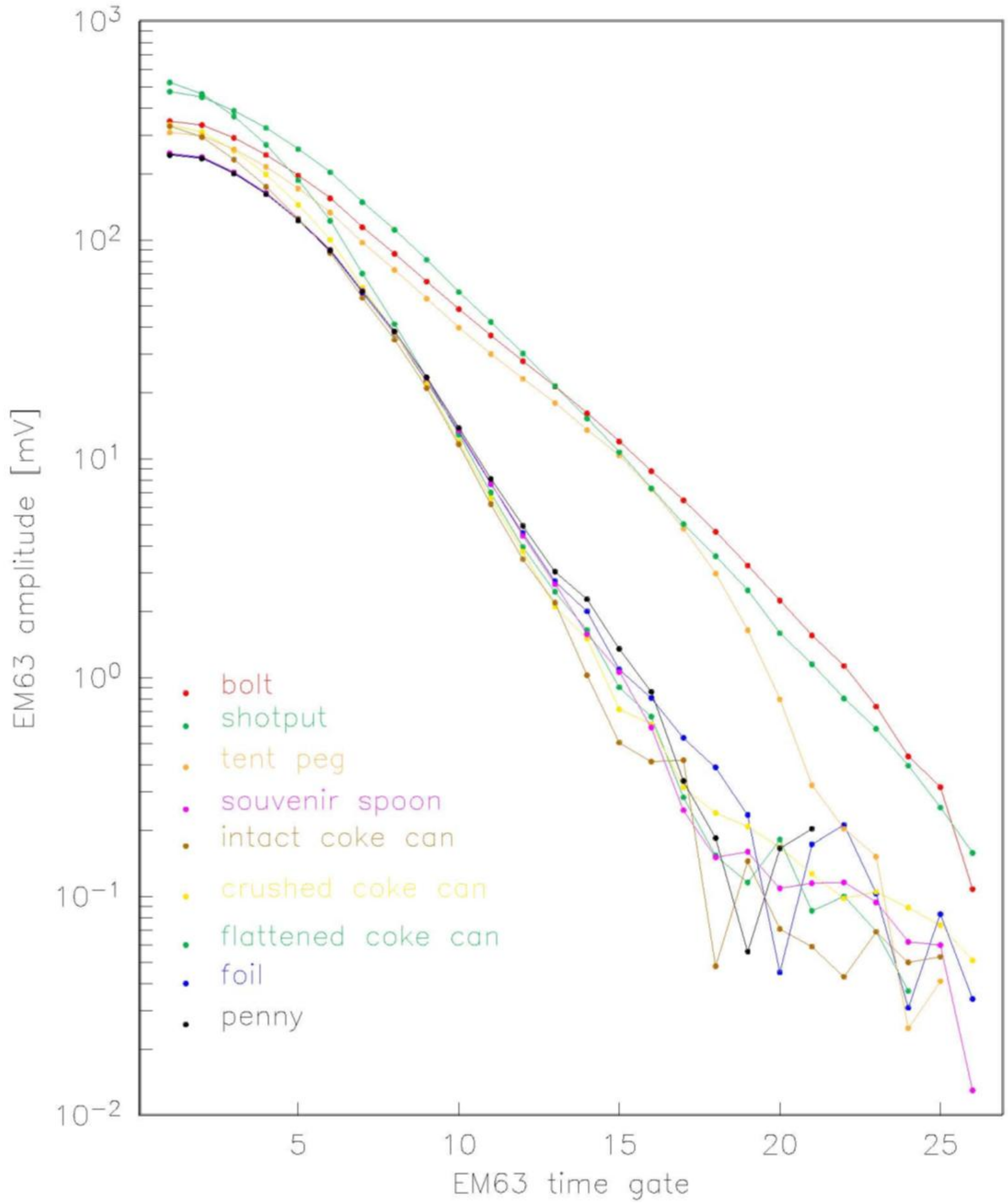


Figure 15. Decay curves of Riverside control site. Bottom right shows signal lost in background noise. The heavy bolt and shotput seem to have similar curves most likely due to their similar lengths and densities. The lower decay curves seem to also have density in common. The tent peg curve is of interest, as it transitions from the higher density objects to the lower density objects. This may be due with the round shape to the stake's head.

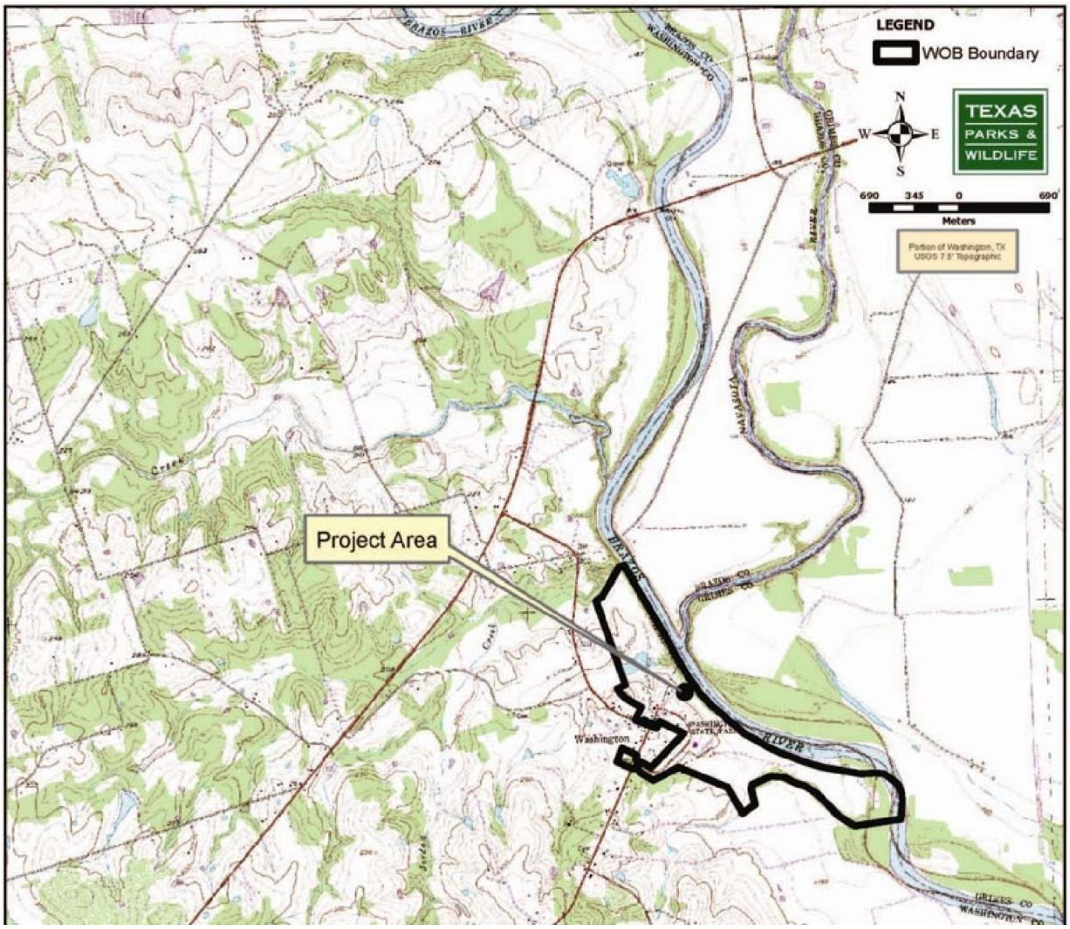


Figure 16. U.S.quadrangle showing WOBSHS and project area.

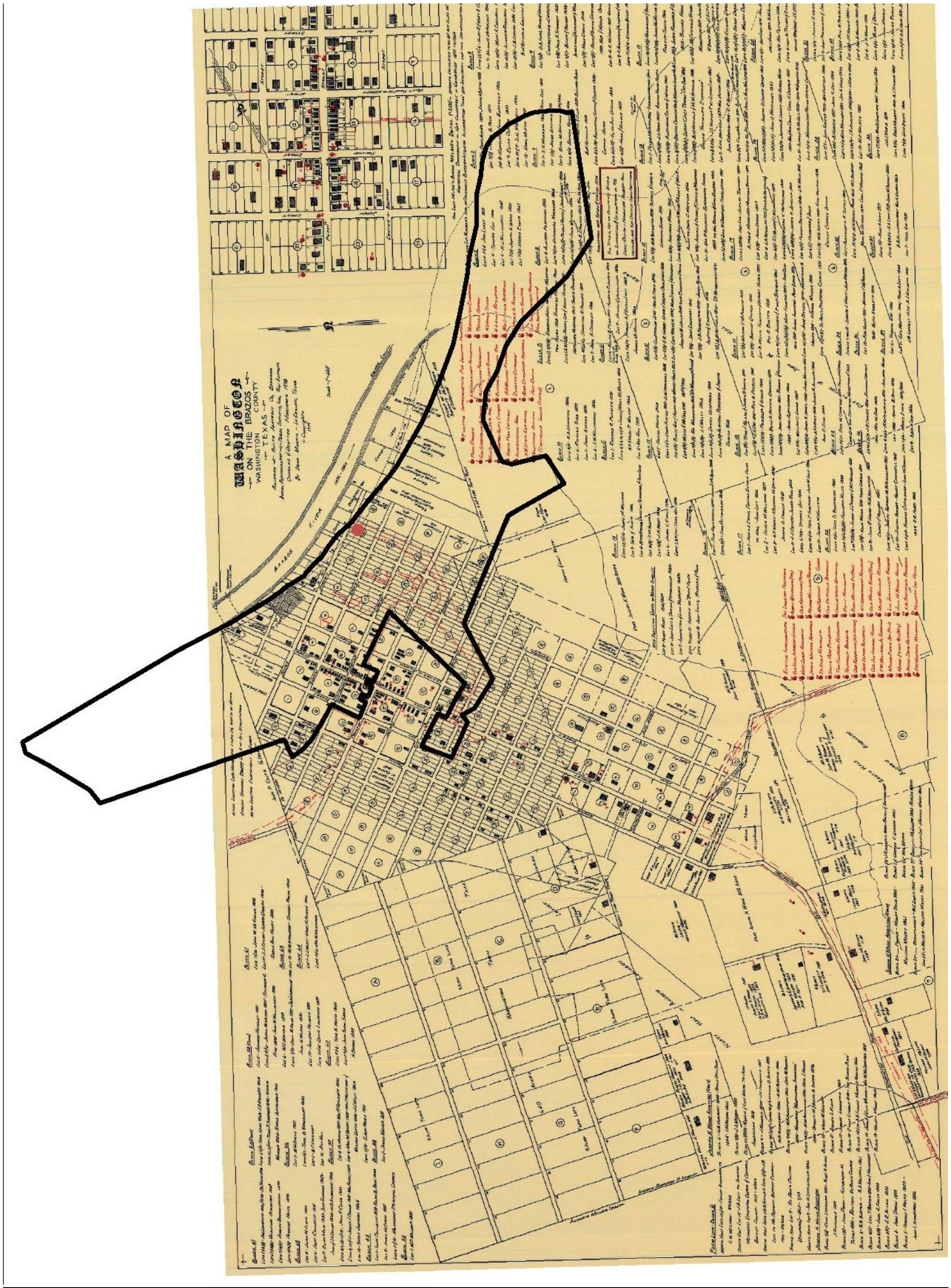


Figure 17. Dana Morris map of WOB. Estimated location of horse stable indicated by location of red dot.

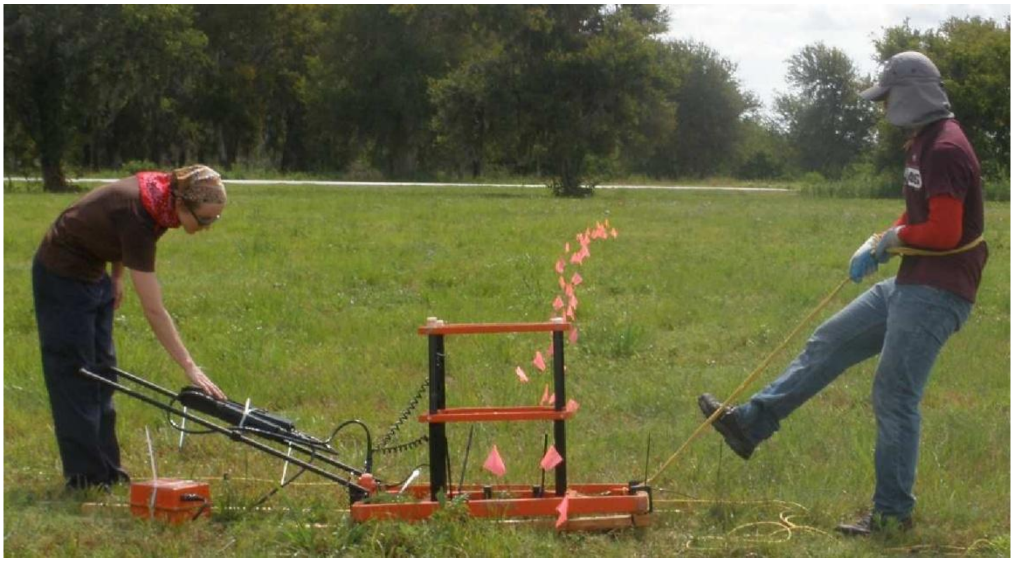


Figure 18. The Geonics EM63 electromagnetic system. Photo by author.

Figure 19. Arial view of WOB project area including EM63 data blocks A-E. Arial photo created with Google Earth.

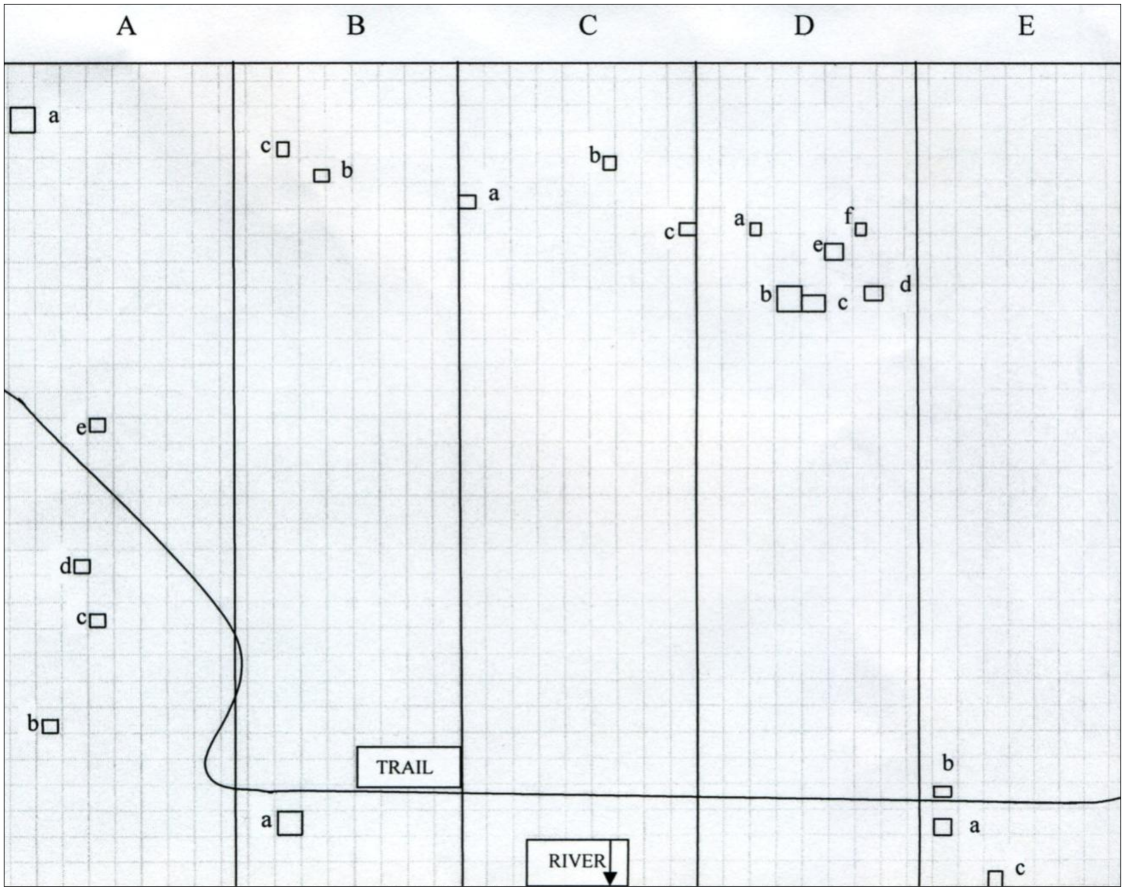


Figure 20. Site plan of WOB project. All units produced recoverable items, giving a 100% success rate to the object findability of the EM63.

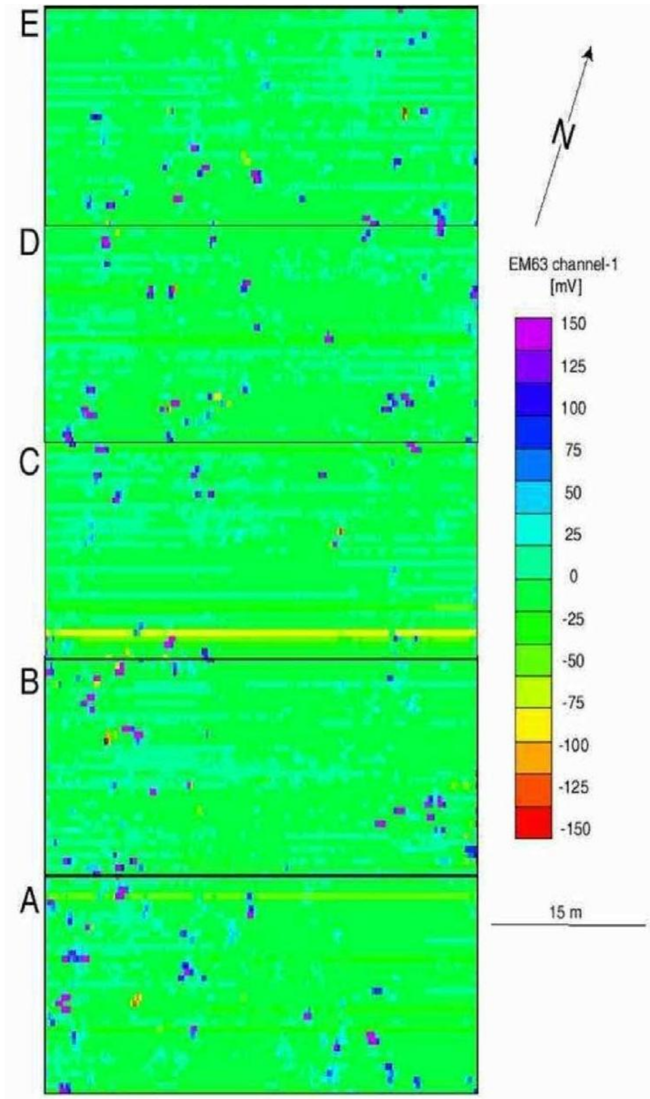


Figure 21. EM63 data plotted for WOB project. Colors indicate increase or decrease in electromagnetic response in millivolts on channel 1 from the neutral green. The yellow lines indicate battery decline.

2m

Figure 22. Braided cable in unit Ba at WOB. Thought to be part of a more extensive system of anchors and cables to reinforce the river bank put in by the Army Corps of Engineers in the 1960s.

Figure 23. Top: ceramic sherds, brick frag, and glass shards from unit Db3 at WOB. Transfer print and whiteware sherds date to the 19th century. Bottom: ceramic sherds and glass shards from Dc4 at WOB. Note similar sherds in both units, which are contiguous. Photos by author.

Figure 24. Ceramic sherd found in unit Db5. John Ridgeway’s ceramic maker’s mark used on Staffordshire white ware (Kowalski and Kowalski 1997). Photo by author.

Figure 25. Bone button found in unit Dc2, WOB. Button dates to the early 19th century. Photo by author.

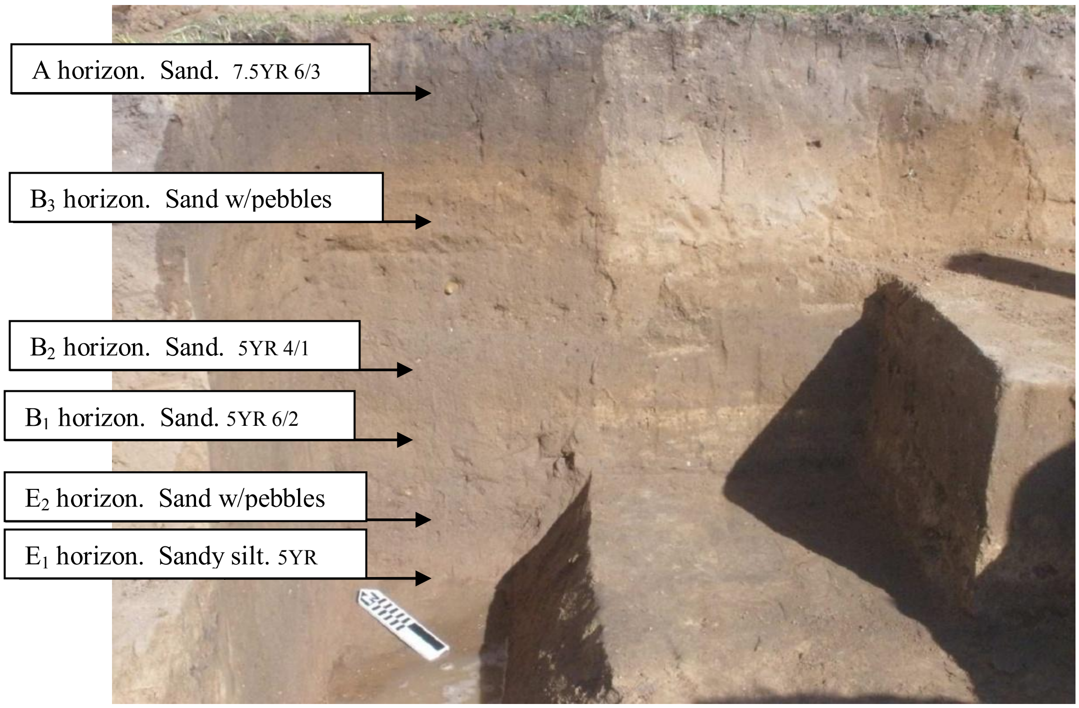


Figure 26. North profile of unit Db. Note the flood layers (layers of pebbles and sand). These repeating layers indicate regular flooding of the Brazos at this location, accelerating deposition. Photo by author.

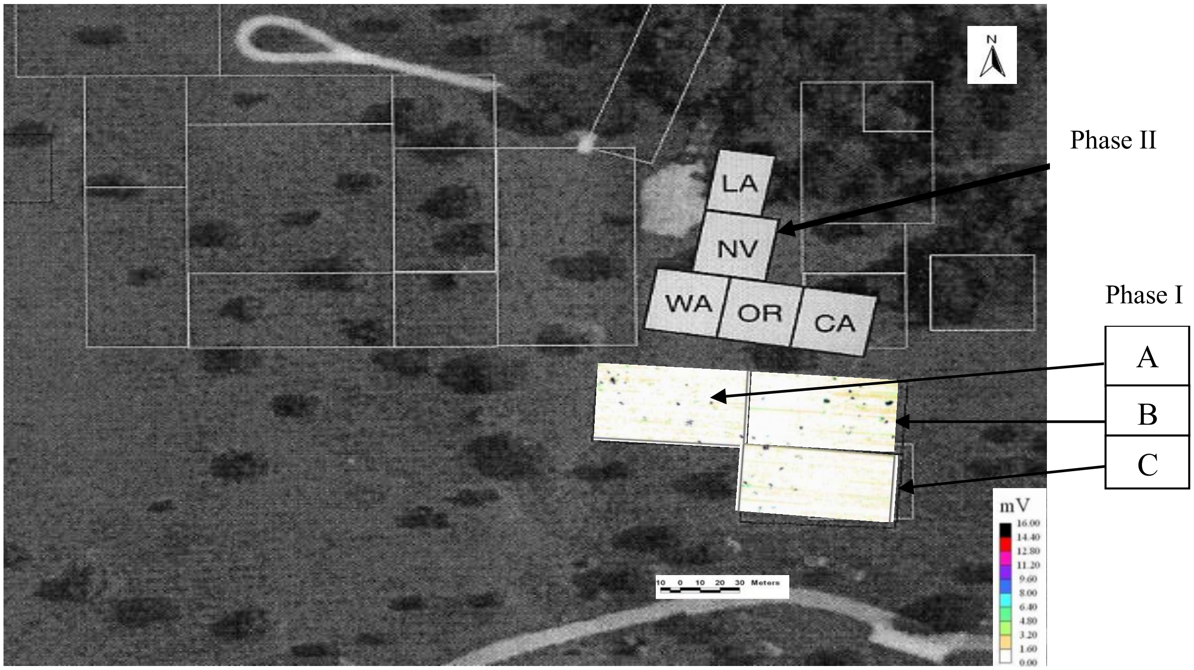


Figure 27. Arial photo of survey area at SJB. Phases I and II include Georeferenced EM63 data. White outlined blocks are previous survey areas conducted by Moore Archaeological Consulting.

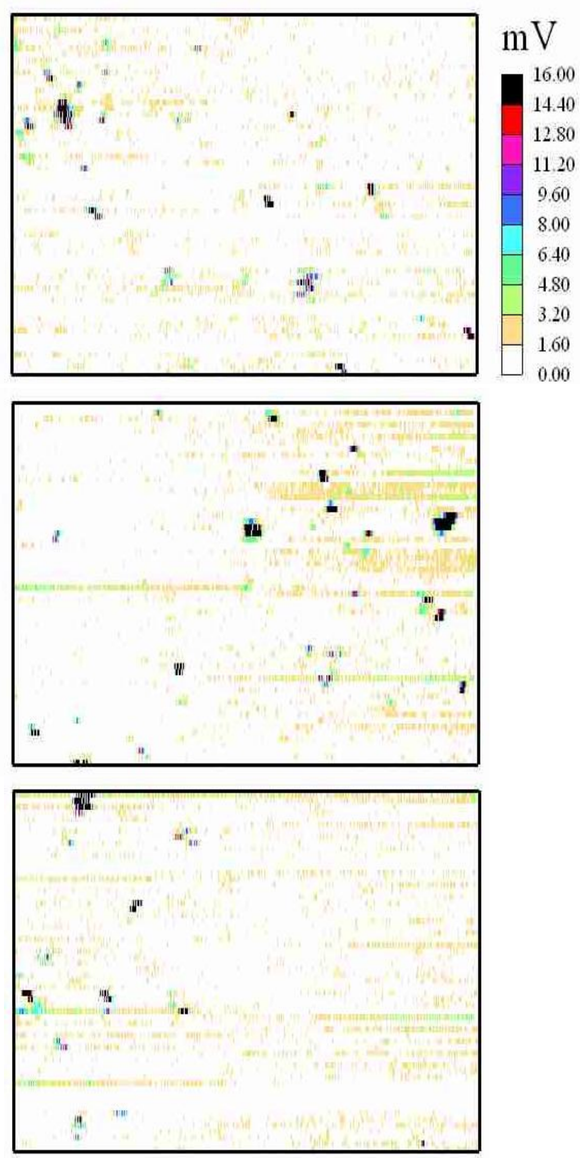
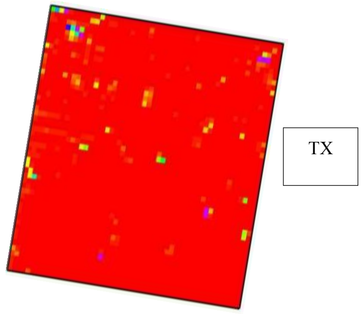


Figure 28. EM63 data for Phase I blocks A, B & C. Data provided courtesy of Carl Pierce. Colors increase in intensity from the white background as objects increase in millivolt response.

Figure 29. SJB Phase I site plan. Six 2x2m units were excavated to a depth of 50 cm.



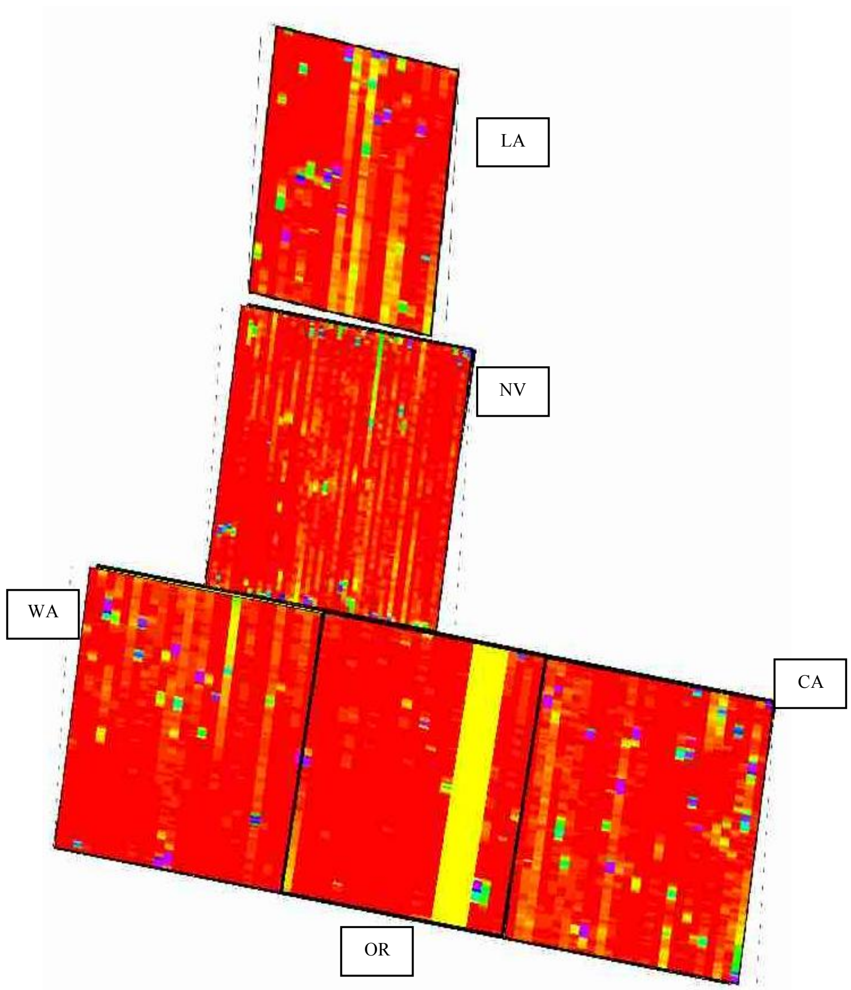


Figure 30. EM63 data for Phase II SJB. Colors indicate millivolt response from channel 1. Yellow rectangle in OR indicates equipment failure in which no data was recorded. Yellow streaks in the other blocks indicates battery charge variation.

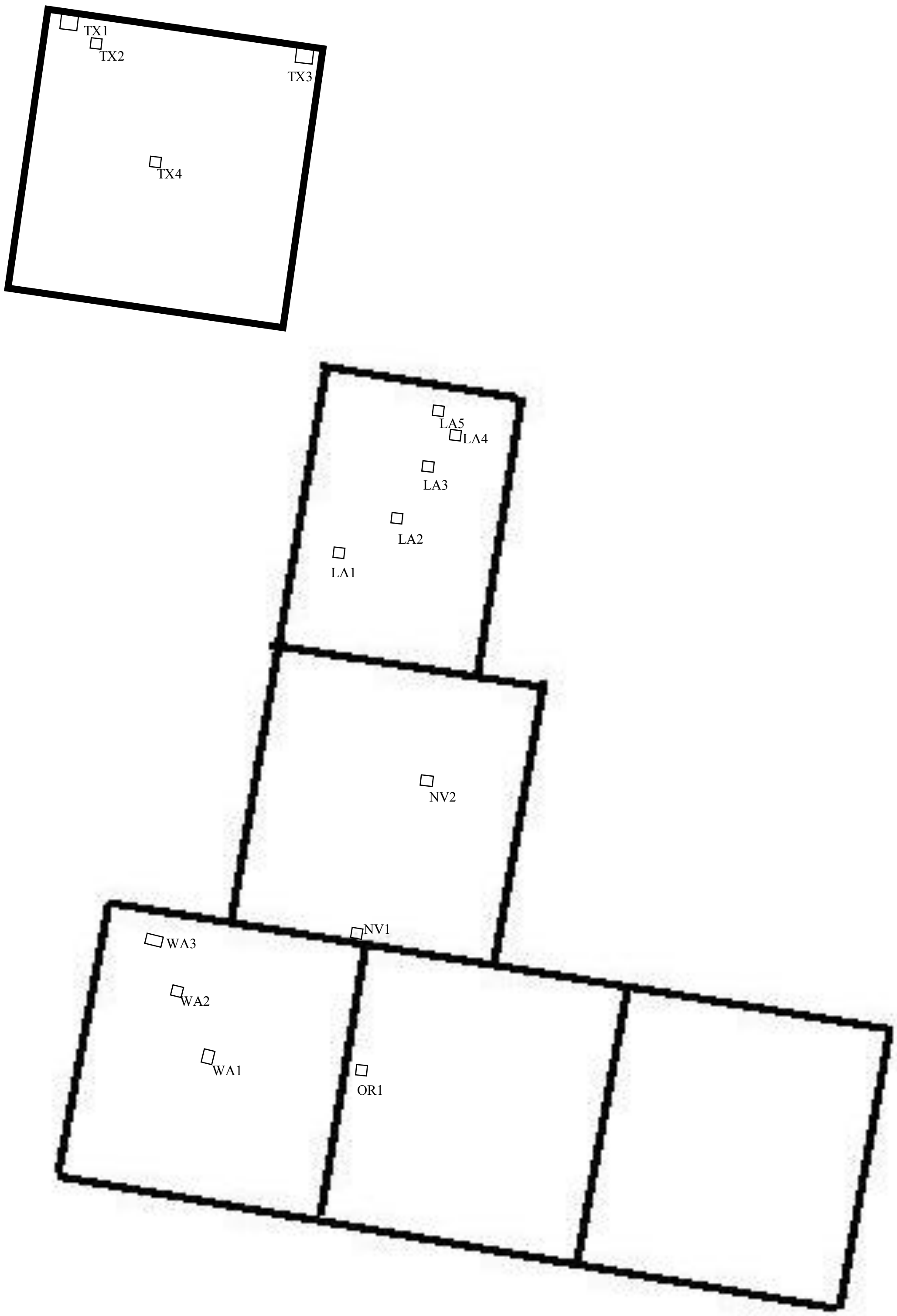


Figure 31. Site plan for SJB Phase II. No artifacts were recovered from block CA.

Figure 32. WA2. Metal hook in asphfalt. Most likely 19th/early 20th century "hook-nail."

Photo by author.

Figure 33. LA4. Iron hook. End of hook is tapered, and does not appear to be clenched (indicating repurposing). The curve of the shaft is very uniform, rather than angled which you would expect if it was hit over with a hammer. The square nail was likely bent over after being heated to form this specific "J" shape. Left: photo by author. Right: Photo courtesy of Nautilus Conservation.

Figure 34. Artifacts LA3 and LA5. Both are modern iron can openers. The acidity of the soil can be attested by the degradation of the iron within a span of years to possibly decades. Photo by author.

Figure 35. LA2. Unidentified iron disk, before and after conservation. Conservation and photos curtesy of Catherine Sincich of Nautilus Conservation.

Figure 36. Moist SJB soil profile showing churning of vertisols. Photo courtesy of Moore Archaeological Consulting.

Figure 37. Austin unit, phase I SJB. Gilgai microrelief can be seen in the “nutty” structure of zone 1, the parallelepiped formation in zone 3, and slickenside formation of zone 4. This picture was taken during arid conditions. Photo by author.

Figure 38. Georeferenced map of soil cores taken at SJB. “Purple core” corresponds to “A&M core” on the Table 6 SJB Soil Core Data. Georeferencing completed curtsey of Douglas Mangum of Moore Archaeological Consulting.

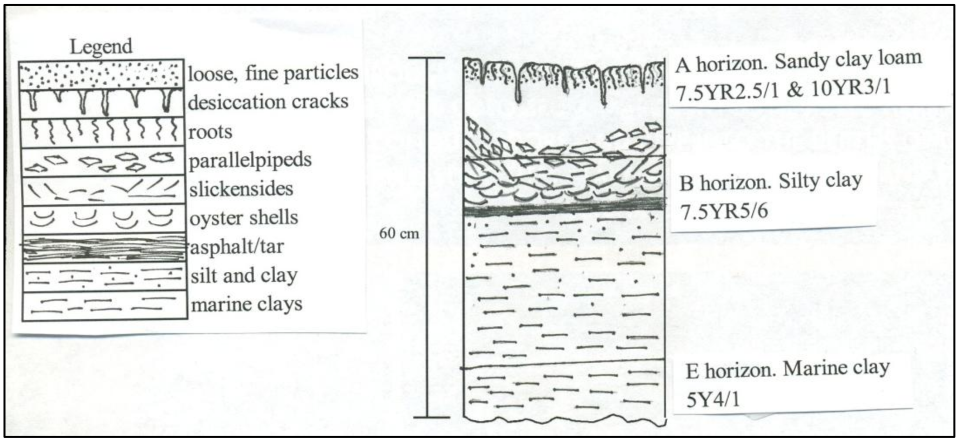


Figure 39. Generalized stratigraphic column of project area at SJB. Includes vertisol characteristics, layer of oyster shells, and asphalt/tar roadway seen across site.

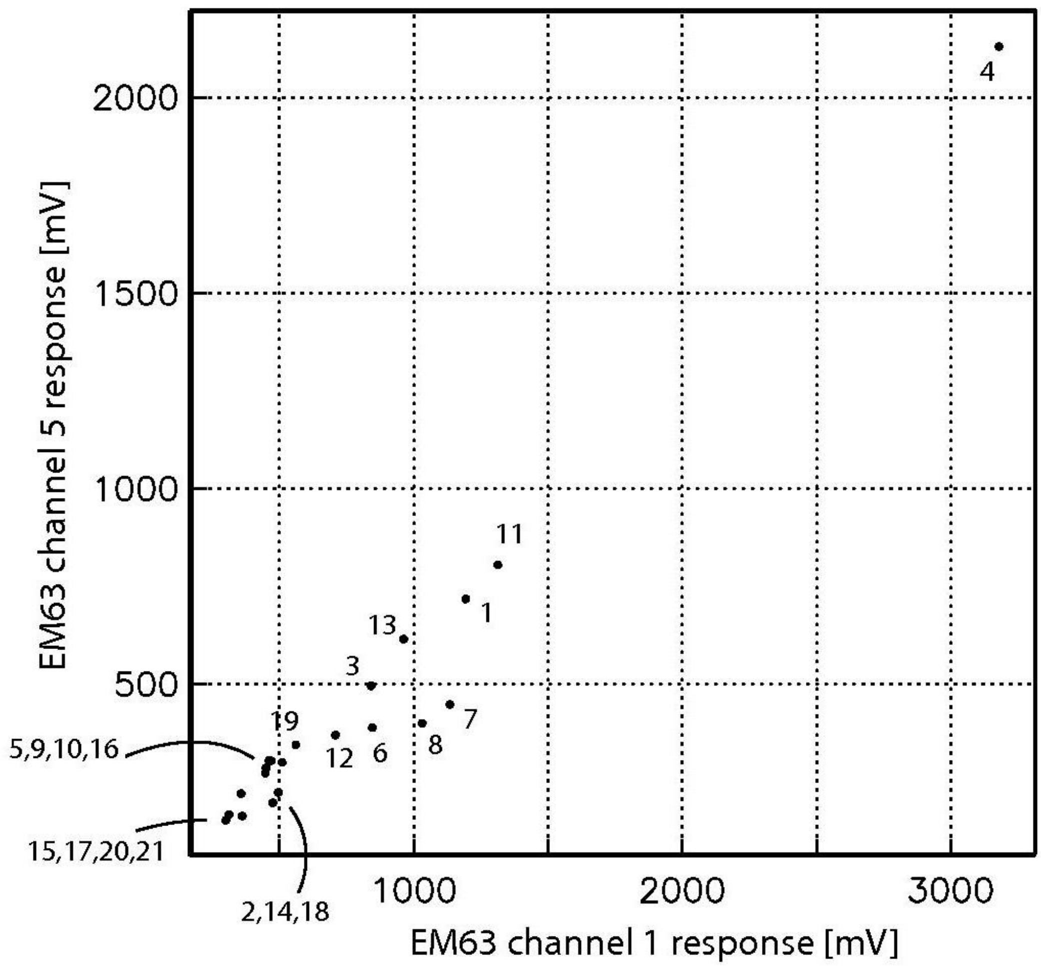


Figure 40. Artifacts sorted by maximum amplitude and electromagnetic decay drop-off rate at WOB. Objects plotting in lower left corner indicate small and shallowly buried. Objects plotting in lower right corner indicate a medium-sized object, or larger object shallowly buried. Upper right corner indicates a larger object deeply buried, or multiple smaller objects. Plot indicates there was not enough distinction between artifacts for interpretation of signature characteristics.

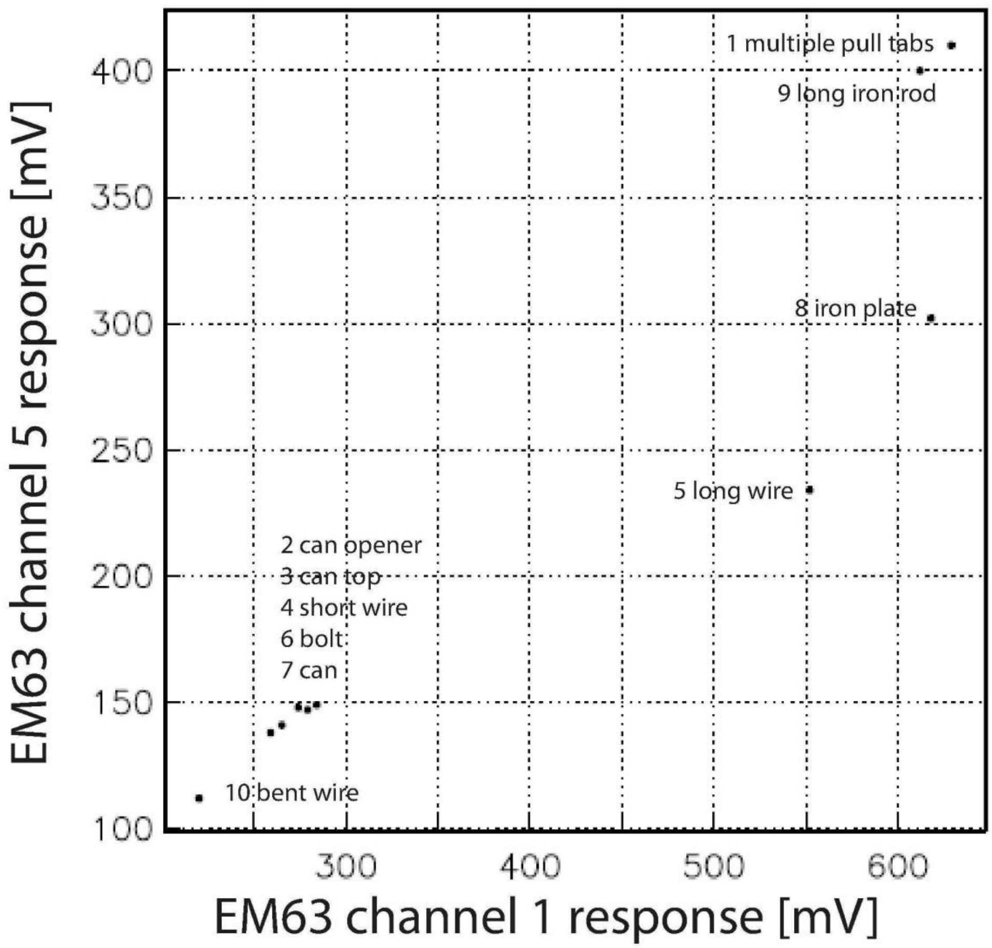


Figure 41. Artifacts sorted by maximum amplitude and drop-off rate in TX block at SJB. The type of plot gives an indication of depth vs. density of object, as described in Figure 39.

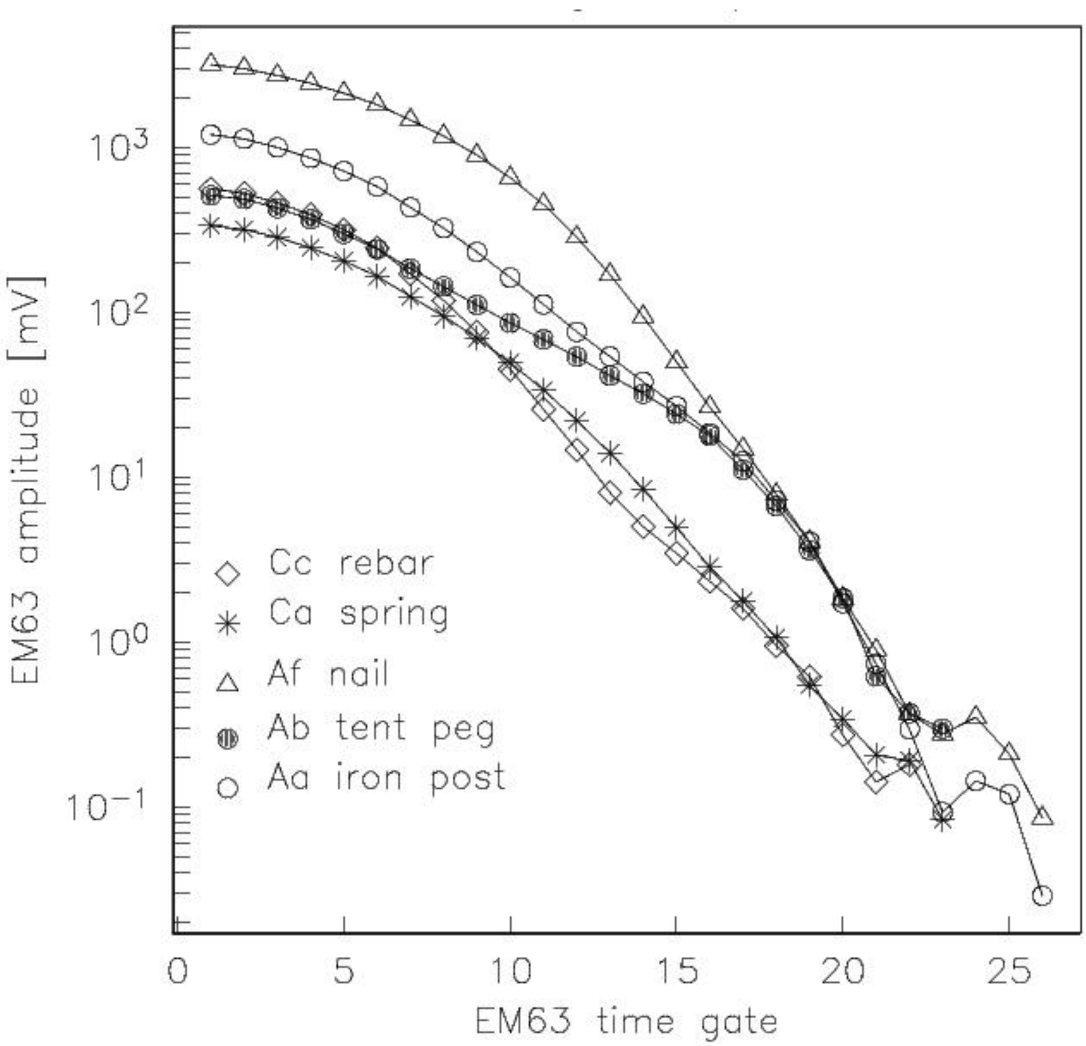


Figure 42. Decay curves of WOB artifacts. The tent peg seems to change signature characteristics, possibly due to a rounded head.

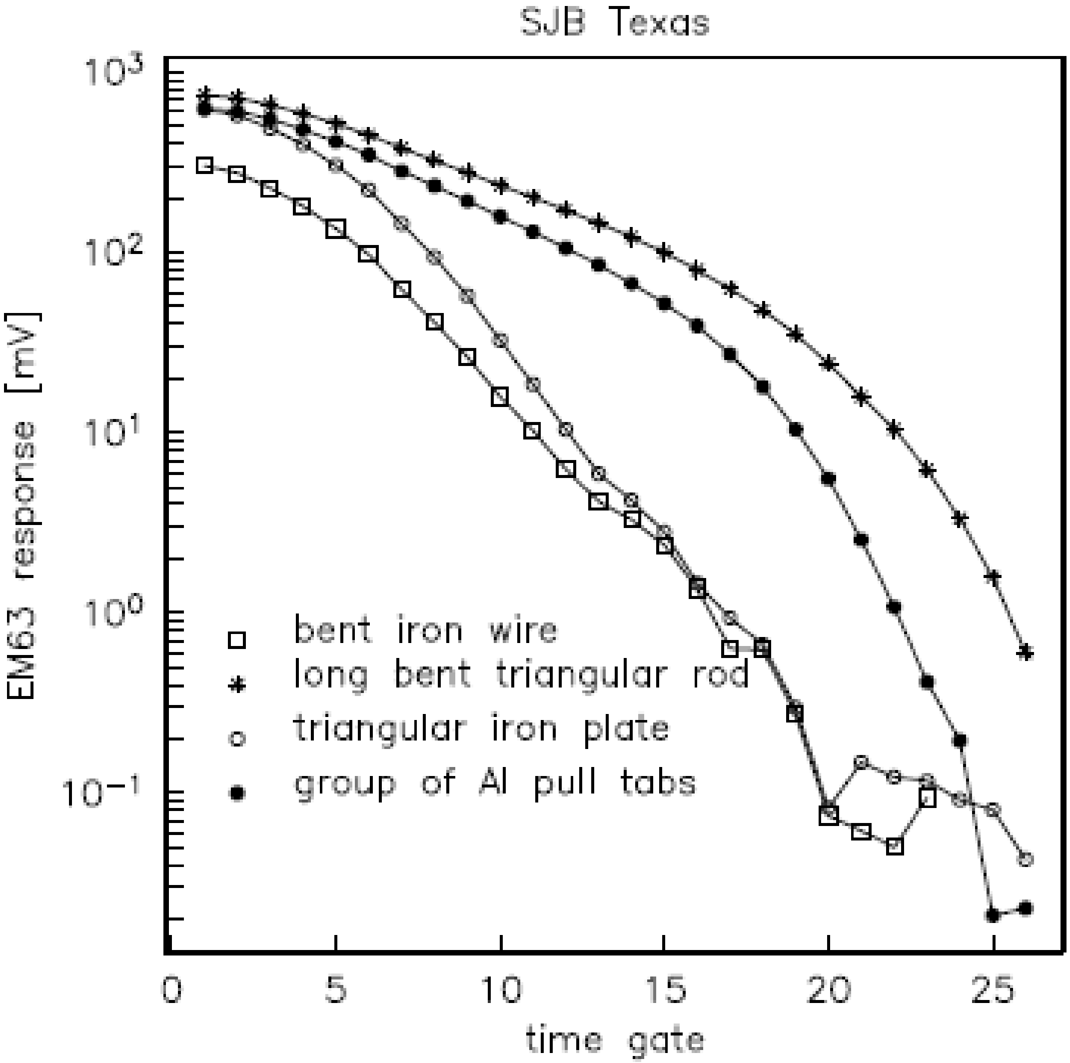


Figure 43. Decay curves of SJB metal artifacts. As at the previous two sites, shape seems to be the strongest distinguishing characteristic of the object signature.

APPENDIX B

TABLES

Table 1. Chronology of the Texian Revolution

April 1830 – The Mexican Congress passes immigration law forbidding new immigration from the U.S., unless approved by Mexico City specifically. The right to immigrate can be bought, for a price.	**December 5-9** - Texian army storms Béxar (San Antonio). General Cos surrenders and withdraws to Mexico.
April 1833 – Antonio López de Santa Anna is elected president of Mexico. The Convention of 1833 convenes with 56 delegates. It appoints commission to draft a constitution for the proposed semi-autonomous Texas.	**February 23, 1836** - Santa Anna besieges the Alamo. A request for reinforcements is sent to the group of Texian delegates convening at Washington-on-the-Brazos.
Winter 1833 - The Centralists in Mexico gain power and President Santa Anna repeals the Federal Constitution of 1824, effectively making himself dictator. The Mexican Congress passes an act to discharge all local militias and expel all illegal settlers from Coahuila y Texas .	**March 2** – Elected Texian delegates declare Texan independence at Washington-on-the-Brazos, sign the Texas Declaration of Independence, and write the Constitution for the new republic.
Early Spring 1834- Stephen F. Austin sends a letter to the mayor of San Antonio, encouraging revolt. The letter is intercepted, and Austin is jailed until May 1835.	**March 6** - Santa Anna storms the Alamo, killing all Anglo men, including Davy Crockett and James Bowie.
January 1835 - A new Mexican Congress convenes with the majority of seats being held by the military or the church, which whom Santa Anna has a secret alliance with.	**March 11** - Sam Houston takes command of Alamo relief force at Gonzales.
March 31 - The Mexican state of Zacatecas rises up in revolt over the repealed Constitution.	**March 13** - Susannah Dickinson arrives at Gonzales with the news that the Alamo has fallen. The Runaway Scrape begins with Houston's apparent retreat.
May 11 - Santa Anna crushes the Zacatecas revolt, massacring over 2000 non-combatants.	**March 27** – James Fannin and nearly 400 Texian soldiers are executed after surrendering at Goliad.
October 2 - Texian settlers clash with Mexican troops at Gonzales, when the army tries to take back a cannon given by them to the colonists for protection against Indian raids.	**April 12** - News arrives at WOB that Santa Anna is on his way. Pres. Burnet and cabinet flee towards Harrisburg.
October 3 - The Mexican Congress frames a new constitution dissolving state legislatures and restructuring states into departments under the military.	**April 18** – Houston and army arrive outside of Lynchburg. Scouts report that Sana Anna is only three miles away.
October 28 - The Battle of Concepcion is won by Texian forces.	**April 21st, 1836 -** The Battle of San Jacinto is won by the Texian Army under General Sam Houston.
	May 14 – The Treaty of Velasco is signed by cabinet members of the Republic of Texas and General Santa Anna.

Table 2. Chronology of the San Jacinto Battleground and State Historic Site

1824

10 August – Arthur McCormick granted a sitio on Buffalo Bayou.

August - December – McCormick's grant is surveyed; Arthur McCormick drowns.

His widow, Margaret (Peggy) McCormick becomes grant holder.

1836

Sam Houston's Texian army crosses the Buffalo Bayou.

20 April – Texian army arrives on McCormick's land and discovers the Mexican army camped nearby.

Sidney Sherman's troops engage Mexican army that afternoon.

21 April – Texians attack Mexican forces in late afternoon and route them in about eighteen minutes.

Mexican troops fall back into the swamp around Peggy's Lake and are massacred.

April – Peggy McCormick and her sons return to the grant, bury some of the Mexican dead, and resume farming.

1836-1915

Town of San Jacinto forms gradually in the area opposite Lynch's Ferry after the Battle.

1840-1850

Peggy McCormick establishes a cattle herd but is cheated by fraudulent resurveys of the grant.

1854

Peggy McCormick dies when her cabin burns down.

1836-1856

Informal visitation by tourists and veterans to the privately-owned battlefield land occurs.

Early San Jacinto Day celebrations held on battlefield. Veterans conduct reunions and meetings on the battlefield.

1856

Fund is started during a meeting at the field for a monument to be placed over the battleground burial.

1870

Start of dredging for ship channel to Houston, spoil deposited along Buffalo Bayou and San Jacinto River.

1881

2nd attempt at placing a monument at the graves approved; only identifiable battle grave is that of Benjamin R. Brigham.

Table 2. continued

1883

16 May – State purchases 10 acres of the battlefield area around the 1881 monument.

1894

A group of veterans of the battle walk the battleground to identify key features and battle elements.

1897

Features identified by the veterans are marked with pipes.

1898-1916

Oil and water drilling have caused about 1.5 feet of subsidence in park area.

1900

The state of Texas now owns 336.28 acres of the battlefield.

1907

San Jacinto Park Commission established.

1909

Additional land purchases of traditional battlefield area.

1912

Daughter of the Republic of Texas replace the pipe markers on the battlefield with engraved granite markers.

1916-1954

Subsidence observed to have increased to 2.6 feet.

1936

Texas Freemasons erect a monument in the area of Sam Houston's Texian Army camp.

Work starts on the 570-foot tall San Jacinto Monument and the reflecting pool.

1938

Superintendent's residence and public restroom building built.

Table 2. continued

1939

Subsidence has increased to as much as 6 feet in some areas of the park.

1943-1973

Work is completed on the Monument and reflecting pool.

1948

April – The retired battleship USS *Texas* arrives at the park and is placed in a hastily-dug slip off of the Houston Ship Channel/Buffalo Bayou in the area of Houston's camp.

1965

San Jacinto Park Commission is abolished; administration transferred to TPWD.

1968

Markers from the de Zavalla Cemetery across the Ship Channel are moved into the Texian Camp area area because of flooding at the original site.

1976

Access roads on either side of the reflecting pool are removed and dikes are built to help control flooding caused by land subsidence.

1996

Subsidence in some areas is now as deep as 8 to 10

feet.

2008

Hurricane Ike damages park buildings and landscape.

2009

Gen. Alamonte's surrender site rediscovered just off beyond the state-owned boundary.

2010

Prairie restoration project undertaken by Texas Parks and Wildlife.

Table 3. Artifact log for WOB

Aa3=Block A, unit a, level 3

provenience	**description of level contents**	**Depth from surface**	**apx age**	**coordinates**
Aa2	short metal t-post with bolt	40 cm	Lt 19th, early 20th	(-0.145, -62.172)
Aa3	clear glass bottleneck, deer bone	50 cm	20th cen	(-0.313, -61.78)
Ab1	metal tent stake	7 cm	lt 20th cen	(-0.969, -10.947)
Ac1	tin can top, piece of aluminum	surface	early 20th cen	(11.032, -61.543)
Ac2	crimped wire	7 cm	early 20th cen	(10.826, -60.862)
Ad1	machine-cut bolt	10 cm	early 20th cen	(14.042, -61.13)
Ae1	machine-cut metal nail	11 cm	early 20th cen	(4.917, -20.834)
Ae2	braided cable, not collected	15 cm	1950-1960	(7.88, -17.311)
Ba1	thin metal wire	8 cm	20th cen	(19.538, -3.007)
Bb1	aluminum can	7 cm	lt 20th cen	(23.411, 8.316)
Ca1	short metal t-post, rebar	56 cm	early 20th cen	(50.683, -57.449)
Cb1-2	brick, thin metal wire	12 cm	20th cen	(47.925, -60.625)
Cc1-1	metal tractor spring	10 cm	early 20th cen	(51.193, -61.505)
Da1	ceramic sherds	10 cm	early 19th cen	(57.885, -47.206)
Da2	ceramic sherds and glass shards	17 cm	early 19th cen	(58.004, -47.206)
Da3	animal bone	20 cm	19th cen	(57.885, -47.206)
Db2	ceramic sherds	13 cm	early 20th cen	(71.462, -42.574)
Db3	ceramic sherds	25 cm	19th cen	(72.205, -42.479)
Db4	ceramic sherds, glass shards	42 cm	early 19th cen	(72.205, -42.479)
Db5	ceramic sherds	54 cm	19th cen	(72.205, -42.479)
Dc2	ceramic sherds, bone button	14 cm	19th cen	(71.574, -47.816)

Table 3. continued

Aa3=Block A, unit a, level 3

provenience	description of level contents	Depth from surface	apx age	coordinates
Dd3	metal iron fragments	25 cm	?	(71.971, -43.32)
Dd4	ceramic sherds	40 cm	19th cen	(71.971, -43.32)
De2	ceramic sherds	17 cm	early 20th cen	
Df	ceramic sherds	25 cm	19th cen	
Ea1	braided cable, not collected	10 cm	1950-1960	(83.112, -3.018)
Eb2	braided cable, not collected	35 cm	1950-1960	(83.098, -3.014)
Ec2	braided cable, not collected	45 cm	1950-1960	(79.589, -3.016)

Table 4. Phase I SJB artifact log

provenience	description	depth from surface	apx age
Austin	metal hook	4 cm	20^{th} cen
Austin	concrete pipe fragment	6 cm	20^{th} cen
Houston 1	3 cm long machine-cut bolt	6 cm	20^{th} cen
Houston 2	3 cm long machine-cut bolt w/nut	6 cm	20^{th} cen
Lamar	rubber baseball	4 cm	20^{th} cen
Lamar	concrete pipe fragment	5 cm	20^{th} cen
Juan Seguin	2.5 cm long plastic thread spindle	3 cm	lt 20^{th} cen

Table 5. Phase II SJB artifact log

block/unit	**description**	**depth**	**apx age**
WA	nail/hook	15 cm	19th cen
WA	bottle glass sherds	9 cm	20th cen
WAc2	metal jar rim	25 cm	lt 19th cen
WA3	metal T-post	2 cm	20th cen
OR1	aluminum soda can	6 cm	20th cen
OR2	aluminum soda can	6 cm	20th cen

Table 6. Soil core data from SJB

	(orange core) N29˚44.831' W95˚04.622		(A&M core) N29˚44.831' W95˚04.622		(blue core) N 29˚44.810' W 95˚04.606		(red core) N 29˚44.837' W 95˚04.616'			(yellow core) N 29˚44.791' W 95˚04.599'		(green core) N 29˚34.762' W95˚12.249'	
description	sandy clay loam		sandy clay loam 7.5YR2.5/2		clay loam		silty clay			silty clay 7.5YR2.5/1		silty loam	
Segments	1	2	1	2	1	2	1	2	3	1	2	1	2
Length, cm	0 - 16	16 – 31.5	0-12	12-30	0 – 11	11 - 30	0-2	2-6	6-12	0 - 10	10 - 27	0 - 11	11- 30
Color	7.5YR 2.5/2	7.5YR 2.5/1			7.5 YR 2.5/1	10YR2 /1	10YR3/2	10YR4/3	10YR2/1			10YR 4/1	10YR3/ 1
Texture by feel	sandy loam	clayey loam	silty clay	clayey loam	clayey loam	clay	sandy loam	sandy clay loam	silty clay loam	clay	silty clay	silty clay loam	silty loam
pH	6.24	6.34	6.34	N/A	6.05	6.15	8.45	8.70	7.90	5.23	5.98	6.25	6.3
% Moisture	N/A	7.33	7.33	7.34	23.89	23.02	19.16	6.74	39.92	10.53	16.13	23.81	50.17
FOC 275˚C	0.082	0.054	N/A	N/A	0.0837	0.0646	0.0409	0.0512	0.0493	0.042	0.045	0.058	0.057
FOC 900˚C	N/A	N/A	0.019	0.020	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcareous Content													

0.5 M	no	no	no	no	no	no	yes	yes	no	no	no	no	no
1 M	no	no	no	no	no	no	yes	yes	no	no	no	no	no
2M	no	no	no	no	no	no	yes	yes	yes	no	no	no	no
Bulk Density, g/cm3	N/A	0.84	N/A	N/A	1.30	1.49	1.49	1.83	1.09	1.67	N/A	N/A	N/A
Particle Density, g/cm3	N/A	1.86	N/A	N/A	1.82	2016	2016	3.42	2.43	3.55	N/A	N/A	N/A
Porosity	N/A	54.8	N/A	N/A	28.57	31.02	31.02	53.5	44.9	47.0	N/A	N/A	N/A

Table 7. Homogenized group soil samples

	N29°44.831' W95°04.622 (orange core)	N29°44.831' W95°04.622 (A&M core)	N 29°44.810' W 95°04.606' (blue core)	N 29°44.837' W 95°04.616' (red core)	N 29°44.791' W 95°04.599' (yellow core)	N 29°34.762' W 95°12.249' (green core)
description	sandy clay loam 7.5YR2.5/1	sandy clay loam 7.5YR2.5/2	silty clay loam 7.5YR2.5/1	silty clay 10YR4/3	silty clay 10YR3/1	silty clay loam 10YR3/1
Particle size, %						
> 2 mm	19.4		12.68	0	11.2	24.5
500 um – 2 mm	19.0		44.68	23.6	35.8	32.1
250 – 500 um	33.8		16.73	11.7	27.8	10.4
125 – 250 um	27.0		1.60	40.2	16.9	13.2
< 125 um	0.80		24.03	24.5	4.4	19.8
Bulk Density, g/cm3	0.990		0.91	1.052	1.06	1.15
Particle Density, g/cm3	2.15		2.0	2.27	2.0	2.36
Porosity	54.0		54.5	53.4	51.3	51.3

VITA

Dana Lee Pertermann
Dept. of Anthropology, Texas A&M University MS 5342
College Station, TX 77843

Academic History

Texas A&M University, College Station, TX
PhD, Department of Anthropology, 2011
Dissertation Title: *Electromagnetism, Site Formation Processes, and Conflict Event Theory at the San Jacinto Battleground and Washington-on-the-Brazos, Texas*

Illinois State University, Normal, IL Masters of Arts, Historical Archaeology, 2006

University of Zurich, Switzerland Graduate work, Department of Classical Archaeology, 2001-2003

University of Minnesota, Minneapolis, MN Bachelor of Arts, Geology, 2001

Teaching and Research Experience

Adjunct Faculty – San Jacinto College, Houston, TX; Physical Geology, Historical Geology
Adjunct Faculty – Northwestern State University of Louisiana; General Anthropology
Adjunct Faculty – Blinn College, Bryan, TX; Cultural Anthropology
Project Investigator – Washington-on-the-Brazos State Historic Site, Texas
Dissertation field work – San Jacinto Battleground, Texas
Graduate Supervisor – Bequette-Ribault Archaeological Field School, Illinois State University
Project crew member – Matterdale Archaeological Project, Glasgow University, UK

Presentations

Winter 2011 "Conflict Archaeology at the San Jacinto Battleground." Society of Historical Archaeology Annual Meeting, Austin, TX.

Spring 2010 "The How and Why of Battlefields." Society of American Archaeology Annual Meeting, St. Louis, MN.

Spring 2008 "The Geneses of Battlefield Archaeology: Archaeological Investigations at the San Jacinto Battleground, Texas." Society for Historical Archaeology Annual Meeting, Toronto, Canada.

Spring 2006 "Site Formation Processes Investigation at the Bequette-Ribault Site in Ste. Genevieve, MO." Society for Historical Archaeology Annual Meeting, Sacramento, CA.

Publications

2008 Geoarchaeology and the Hydrometer at the Bequette-Ribault Site, Ste. Genevieve, Missouri. *Technical Briefs in Historical Archaeology* 3: 8–14.